UNITED STATES DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Fatal Underground Mine Explosion
April 5, 2010

Upper Big Branch Mine-South, Performance Coal Company
Montcoal, Raleigh County, West Virginia, ID No. 46-08436

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EXECUTIVE SUMMARY

On April 5, 2010, at approximately 3:02 p.m., a massive coal dust explosion occurred at the Upper Big Branch Mine-South (UBB), killing 29 miners and injuring two. UBB is operated by Performance Coal Company (PCC), a former subsidiary of Massey Energy Company (Massey) (together PCC/Massey), and is located in Montcoal, West Virginia. This tragic explosion was the largest coal mine disaster in the United States in 40 years.

Immediately following the explosion, President Barack Obama called Secretary of Labor Hilda Solis and Assistant Secretary for Mine Safety and Health Joseph Main to the White House and charged them with conducting the most thorough and comprehensive investigation possible. The President directed Secretary Solis to work with the Justice Department to ensure that the government also investigated any potential criminal activity.

The Department of Labor's Mine Safety and Health Administration (MSHA) conducted its investigation under the authority of the Federal Mine Safety and Health Act of 1977 (Mine Act), which requires that authorized representatives of the Secretary of Labor carry out investigations in mines for the purpose of obtaining, utilizing, and disseminating information relating to the causes of accidents. This report is the product of that investigation, which included a comprehensive underground examination, 269 individuals interviewed, review of some 88,000 pages of documentary evidence, detailed mapping of the mine, inspection and testing of thousands of pieces of physical evidence, and the commissioning of outside experts to study the disastrous explosion. It describes the events leading up to the UBB explosion, rescue and recovery operations, the investigative process, the physical causes of the explosion, the root cause and contributory causes, and the citations and orders issued for safety and health violations. MSHA and the Department of Labor's Office of the Solicitor continue to cooperate with the Department of Justice in the criminal investigation of the tragedy.

MSHA conducted the underground investigation in coordination with the West Virginia Office of Miners' Health Safety and Training (WVOMHST), the Governor's Independent Investigative Panel (GIIP), and PCC/Massey. The United Mine Workers of America (UMWA) participated in the investigation in its capacity as a representative of miners designated pursuant to the Mine Act, as did Moreland & Moreland, l.c.

Many witnesses tragically lost their lives on April 5, 2010. In addition, a number of witnesses exercised their rights under the Fifth Amendment to the U.S. Constitution and declined to be interviewed. Despite the unavailability of their testimony, MSHA has determined the likely causes of the explosion.

Overview of the UBB Accident Investigation Report's Findings

The 29 miners who perished at UBB died in a massive coal dust explosion that started as a methane ignition. The physical conditions that led to the explosion were the result of a series of basic safety violations at UBB and were entirely preventable. PCC/Massey disregarded the resulting hazards. While violations of particular safety standards led to the conditions that caused the explosion, the unlawful policies and practices implemented by PCC/Massey were the root cause of this tragedy. The evidence accumulated during the investigation demonstrates that PCC/Massey promoted and enforced a workplace culture that valued production over safety, including practices calculated to allow it to conduct mining operations in violation of the law.

The investigation also revealed multiple examples of systematic, intentional, and aggressive efforts by PCC/Massey to avoid compliance with safety and health standards, and to thwart detection of that non-compliance by federal and state regulators.

Witness testimony revealed that miners were intimidated by UBB management and were told that raising safety concerns would jeopardize their jobs. As a result, no safety or health complaints and no whistleblower disclosures were made to MSHA from miners working in the UBB mine in the approximately four years preceding the explosion. This is despite an extensive record of PCC/Massey safety and health violations at the UBB mine during this period.

PCC/Massey established a practice of using staff to relay advance notice of health and safety inspections to mine personnel when federal and state inspectors arrived at the mine. The advance notice allowed PCC/Massey employees to conceal violations from enforcement personnel. PCC's chief of security was convicted in federal court for lying to MSHA about whether advance notice was a practice at UBB; the evidence at the trial showed that it indeed was a practice and he had directed UBB personnel to provide advance notice of inspectors' arrival on the mine property. His conviction underscores the extent to which practices designed to hide PCC/Massey safety and health violations were engrained at UBB.

PCC/Massey kept two sets of books with respect to safety and health hazards in the UBB mine. The first set was the required examination book mandated by the Mine Act, which was open for review by MSHA and miners and was required to include in it a complete record of all hazards identified by PCC examiners and other company officials. PCC/Massey also maintained a second set of books that reported on production and maintenance, as well as hazards and violations of law. PCC/Massey noted some hazards in this second set of books that it did not record in the required examination books. PCC/Massey did not make this second set of books available to mine employees or inspectors.

PCC/Massey allowed conditions in the UBB mine to exist that set the stage for a catastrophic mine explosion. The tragedy at UBB began with a methane ignition that transitioned into a small methane explosion that then set off a massive coal dust explosion. If basic safety measures had been in place that prevented any of these three events, there would have been no loss of life at UBB.

PCC/Massey could have prevented the methane ignition and explosion had it maintained its longwall shearer in safe operating condition. A longwall shearer is part of a longwall mining machine and has large rotating cutting drums equipped with bits that cut coal as it moves on a track across the working face. A system of water sprays suppresses dust as well as “hot streaks,” which are smears of metal found on rock when metal is heated to near its melting point from friction caused by the shearer’s bits hitting into layers of rock above or below the coal seam. PCC/Massey operated the shearer at UBB with worn bits and missing water sprays, creating an ignition source for methane on the longwall.

Had PCC/Massey followed basic safety practices, the small methane explosion that set off the dust explosion would have been contained or prevented. PCC/Massey did not take proper measures to detect methane concentrations throughout the mine. PCC/Massey’s failure to comply with UBB’s approved ventilation and roof control plans exacerbated the risk of methane accumulation. The law requires adequate ventilation of underground coal mines to prevent unsafe levels of methane and other dangerous gasses, and provide miners with breathable air. PCC/Massey ventilation practices led to erratic changes in air flow and direction. Its failure to install supplemental roof supports as required by UBB’s plan led to a roof fall in an airway that limited airflow, contributing to the accumulation of methane in the area where the explosion originated.

Finally, PCC/Massey violated fundamental safety standards by permitting significant amounts of float coal dust, coal dust, and loose coal to accumulate in the mine. This became the fuel for the explosion. Sufficient rock dust, used to make coal dust inert and prevent it from catching fire or fueling an explosion, would have prevented a coal dust explosion from occurring. PCC/Massey did not follow the fundamental safety practice of applying rock dust adequately to eliminate this hazard.

PCC/Massey knew or should have known about all of these hazards but failed to take corrective action to prevent a catastrophic accident. For example, UBB’s required examination books showed records of hazards that PCC/Massey did not correct. The examination books also showed that PCC/Massey failed to perform required pre-shift, on-shift, and weekly examinations to find and correct hazards. When the books indicated PCC/Massey examiners did conduct exams, they failed to identify obvious hazards, such as accumulations of loose coal, coal dust, and float coal dust in the area where the explosion occurred.

Specific Accident Investigation Conclusions – PCC/Massey's Management Practices that Led to the Explosion

PCC/Massey failed to perform required mine examinations adequately and remedy known hazards and violations of law

MSHA regulations require mine operators to examine certain areas of the mine on a weekly basis, as well as before and during each shift, to identify hazardous conditions. MSHA's accident investigation found that PCC/Massey regularly failed to examine the mine properly for hazards putting miners at risk and directly contributing to the April 5 explosion. At UBB, PCC/Massey examiners often did not travel to areas they were required to inspect or, in some cases, travelled to the areas but did not perform the required inspections and measurements. For example, PCC/Massey conducted no methane examinations on the longwall tailgate, the area of the longwall where the explosion began, in the weeks prior to the explosion. Even when PCC/Massey performed inspections and identified hazards, it frequently did not correct them. Because of these practices, loose coal, coal dust, and float coal dust accumulated to dangerous levels over days, weeks, and months and provided the fuel for the April 5 explosion.

PCC/Massey kept two sets of books, thus concealing hazardous conditions

During the course of the investigation, MSHA discovered that PCC/Massey kept two sets of books at UBB: one set of production and maintenance books for internal use only, and the required examination books that, under the Mine Act, are open to review by MSHA and miners. MSHA regulations mandate that the required examination books contain a record of all hazards. Enforcement personnel must rely on their accuracy and completeness to guide them in conducting their physical inspections.

PCC/Massey often recorded hazards in its internal production and maintenance books, but failed to record the same hazards in the required examination book provided to enforcement personnel to review. Some of the hazards described in the hidden "second set of books" were consistent with conditions that existed at the time of the explosion, including the practice of removing sprays on the longwall shearer. Testimony from miners at UBB revealed they felt pressured by management not to record hazards in the required examination books. Furthermore, even when PCC/Massey recorded hazards in the required examination books – such as belts that needed to be cleaned or rock dusted – it often failed to correct the identified hazards.

In addition to undocumented hazards in the required examination books, PCC/Massey failed to report accident data accurately. MSHA's post-accident audit revealed that, in 2009, UBB had twice as many accidents as the operator reported to MSHA.

PCC/Massey intimidated miners to prevent MSHA from receiving evidence of safety and health violations and hazards

The Mine Act protects miners if they are fired or subjected to other adverse employment actions because they reported a safety or health hazard. These whistleblower protections give miners a voice in the workplace and allow them to protect themselves when mine operators engage in illegal and dangerous practices. Testimony revealed that UBB's miners were intimidated to prevent them from exercising their whistleblower rights. Production delays to resolve safety-related issues often were met by UBB officials with threats of retaliation and disciplinary actions. On one occasion when a foreman stopped production to fix ventilation problems, Chris Blanchard, PCC's president, was overheard saying: "If you don't start running coal up there, I'm going to bring the whole crew outside and get rid of every one of you." Witness interviews also revealed that a top company official suspended a section foreman who delayed production for one or two hours to make needed safety corrections.

MSHA did not receive a single safety or health complaint relating to underground conditions at UBB for approximately four years preceding the explosion even though MSHA offers a toll-free hotline for miners to make anonymous safety and health complaints. PCC/Massey also had a toll-free number for safety and health complaints, but miners testified that they were reluctant to use it for fear of retaliation.

PCC/Massey failed to provide adequate training for workers

Records and testimony indicate that PCC/Massey inadequately trained their examiners, foremen and miners in mine health and safety. It failed to provide experienced miner training, especially in the area of hazard recognition; failed to provide task training to those performing new job tasks; and failed to provide required annual refresher training. This lack of training left miners unequipped to identify and correct hazards at UBB.

PCC/Massey established a regular practice of giving advance notice of inspections to hide violations and hazards from enforcement personnel

Under the Mine Act, it is illegal for mine operators' employees to give advance notice of an inspection by MSHA enforcement personnel. Despite this statutory prohibition, UBB miners testified that PCC/Massey mine personnel on the surface routinely notified them prior to the arrival of enforcement personnel. Miners and others testified they were instructed by upper management to alert miners underground of the arrival of enforcement personnel so hazardous conditions could be concealed. UBB dispatchers testified they were told to notify miners underground when MSHA inspectors arrived on the property, and if they did not, there would be consequences.

Advance notice gave those underground the opportunity to alter conditions and fix or hide hazards immediately prior to enforcement personnel's arrival on the working section. PCC/Massey also made ventilation changes in the areas where MSHA inspectors planned to travel, concealing actual production conditions from enforcement personnel.

On October 26, 2011, Hughie Elbert Stover, PCC's former head of security for UBB, was found guilty in the United States District Court for the Southern District of West Virginia of a felony count of making false, fictitious and fraudulent statements to MSHA regarding company policy on advance notice. In an interview with the MSHA accident investigation team, Stover testified that Massey had a policy prohibiting security guards from providing advance notice of MSHA inspections; however, the evidence indicated that he had personally directed guards to provide advance notice.

Specific Accident Investigation Conclusions – Physical Causes of the Explosion

A small amount of methane, likely liberated from the mine floor, accumulated in the longwall area due to poor ventilation and roof control practices

Based on physical evidence, the investigation concluded that methane was likely liberated from floor fractures into the mine atmosphere on April 5, the day of the explosion. The investigation team subsequently identified floor fractures with methane liberation at longwall shields (a system of hydraulic jacks that supports the roof as coal is being mined) near the tailgate, the end of the longwall where the explosion began. This methane liberation occurred because PCC/Massey mined into a fault zone that was a reservoir and conduit for methane. MSHA believes that this is the same fault zone associated with methane inundations at UBB in 2003 and 2004, and a 1997 methane explosion.

PCC/Massey's failure to comply with its roof control plan allowed methane to accumulate in the tailgate area. UBB's roof control plan required placement of supplemental supports, in the form of two rows of 8-foot cable bolts or posts, between the primary supports in the longwall tailgate. PCC/Massey installed only one row of these supplemental supports. This lack of roof support contributed to the fall of the tailgate roof, which in turn restricted the airflow leaving the longwall face. The reduced air flow allowed methane to accumulate in the tailgate without being diluted or ventilated from the mine. As a result, an explosive mixture of methane was present in this area.

PCC/Massey failed to maintain the UBB longwall shearer, creating an ignition source for accumulated methane

MSHA has identified the longwall shearer as the likely source of the ignition of the methane accumulated in the tailgate area. PCC/Massey was using the longwall shearer to mine in the area near the tailgate. Evidence showed that methane likely migrated from behind the longwall shields to the longwall shearer, and that an accumulation of methane developed near the tailgate. Evidence also revealed that the longwall shearer was not properly maintained by PCC/Massey. Two of the cutting bits on the tail drum were worn flat and lost their carbide tips. The dull, worn shearer bits likely created an ignition source by creating hot streaks while cutting sandstone.

Well-maintained longwall shearers, which include sharp bits and effective water spray systems, protect against these kinds of ignitions and also control the dust during the mining process. The water sprays create air pressure to move methane away from the area where the shearer is cutting and prevents ignitions by spraying water to suppress hot streaks on the longwall face. At the time of the accident, PCC/Massey's longwall shearer was cutting through both coal and sandstone with seven water-spray nozzles missing. As a result, the shearer did not have the minimum required water pressure. The ineffective sprays failed to move the methane away from the shearer bits and cool the hot streaks created during the mining process. As a result, methane ignited.

The evidence indicated that the flame from the initial methane ignition then ignited a larger accumulation of methane. However, the ignition of the larger body of methane did not happen immediately. Approximately two minutes elapsed between the ignition and the explosion. The electronically recorded event log indicates the shearer was shut off with the remote control just before 3:00 p.m. MSHA has concluded that the tail shearer operator stopped the shearer shortly after the initial ignition, which continued to burn near the longwall tailgate. Realizing that the ignition could not be controlled, the miners in the tailgate area began evacuating. At approximately 3:02 p.m., the flame encountered a larger methane accumulation in the tailgate area, triggering a localized explosion.

PCC/Massey allowed coal dust to accumulate throughout UBB, providing a fuel source for a massive explosion

The small methane explosion near the tailgate immediately encountered fuel in the form of dangerous accumulations of float coal dust and coal dust, which propagated the explosion beginning in the tailgate entry. The resulting coal dust explosion killed the 29 miners. PCC/Massey records demonstrate that examiners allowed these and other accumulations in the mine to build up over days, weeks, and months. Loose coal, coal dust and float coal dust were abundant in all areas of the mine, including the area affected by the explosion. Many of these accumulations were left from the initial development of this area of the mine, indicating a long-established policy of ignoring basic safety practices.

PCC/Massey failed to rock dust the mine adequately to prevent a coal dust explosion and its propagation through the mine

If the mine had been rock dusted so that the coal dust had contained sufficient quantities of incombustible content, the localized methane explosion would not have propagated, or expanded, any further. According to testimony and other evidence, PCC/Massey applied grossly inadequate quantities of rock dust. Miners stated that areas were not well dusted, that the walls, roof and floor in areas of the mine were dark-colored – which indicates a lack of rock dust. There is no evidence that during the mining of the longwall, PCC/Massey ever applied rock dust in the tailgate entry -- the entry where the mine's ventilation system carried coal dust from the mining process. The mine's rock dusting equipment frequently failed As a result of a systematic failure to properly apply rock dust, the coal dust explosion continued to propagate through the mine, killing miners as far as approximately 5,000 feet from the point of ignition.

Rescue and Recovery Efforts at UBB

Intensive rescue activities involving more than 20 rescue teams – including teams from MSHA, PCC/Massey, the WVOMHST, and other mine operators – mobilized and began to search for missing miners soon after the accident occurred on April 5. The presence of combustible gasses in the mine prompted rescue teams to evacuate at least three times during the rescue efforts. On April 9, rescue teams located the last of the victims and determined that none of the 29 miners reported missing had survived. On Tuesday, April 13, the last victim was recovered from the mine.

During rescue and recovery efforts, MSHA family liaisons – pursuant to a program established under the Mine Improvement and New Emergency Response (MINER) Act of 2006 – served as the agency's primary communicators with the families of the missing miners. The liaisons remained with the families continuously from April 5 through April 10. Assistant Secretary Main, Coal Administrator Kevin Stricklin, then-Governor Manchin and, at times, company representatives, gave regular updates to the families on the search for their loved ones.

Specific Accident Investigation Conclusions - Alternate Theories Tested and Found Insufficient

The MSHA accident investigation team carefully considered other possible scenarios to explain the events of April 5, 2010, but a lack of supporting evidence disproved these alternative explanations. One theory tested was that a massive inundation of methane caused the explosion. However, the flame path, pressures generated by the explosion, and the limited quantity of methane detected prior to and after the explosion were inconsistent with that theory. In addition, previous methane inundations at UBB in 2003 and 2004 were localized at the point of gas discharging from fractures in the mine floor and gas release would dissipate within a few days. The volume and pressure of gas and the size of the floor fractures were relatively small. Thus, the volume of gas released from the floor was also small. Similarly, the team could find no evidence to support the theory that the explosion was caused by cutting into a gas well or by a seismic event.

Specific Accident Investigation Conclusions – Citations and Orders Issued

Associated with the issuance of this accident investigation report, MSHA issued 12 citations and orders to PCC/Massey for violations of the Mine Act and its implementing regulations that contributed to the April 5 explosion. MSHA also issued 357 violations of the Mine Act and regulations to PCC/Massey for conditions and practices discovered at UBB that did not directly contribute to the explosion.

MSHA designated 9 of these contributory violations as “flagrant.” Flagrant violations, the most serious violations MSHA can issue, are eligible for the highest penalty possible under the Mine Act. The flagrant violations committed by PCC/Massey are:

- illegally providing advance notice to miners of MSHA inspections (a violation of Section 103(a) of the Mine Act);
- failing to properly conduct required examinations and to identify, record, and correct hazards (4 flagrants for violations of 30 CFR sections 75.360, 75.362, 75.363(a), and 75.364);
- allowing hazardous levels of loose coal, coal dust, and float coal dust to accumulate (violation of 30 CFR section 75.400);
- failing to adequately apply rock dust to the mine (violation of 30 CFR section 75.403);
- failing to comply with the approved ventilation plan by operating the shearer with missing and clogged water sprays (violation of 30 CFR section 75.370(a)(1)); and
- failing to adequately train its miners (violation of 30 CFR part 48.3).

PCC/Massey also committed three contributory violations that were not flagrant:

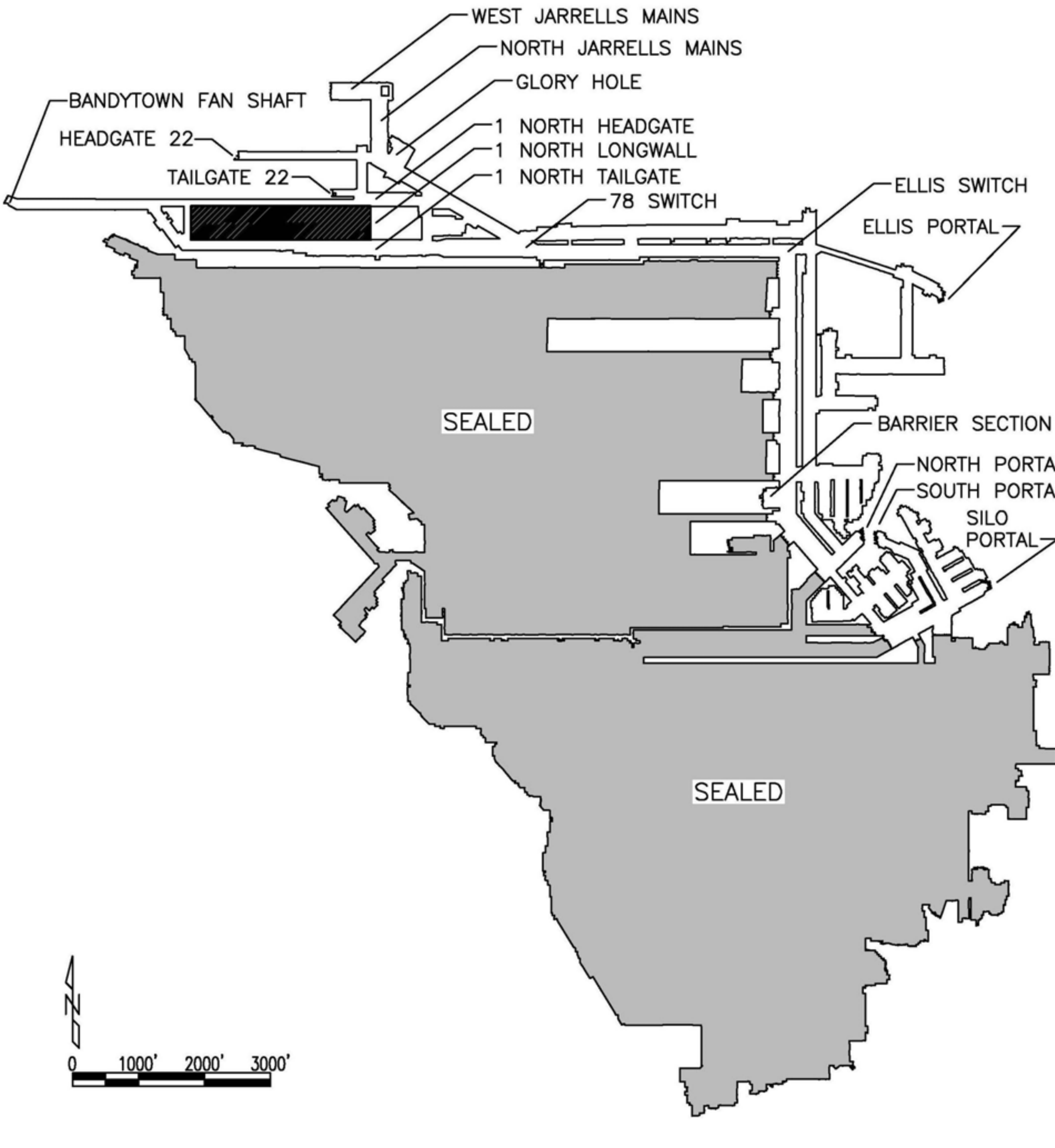
- failing to maintain the longwall shearer (worn bits) in safe operating condition (violation of 30 CFR 75.1725(a));
- failing to comply with its approved roof control plan in the 1 North Panel tailgate entry, as required by the approved roof control plan (violation of 30 CFR 75.220(a)(1)); and
- failing to maintain the volume and velocity of the air current in the areas where persons work or travel at a sufficient volume and velocity to dilute, render harmless, and carry away flammable, explosive, noxious, and harmful gases, dusts, smoke, and fumes (violation of 30 CFR 75.321(a)(1)).

MSHA also issued two contributory violations to David Stanley Consulting, LLC, a contractor that supplied examiners and other miners to work at the UBB, for its examiner's failure to properly conduct examinations.

MSHA Internal Review

In addition to the accident investigation, a separate internal review is examining MSHA's actions related to UBB prior to the explosion and during the rescue and recovery operation. The internal review will evaluate the quality of MSHA's enforcement activities, including any weaknesses, and the adequacy of regulations, policies and procedures. A report and recommendations will be provided to the Assistant Secretary for appropriate action with the aim of better improving the agency's performance and helping prevent the occurrence of future accidents.

MINE MAP



WEST JARRELLS MAINS
NORTH JARRELLS MAINS
GLORY HOLE
BANDYTOWN FAN SHAFT
HEADGATE 22
1 NORTH HEADGATE
1 NORTH LONGWALL
TAILGATE 22
1 NORTH TAILGATE
78 SWITCH
ELLIS SWITCH
ELLIS PORTAL
SEALED
BARRIER SECTION
NORTH PORTAL
SOUTH PORTAL
SILO PORTAL
SEALED
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GENERAL INFORMATION

On April 5, 2010, at approximately 3:02 p.m., a massive coal dust explosion occurred at Upper Big Branch Mine-South (UBB), resulting in the deaths of 29 miners and injuries to two miners who survived. A list of the victims and injured is provided in Appendix A.

Mine Information

The Upper Big Branch Mine-South (UBB), I.D. No. 46-08436, is an underground bituminous coal mine located approximately one mile west of Montcoal, off State Route 3 in Raleigh County, West Virginia. At the time of the accident, the mine was owned and operated by Performance Coal Company (PCC) of Naoma, West Virginia, a subsidiary of Massey Energy Company (Massey). The mine had opened as the Montcoal Eagle Mine on September 1, 1994, operated by Peabody Coal Company. PCC acquired the mine and began production shortly after October 15, 1994 as Upper Big Branch Mine-South. Alpha Natural Resources acquired PCC and Massey in June, 2011.

PCC mined coal at UBB from the Eagle coal seam. The average thickness of the seam was 54 inches, including sandstone partings. PCC achieved an average mining height of approximately 84 inches by mining the immediate roof and floor, predominantly composed of shale and sandstone. In 2009, PCC produced 1,235,462 raw tons of coal. At UBB, PCC utilized a longwall, a method of mining in which a cutting machine known as a “shearer” cuts coal in a long, single slice. Typically, the longwall operated seven days per week and development sections operated five to six days per week. There were two overlapping 10-hour longwall production shifts and a 9-hour maintenance shift. According to company records, PCC employed 186 underground and four surface employees at UBB on the day of the accident. There were also 16 labor contractors working for David Stanley Consultants, LLC. (DSC) and Mountaineer Labor Solutions, LLC (MLS). At the time of the accident, no labor organization represented employees; nor was there a miners’ representative designated under the Mine Act.

At the time of the accident, the mine had four sets of drift openings and a fan shaft. Miners generally entered the mine from the Ellis portal or the North or South (known as UBB) portals. Four active sections were producing coal, including the 1 North Longwall Panel, Headgate 22 (HG 22), Tailgate 22 (TG 22), and one advancing room-and-pillar section (known as the “Barrier Section”). A detailed mine map is shown in Appendix B. There was also one deactivated super section located in the southern area of the mine. The approximately 1,000-foot wide, active longwall panel had mined approximately 5,450 feet, with about 1,240 feet remaining in the panel. Previously-mined longwall panels ranged from 3,000 feet to 17,000 feet in length. In the course of this previous mining, a non-fatal ignition or explosion occurred in 1997 on the 2 West Panel, and gas inflow incidents occurred in 2003 on Longwall Panel 16 and in 2004 on Longwall Panel 17. These events will be discussed in subsection “Outburst History at UBB” later in this report.

PCC transferred personnel, mining equipment, and supplies throughout the mine using battery-powered mantrips and supply motors. PCC transferred coal from the respective sections to the surface by a series of conveyor belts, which were in turn connected to overland belts. The overland belts carried the coal through adjacent mine workings in the Eagle Seam to the Marfork preparation plant near Packsville, West Virginia. PCC used an Atmospheric Monitoring System (AMS) on the conveyor belts for fire-detection and for individual conveyor belt status reports. An AMS operator monitored the system from the surface. Underground employees used a “leaky feeder” radio system installed at all active sections and along the primary and secondary escapeways for two-way communications. Underground employees would report their locations periodically to the dispatcher for tracking purposes. Underground employees were also tracked using wireless radio frequency identification (RFID) tags and a network of RFID tag readers. At the time of the accident, the tracking system was installed to just inby crosscut 101 of the North Glory Mains.

Management Structure

Testimony indicated that the upper management officials at UBB on April 5, 2010 were:

- Christopher L. Blanchard, President
- Jamie Ferguson, Vice President
- Wayne Persinger, General Manager
- Everett Hager, Superintendent - North
- Gary May, Superintendent - South
- Terry Moore, Mine Foreman - North
- Rick Foster, Mine Foreman - South
- Paul Thompson, Maintenance Manager
- Jack Roles, Longwall Coordinator
- Berman Cornett, Safety Director
- Jim Walker, Safety Director
- Jason Whitehead, Vice President of Route 3 Operations

In addition to these individuals, PCC maintained a separate list of “Corporate Officers” on April 5, 2010:

- Christopher L. Blanchard, President
- Tammy L. Tomblin, Chief Accounting Officer
- Jeffrey M. Jarosinski, Treasurer
- Richard R. Grinnan, Secretary
- Andrew B. Hampton, Assistant Secretary
- M. Shane Harvey, Assistant Secretary
- Phillip C. Monroe, Assistant Secretary
- Larry E. Palmer, Assistant Secretary

Massey also provided significant oversight and involvement at the mine in engineering, production, and safety issues. A list of Massey's corporate structure as reported to the Securities and Exchange Commission (SEC) can be found in Appendix C. Some of these key officials include:

Don L. Blankenship, Chairman and Chief Executive Officer
Baxter F. Phillips, Jr., President
J. Christopher Adkins, Senior Vice President and Chief Operating Officer
Mark A. Clemens, Senior Vice President, Group Operations
Michael K. Snelling, Vice President, Surface Operations
Michael D. Bauersachs, Vice President, Planning
Jeffrey M. Gillenwater, Vice President, Human Resources
Richard R. Grinnan, Vice President and Corporate Secretary
M. Shane Harvey, Vice President and General Counsel
Jeffrey M. Jarosinski, Vice President, Treasurer and Chief Compliance Officer
John M. Poma, Vice President and Chief Administrative Officer
Steve E. Sears, Vice President, Sales and Marketing
Eric B. Tolbert, Vice President and Chief Financial Officer
David W. Owings, Corporate Controller and Principal Accounting Officer

The management officials of DSC (which provided contract labor to UBB) on April 5, 2010 were:

Jim Hayhurst, President/Chief Executive Officer
John Bevilock, Executive Vice President
Jim Gump, Director/Operations & Safety
Beth Straton, Regional Manager

The management officials of MLS (which provided contract labor to UBB) on April 5, 2010 were:

Brian Buzzard, Owner
Kim Buzzard, Owner

DESCRIPTION OF THE ACCIDENT

Events Preceding the Explosion

The longwall began production at UBB in September 2009, several years earlier than planned, because three longwall panels that were to be mined at the Castle mine were, in fact, not mineable due to thin coal. The longwall began production at UBB in September, 2009 even though the tailgate for 1 North Panel at UBB was not designed for a longwall. Instead, it was planned to be used to access continuous miner panels.

Water in the area behind the longwall was a persistent problem at UBB. Water leakage due to subsidence into a flooded area in the overlying Castle mine resulted in accumulations in several areas in the bleeders and, early on in development, on the longwall face. The operator employed pumps to maintain the water depth at a level which would not affect ventilation.

What follows is a chronological summary of the movements of miners and mining events just prior to the explosion. While much is now known, some events cannot be detailed with precision; many witnesses to events tragically lost their lives on April 5. Additionally, a number of key management officials exercised their Fifth Amendment rights and declined to talk to MSHA investigators. All personnel who exercised their Fifth Amendment rights can be found in Appendix D.

April 4, 2010 was Easter Sunday and UBB was reportedly idle most of the day in observance of the holiday. Preshift examinations for the midnight shift began at approximately 8:00 pm, and no hazards were recorded. At about 11:00 p.m., the UBB midnight maintenance crews began working to prepare the mine for the resumption of production on Monday's day shift. The midnight shift reported no hazards, unusual conditions or events. Prior to the arrival of the day shift production crews on Monday morning, the preshift examinations for the longwall and two gateroad development sections were called out of the mine between 5:16 a.m. and 5:51 a.m. on April 5, 2010. According to the preshift report for HG 22, two entries required cleaning and rock dusting. No other hazards were reported; however, there was no report that the belt was examined. No hazards were reported for the longwall or TG 22 section. Between 3:00 a.m. and 6:00 a.m. on April 5, the preshift examinations were conducted on the conveyor belts in the northern part of the mine. The records for those examinations indicated that six of the nine belts examined required rock dusting and five of the belts required cleaning.

On April 5, 190 UBB employees and 16 contract miners were working or scheduled to work. The day-shift production crews included miners working on the longwall, HG 22, TG 22, and Barrier sections; the support crews included those on pumping and track maintenance. At times throughout the day, additional managers, examiners and miners entered and exited the mine. The starting times for the day shift production and support crews were staggered.

The longwall and HG 22 crews entered the mine at the Ellis Portal at approximately 6:00 a.m. Longwall Section Foreman, Richard "Rick" Lane, had a crew consisting of Rex Mullins, Headgate Operator; Joel Price and Gary Quarles, Jr., Shearer Operators; Dillard Persinger, Shield Operator; and Christopher Bell, Utility. They were accompanied by the longwall maintenance/utility crew, including Charles "Timmy" Davis, Assistant Longwall Coordinator; Grover Skeens, Maintenance Foreman; Nicholas McCroskey, Electrician; Cory Davis and Adam Morgan, red hats (trainees); and Joshua Napper, red hat (contractor trainee).

The HG 22 Section Foreman, Edward "Dean" Jones had a crew that consisted of William Griffith and Joe Marcum, Continuous Miner Operators; James "Eddie" Mooney and Ricky Workman, Shuttle Car Operators; Howard "Boone" Payne and Kenneth Chapman, Roof Bolt Operators; Gregory Brock, Electrician; and Ronald Maynor, Scoop Operator.

Michael Elswick, Belt Examiner, entered the mine through the Ellis Portal at 6:03 a.m. At 6:36 a.m., Elswick traveled inby the 78 switch, which is located at the mouth of the North Glory Mains.

Jeremy Burghduff, Outby Foreman, took his crew, David Farley and Jason Stanley, into the mine from the Ellis Portal at 6:28 a.m. to pump water behind the longwall and to conduct the weekly examination of the area and the preshift examination for the crew that was with him. Both members of Burghduff's crew were contractors employed by DSC. Stanley was a red hat miner. Burghduff's assignment included examining and maintaining a series of compressed air pumps behind the 1 North Panel.

The Barrier Section Crew (Jack Martin, Section Foreman; Jeremy Rife and Eddie Foster, Continuous Miner Operators; Chris Cadle and Danny Williams, Roof Bolter Operators; Melvin Lynch and Wes Curry, Shuttle Car Operators; and James Bailey, Electrician) entered the mine from the North portals at approximately 6:40 a.m.

The TG 22 Section Foreman, Steve Harrah, took his crew into the mine at 6:42 a.m. from the North Portal. This crew included Robert Clark, Continuous Miner Operator; William Lynch and Deward Scott, Shuttle Car Operators; Carl Acord, Timmy Blake, and Jason Atkins, Roof Bolters; Benny Willingham, Scoop Operator; and James K. Woods, Electrician.

Ralph Plumley, Track Coordinator, and his crew entered the mine at approximately 7:26 a.m. from the Ellis Portal. Plumley's crew consisted of Eric Jackson and Tommy Owen Davis, both track workers. The destination of this crew was HG 22, where they were to continue advancing the track into the section.

Interviews of the dayshift miners indicated that April 5 was not unusual until the time of the explosion. Mike Kiblinger, Tim Sigmon, and Matt Warden went to the HG 22 mother drive installation area around 9:30 a.m. to move their tools from that location to the new development near the Ellis Portal. Mark Gilbert, John Cox and Jerry Weeks delivered supplies to HG 22 at approximately 11:00 a.m. Scott Halstead started his examination from the longwall headgate at approximately 12:40 p.m. and he walked out of the Ellis Portal at approximately 2:25 p.m. Thomas Sheets and Virgil Bowman installed electric cables at the HG 22 mother drive and left the area at approximately 2:15 p.m. Billy Massey and Bruce Vickers delivered supplies to HG 22 and left the section about 2:15 p.m. None of these individuals indicated that they were aware of any problems or unusual conditions.

Billy Massey said that he saw Everett Hager, Mine Superintendent, at HG 22 shortly before 2:00 p.m. Electronic tracking data showed that Hager and Jack Roles, Longwall Coordinator, traveled outby the tag reader at 6 North starter box near 78 Switch at 1:55 p.m. These UBB managers exercised their Fifth Amendment rights and declined to be interviewed. Therefore, their exact routes of travel and activities can not be definitively determined.

Toward the end of the day shift, a series of reports were called out of the mine. The evening preshift report for HG 22 indicated one entry that required rock dusting but no other hazards. The maximum reported methane level was 0.3 percent; however, the air quantity was not recorded as required. Although the pre-shift report was called out to Patrick Hilbert, evening shift foreman for HG 22, neither the certified person who performed the pre-shift exam nor the time of the exam was recorded. Steve Harrah called out the TG 22 pre-shift examination at 2:38 p.m. to Brian Collins, the evening shift TG 22 foreman, who recorded the report. The TG 22 examination listed "0 %" methane, 32,360 cubic feet per minute (cfm) air quantity in the last open crosscut (LOC), and no hazards. The longwall pre-shift examination was called out by Rick Lane at 2:40 p.m. and was recorded by Kevin Medley, the oncoming evening shift foreman for the longwall. The longwall pre-shift examination listed 0.0 percent methane, 56,840 cfm air quantity in the intake, and air velocity readings of 776 feet per minute (fpm) at longwall shield 9 and 513 fpm at shield 160, and no hazards. Michael Elswick, fireboss, phoned out the pre-shift report for the conveyor belts at 2:30 p.m. and the report listed that eight of ten belts needed rock dusting and six belts needed cleaning.

Normal production was reported for HG 22 and TG 22 during the day shift. However, the longwall was not running for much of the day due to mechanical problems. The first production report was called out at 7:30 a.m. The longwall made two passes and ran until 11:00 a.m. The longwall was down from 11:00 a.m. to about 1:30 p.m. because of a lost "B-Lock" on the ranging arm of the longwall shearer. Rex Mullins called outside at 2:30 p.m. to report that the longwall shearer was at shield 115 and cutting toward the tailgate.

Jeremy Burghduff and his pumping crew left the tailgate area of the longwall in their mantrip around 2:30 p.m. and called out for clearance to use the track at 78 switch at 2:36 p.m. Ralph Plumley and his track maintenance crew left the HG 22 section around 2:30 p.m. and called out for track access at 78 switch at 2:42 p.m.

Elswick had called his examination out of the mine at 2:30 p.m. and was waiting near the longwall mother drive to catch a ride out of the mine. The TG 22 crew left the section about 2:50 p.m. and at 3:00 p.m. called for track access at 78 switch. The HG 22 crew was in the process of boarding its mantrip at the time of the explosion, while the longwall crew was still in the process of mining coal.

Investigation of the longwall shows that it was operating near the tailgate up until a minute or two prior to the explosion. The shearer was shut off by the tailgate side remote control at approximately 3:00 p.m. The pan line was shut down by someone on the longwall face. The headgate operator manually cut off the water to the shearer and manually disconnected the high-voltage power to the shearer. The longwall personnel near the shearer traveled about 400 feet from the tailgate prior to the explosion. The distance between the miners and the shearer indicates that the miners realized that an uncontrollable event was occurring and they were traveling away from that area at the time of the explosion.

Description of the April 5, 2010 Accident

A massive explosion occurred in the northern portion of UBB at approximately 3:02 p.m. At this time, the electrical power went off to the Ellis Portal; this portal's power was supplied from underground. Phone communications with the longwall, HG 22, and TG 22 sections were disrupted. Witness testimony, various digital records, and post-explosion analyses of the electronic timing devices confirm the timing of the explosion.

Individuals who were either in the mine or near the portals about 3:00 p.m. described their observations of the conditions including the magnitude of the explosion. The evening shift longwall crew and the HG 22 crew were boarding mantrips about three crosscuts inside the Ellis Portal. They felt a reversal of the air direction, and subsequently, the air flow from inside the mine increased in intensity to the point where the miners were pelted with dirt and debris, their hard hats were blown off, and some miners were knocked over. Mike Kiblinger, an outby maintenance foreman, who was standing by the Ellis Portal at the time of the explosion, recalled "It was blowing crib blocks out and just like a real strong wind, like a hurricane wind. And… a couple people. It blew them out. They were rolling."

Adam Jenkins, Dispatcher at the UBB office, described the event:

> …at three o'clock…called me from 78 Break, asked for a road outside… And a couple minutes later that's when it happened. All the dust started—just a white smoke started pouring out the portals, and it sounded like thunder. It was constant. And I didn't know what happened. And Gary May, he said, Oh, Lord,… something's bad happened…
>
> That all happened at the same time. That's when all that dust started gushing out here and the COs [AMS] went all crazy all at the same time. It all happened within seconds of each other. So I turned around and the COs started going off, and then the dust started coming out the portals, because you could see it from the window…

Greg Clay, Purchasing Agent, witnessed the results of the explosion at the UBB Portals:

> I was trying to get ahold [sic] of the headgate operator because I was waiting on the three o'clock report. And I guess about three minutes after 3:00, I just heard this bam (indicates noise). I thought the fan had thrown a blade or something because it's making a real bad noise. And I raised

> up out of my chair…I looked out the window and I could just see rock dust and debris blowing out of the portals. And it just sounded like jet engines at each portal. The air was just gushing out of the portals.

Several witnesses testified that mine fans at the UBB Portals stalled from the air pressure. Thomas Sheets, Maintenance Foreman said:

> …the fan's…sounds like it's going to come off the foundation [fan at UBB Portal]. So I start running towards the fan. John Henline come down and started running towards the fan with me. Dust started coming out the track entry. We got to the fan house. I started to shut the fan down. I didn't know what happened. I just didn't think that quick, but I thought the fan was coming off the foundation, and I don't want the fan blades going. That's quite a mess, and then just in a matter of minutes it was all over. Pressure came down…That was basically it. We knew we had an explosion at this point. John Henline said 'She's blew up'…

At the time of the explosion, a crew that had been setting up a miner section near the Ellis Portal was traveling inby in a mantrip on the way back to the North Portal at the end of their shift. Joshua Williams, Roof Bolter, described the experience:

> We was coming up the track, and the guy I was bolting with, he said, 'Man, it's dusty.' I said, 'Yeah.' Then he said, 'Do you feel a lot of air coming down the track?' I said, 'Yeah.' He said, 'It wasn't doing that this morning.' We kept on going, and my ears popped and I couldn't hear nothing. And then that's when we hit air… started pushing our mantrip back. It was throwing blocks, foam. That's when I laid down on the mantrip and threw my jacket over my head and was starting to get my rescuer out because I didn't know what in the world was going on. …It blew our mantrip. It blew it probably five crosscuts [outby]…we rode the track all the way back out to the Ellis Portal, and then we went outside…

Several miners near the portals were able to evacuate the mine. Surface personnel began notifying underground personnel to evacuate and initiated the mine's emergency response plan.

Accident Notification, Mine Evacuation and Initial Emergency Response

Accident Notification

The Mine Act and regulations require that a mine operator report a serious accident to MSHA within 15 minutes of the occurrence. This notification is essential so that MSHA can properly assess and respond to the accident. PCC and Massey delayed reporting the accident to MSHA and failed to properly inform MSHA of its magnitude. Chris

Blanchard called Jonah Bowles, Safety Director at Massey's Marfork mine, at 3:27 p.m. and asked him to report this occurrence to MSHA. Bowles called MSHA's Call Center Hotline at 3:30 p.m. and reported an inundation of carbon monoxide (CO) at UBB. He reported CO concentrations of 50 to 100 ppm and an air reversal on the beltline at the Ellis Portal. He was asked if anyone was trapped or injured and responded "no." He was also asked if there was a fire or any fatalities, and again responded "no." He stated that the CO readings might indicate a fire.

The MSHA hotline operator called MSHA Coal Mine Safety and Health District Four (D4) at 3:42 p.m. and relayed this accident information. Robert Hardman, D4 Manager, phoned UBB and issued a verbal control Order under Section 103(j) of the Mine Act to David Taraczkozy, UBB Chief Electrician at 4:00 p.m.

Mine Evacuation

The Barrier Section Crew exited the mine at the North portal at approximately 3:35 p.m. Clifton Earls-Supplyman and Jeremy Woods-Supplyman were removing track at the East Mains area inby the South Portal. They were not informed that an explosion had occurred and exited the mine at about 4:10 p.m.

Initial Emergency Response—Arrival of Rescuers and Other Personnel to the Accident Scene

At the Ellis Portal, approximately 25-30 minutes after the explosion, Chris Blanchard, another top company official, Jack Roles, Everett Hager, Wayne Persinger, and Patrick Hilbert (all of whom were upper management at UBB, except for Hilbert), took a mantrip into the mine. All of these individuals were bare-faced (i.e. without mine rescue apparatus) and some had Solaris handheld multi-gas detectors. At the Ellis switch, they called out their location and proceeded inby slowly. At crosscut 42, they saw the light from a miner's cap lamp approaching them. Continuing inby, at about crosscut 47, they encountered Timothy Blake, the source of the light, walking out of the mine. He was wearing his self-contained self rescuer (SCSR). Chris Blanchard asked what had happened and Blake stated that there had been an explosion. Blake said that his crew was inby about 20 crosscuts. Blake told them that he had put SCSRs on everyone he could (he was unable to do so for Deward Scott because it could not be located). During his interview, Blake stated, "So I went around to each man again, felt for a pulse. Everybody had a pulse but one man. I couldn't find no pulse on him. That's the man I couldn't find a rescuer. And I had to leave them. That was the hardest thing I ever done."

Immediately after the dust stopped blowing out of the UBB Portals, Gary May walked into the North Portal intake entry. Rick Foster took a mantrip into the mine. Jim Walker and Berman Cornett, Safety Directors, started walking in the track entry from the North Portal and met Foster at Plumley switch. Foster, Walker, and Cornett continued inby via the mantrip and caught up with Gary May at the Ellis switch at approximately 3:55 p.m. After making the turn onto the Old North Mains track, Rick Foster proceeded inby via the mantrip, followed by Walker, Cornett, and May on foot.

Meanwhile, Blanchard, another top company official, Persinger, Hager, and Roles, who were ahead of Foster's mantrip, continued inby on foot and left Hilbert (an emergency medical technician) with Blake at the mantrip. Persinger, Hager, and Roles carried extra SCSRs with them. Blanchard and another top company official reached the TG 22 mantrip and flagged the others behind them to hurry. Blanchard and another top company official told Roles to go back and get the mantrip that was left with Blake and Hilbert. Persinger opened the SCSR cache, removed SCSRs from the injured miners and put new SCSRs on them. Persinger provided a written statement on April 6, 2010, which was later provided to the accident investigation team, that James Woods was laboring heavily and that he did not detect a pulse on the remaining TG 22 miners. Foster, Cornett, and Walker arrived in another mantrip. Cornett told Foster to call the dispatcher and request several ambulances.

Soon afterward, Foster was told to get his mantrip out of the way, so he started out of the mine. The injured miners were loaded into the two remaining mantrips. The first mantrip included Harrah, Woods, Lynch and Acord and was operated by Hilbert. Persinger boarded the first mantrip and worked with Woods who was still responsive. The remaining TG 22 miners were loaded back into their mantrip, which was operated by Everett Hager. All three mantrips traveled out of the mine carrying the victims and rescuers, except for Chris Blanchard and another top company official who proceeded inby on foot.

Greg Clay called the Raleigh County 911 Dispatch at 4:22 p.m., requesting several ambulances at UBB. Clay stated they had several injured. Clay said they were in the process of removing the miners from the mine.

The Boone County E-911 was notified at 4:26 p.m. about a possible roof cave-in, with possibly ten miners involved. At about 4:30 p.m. units were en-route from the Whitesville Volunteer Fire Department (WVFD). WVFD paramedics and first responders traveled to the Ellis Portal mine site, arriving before the victims were brought outside. As victims were brought out of the mine, the paramedics attempted resuscitation using defibrillators and CPR. Seven of the miners were unresponsive. Blake came out with the first mantrip and refused treatment by the paramedics. When Woods was brought outside he was loaded into an ambulance and transported to the Whitesville High School football field for transport by medical helicopter.

Jim Hodges, Boone County Medical Examiner, arrived at approximately 5:45 p.m. and the remaining victims on the mantrip from the TG 22 crew were declared dead. The helicopter arrived at Charleston General with Woods at 5:57 p.m. Blake was later transported via ambulance to Raleigh General Hospital, arriving at 7:55 p.m.

Members of Massey's Southern West Virginia Mine Rescue Team were the first to arrive at the Ellis Portal, arriving between 3:30 and 4:00 p.m. Shortly after 4:00 p.m., Chris Adkins, Senior Vice President of Massey Energy Company, and Elizabeth Chamberlin, Vice President of Safety and Training for Massey Coal Services, arrived by helicopter and traveled to the UBB mine office.

Hardman and Michael Dickerson, D4 Staff Assistant and Family Liaison, traveled from the Mount Hope district office to the UBB mine location, arriving at approximately 5:00 p.m. Hardman modified the initial Section 103(j) Order to a Section 103(k) safety Order at 5:20 p.m.

Kevin Stricklin, MSHA Administrator for Coal Mine Safety & Health (CMS&H), had landed at Yeager Airport in Charleston, WV (arriving there on other MSHA business), at 4:20 p.m. After he checked his voice mail and learned of the event, he traveled directly to UBB. Stricklin arrived at UBB at approximately 5:30 p.m. and met Hardman near the Ellis Portal. Hardman told Stricklin that there were six confirmed fatalities and approximately 20 missing miners. Hardman also said that a command center for mine rescue was being organized at the UBB Portal because electric power and communications were not functional at the Ellis Portal. Stricklin and Hardman then drove to the UBB portals.

The West Virginia Office of Miners' Health Safety & Training (WVOMHST) was conducting training for its mine rescue teams at Logan, WV on April 5. Steve Snyder, Inspector at Large, received a call from the state homeland security hotline at 3:50 p.m. informing him of the initial incident report for UBB. Snyder then called the Oak Hill WVOMHST office for more information. At 4:45 p.m. Snyder was told that there had been an explosion at UBB and there were confirmed fatalities. The state mine rescue teams and equipment arrived at the Ellis Portal at 6:10 p.m.

Virgil Brown, Mine Emergency Unit Specialist, and John Urosek, Chief of Mine Emergency Operations for MSHA, received calls from D4 Assistant District Manager Lincoln Selfe sometime before 4:00 p.m. and 4:15 p.m., respectively, requesting mine rescue and technical support assistance at UBB. Brown was at the Pittsburgh Safety and Health Technology Center (PSHTC). Brown suggested that Selfe notify Jerry Cook, Mike Hicks, Mike Shumate, and other MSHA mine emergency team members from the D4 area. Brown gave instructions to move the MSHA Mine Emergency Command vehicle and Mine Rescue Team truck from the Mine Academy in Beckley, West Virginia to the mine site. The MSHA mine emergency command vehicle arrived at UBB at 6:30 p.m.

Bob Hardman, Chris Adkins, and Steve Snyder established a mine rescue command center at the UBB office around 7:00 p.m. Hardman was in charge of the mine rescue operation for MSHA, while Stricklin assisted with the media and families of the victims.

Brown and Urosek started mobilizing other members of MSHA's mine emergency response team and other mine emergency equipment. Brown arrived at the mine at approximately 8:30 p.m.

On April 6, 2010, personnel from MSHA's Directorate of Technical Support including specialists from the Physical and Toxic Agents Division and the Ventilation Division, arrived at the mine at approximately 1:00 a.m. with a portable gas chromatograph. Urosek, who had been at a lead mine in Missouri, arrived at UBB at about 1:30 a.m. The mobile gas laboratory arrived at approximately 3:00 p.m., with additional gas chromatographs.

Rescue Operations

From April 5 to April 9, over 20 mine rescue teams (Appendix E), including those from Massey, other mine operators, MSHA, and WVOMHST, worked around the clock in an attempt to locate and rescue the missing miners. The rescue efforts were prolonged and difficult due to the presence of combustible gases (which required evacuating the teams at times) and the necessity to restore ventilation controls, which the explosion had destroyed. By the end of the day on April 9, rescuers had determined that none of the missing miners survived the explosion.

Monday, April 5, 2010

Robert Asbury and Jim Aurednik, Massey mine rescue team members, loaded their mine rescue equipment on a mantrip and started in from the Ellis Portal. About five crosscuts into the mine, Aurednik saw lights coming from inby on the track and reversed the mantrip that he was driving. The lights were from the mantrip driven by Patrick Hilbert bearing the first known victims (see discussion in "Initial Emergency Response", above). Once outside, Asbury, Aurednik and other members of the mine rescue team removed the victims from the mantrips and, with the Whitesville Fire Department personnel, assisted in providing CPR.

At approximately 6:00 p.m., Asbury, Aurednik, and Mark Bolen, another Massey mine rescue team member, loaded their mine rescue equipment on a mantrip and headed back into the mine. They rode to the Ellis Switch, where Asbury and Aurednik then started walking ahead of the mantrip to check for gas and other hazards. At crosscut 78, they had to abandon the mantrip because of debris on the track. About five or six crosscuts inby crosscut 78, they encountered a broken fresh water line that was flooding the area, causing them to turn around and go back to crosscut 42 on the Ellis track to turn off the main water valve. Asbury, Aurednik, and Bolen returned to crosscut 78 and established a fresh air base (FAB) at this location because ventilation controls inby were damaged and blast damage limited further rail travel.

Massey mine rescue team members Shane McPherson, Mike Alexander, and Larry Ferguson were sent underground a short time later; they met Asbury, Aurednik, and Bolen at the FAB. The combined team continued to advance communications up the North Glory Mains toward the longwall "mother drive." The team encountered Chris Blanchard and another top company official walking toward them a few crosscuts inby the FAB. Blanchard and another top company official were escorted back to the FAB. Evidence of activated SCSRs was found in the tailgate entry four crosscuts outby the face and in 1 North Headgate at the mantrip. It is believed these rescuers were worn by Chris Blanchard and another top company official. Because they exercised their Fifth Amendment rights, the route or extent of their travel is unknown. After they finished briefing the mine rescue team on inby conditions and victim locations, another top company official and Blanchard were told to stay at the FAB while mine rescue team members traveled inby, repairing phone lines and doing basic exploration.

By 7:05 p.m., a total of nine mine rescue teams from Massey and other coal operations were at the mine. In addition, four WVOMHST and one MSHA mine rescue team were on site. One exploratory drill rig and three bulldozers had been mobilized to assist with the rescue operation. At 7:19 p.m., another top company official and Blanchard called out from a mine phone at the FAB and reported that they had been to the tailgate and almost to the headgate of the longwall, but had to retreat as a result of excessive carbon monoxide levels. They reported three victims in the longwall track entry outby crosscut 15.

At 7:40 p.m., Massey's Knox Creek and East Kentucky mine rescue teams and the Northern and Southern WVOMHST mine rescue teams were briefed by Adkins and Hardman at the mantrip barn on the surface of the mine. The teams then traveled into the mine from the North Portal on two mantrips. These teams were accompanied by MSHA mine rescue team members Fred Wills, Mike Hicks, and Jerry Cook. These teams arrived at the FAB at approximately 8:30 p.m. Both teams helped advance the FAB to crosscut 98, near the longwall mother drive. After advancing the FAB, the Knox Creek team began advancing toward the HG 22 section, through the crossover. Another team began exploring the longwall face and found one victim near the longwall mother drive, four victims along the track entry of the longwall, one victim beside the longwall stage loader, two victims near longwall shield 85 and four victims between longwall shields 103 and 106. The maximum carbon monoxide that this team encountered was 280 ppm; they did not encounter low oxygen levels and they did not see any smoke. This team explored from the longwall headgate toward the longwall tailgate, to shield 125.

Meanwhile, the Southern WVOMHST team began exploring the rooms immediately outby the active longwall panel. This team traveled across the North Glory Mains from the FAB and entered the roomed area outby the longwall panel, where it intersected the mains at crosscut 98, to look for missing miners. It advanced inby in entries 3-5 until it encountered the solid longwall block. They encountered extensive soot deposits, carbon monoxide levels of up to 45 ppm, and blown-out stoppings. The team then split up and explored the remaining entries back to the North Glory Mains. Some team members explored a portion of the longwall tailgate entries between crosscuts 30 and 33. They observed that ventilation controls in the tailgate entries were destroyed and the debris was blown outby. After exploring the Panel 1 crossover, the team traveled back to the FAB. This exploration was done bare-faced.

The Knox Creek team members traveled inby in the North Glory Mains. At 9:31 p.m., they were at the longwall mother drive in breathable air. At 9:50 p.m. they had advanced within about two crosscuts from the Glory Hole and donned breathing apparatuses due to encountering 50 ppm CO. They advanced to the mouth of HG 22 at 10:10 p.m. The CO levels had increased to 122 ppm with 0.0 percent methane and 20.7 percent oxygen. At 10:40 p.m., the Knox Creek team started back to the FAB due to their apparatuses having low oxygen reserves. They arrived at the FAB at 11:47 p.m.

At 9:30 p.m., Jamie Ferguson left the FAB with the East Kentucky mine rescue team to relieve the Knox Creek team and explore toward the HG 22 section. At 11:22 p.m. this team had advanced to crosscut 3 on HG 22 and, while under apparatus, reported 14.7 percent oxygen[1], 3.3 percent methane[2] and 8,676 ppm CO[3]. Ferguson reported thick smoke at crosscut 16. At 11:55 p.m. six victims were found in a mantrip just outby crosscut 19. At 12:16 a.m., on April 6, the team started retreating from the section after encountering 3.2 percent oxygen, more than 5.0 percent methane, more than 9,999 ppm CO (over range), and smoke. At 12:45 a.m., on April 6, the command center instructed all teams to evacuate the mine due to explosive levels of methane on the HG 22 section and the presence of smoke, which suggested the presence of fires or hot spots.

Records indicate confusion over the number of victims and missing miners from the time of the event until after the mine rescue teams left the mine on Tuesday morning, April 6. Factors that may have contributed to this confusion include the use of the partially installed Pyott-Boone tracking system in lieu of a traditional tag-in, tag-out board, inoperability of the tracking system north of Ellis switch after the explosion, the

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[1] Oxygen levels below 19.5% are considered deficient. When levels decrease to a range of 16 to 12%, a person can experience increased heart rate, fatigue, impaired judgment and coordination, nausea and vomiting. When levels decline to 10%, one breath can cause loss of consciousness and quickly result in death.

[2] Methane is a colorless, odorless, non-poisonous, and flammable gas, which is explosive between 5% and 15%. According to regulations, when 1% or more of methane is present, the operator is required to cease production and make changes or adjustments to the ventilation system in order to reduce the methane levels to less than 1% prior to resuming production.

[3] Carbon Monoxide is a colorless, odorless, poisonous gas, which attaches to the hemoglobin in blood 200 times easier than Oxygen. Carbon Monoxide is also explosive from 12 to 75% (10,000 ppm would equal 1%). Long-term workplace exposure levels to less than 50 ppm averaged over an 8-hour period are considered acceptable. Exposure levels at 100 ppm are considered dangerous to human health. Carbon Monoxide levels between 35 and 400 ppm can result in dizziness and mild to severe headaches with exposure times of eight hours to one hour respectively as the levels increase. Carbon Monoxide exposure can result in death at 1,600 ppm in less than 2 hours, at 3,200 ppm within 30 minutes, at 6,400 ppm in less than 20 minutes, and at 12,800 ppm after 2-3 breaths in less than three minutes.

use of multiple portals to enter and exit the mine, and Massey's failure to designate a responsible person (RP) to oversee the evacuation of the mine and the mine rescue effort. At 8:10 p.m., Massey reported seven dead and 19 missing miners. At 12:32 a.m. on April 6, the number of missing miners was thought to have been one on the longwall and four on HG 22. At 1:40 a.m., on April 6, Massey reported 25 dead, two injured and four missing miners.

Tuesday, April 6, 2010

All of the mine rescue teams, as well as Blanchard and another top company official, exited the mine by 2:30 a.m. The teams were debriefed and sent to get some rest. Gas monitoring continued at the fans and portals. At 5:50 a.m., MSHA modified the Section 103(k) Order to allow three boreholes to be drilled into the mine to better assess the atmosphere. MSHA Technical Support personnel arrived at UBB about 1:00 a.m. Two boreholes were started and continued to be drilled for the remainder of the day.

Wednesday, April 7, 2010

The first borehole (Hole 1A) intersected the mine at 4:00 a.m. at crosscut 35 on HG 22. MSHA modified the Section 103(k) Order at 6:41 a.m. on Wednesday, April 7, to allow installation of a diesel-powered exhaust fan on borehole 1 (BH 1A). MSHA modified the Section 103(k) Order at 4:10 p.m. to allow installation of a similar exhaust fan on borehole 3 (BH 1B) at 4:10 p.m. An exhausting fan was installed on this borehole in an attempt to ventilate the HG 22 methane accumulation. Gas levels from this borehole and from the Bandytown fan were monitored to determine when safe re-entry of the mine would be possible. Re-entry mine rescue plans were developed while waiting for hazardous gas levels to decrease.

Thursday, April 8, 2010

After determining gas levels had decreased to an acceptable level, MSHA modified the Section 103(k) Order at 3:50 a.m. to allow implementation of an exploration and recovery plan. At 4:55 a.m., four mine rescue teams entered the mine and traveled by rail to crosscut 78. By 7:51 a.m., teams advanced to crosscut 105 in the North Glory Mains in fresh air. By 9:03 a.m., teams advanced to the longwall mule train. Rescue team advance was slow because phone lines were being installed to ensure that teams could communicate in the event of an emergency. Teams advanced to the longwall stageloader at 9:18 a.m. At 9:29 a.m., an explosive level of combustible gases was detected at borehole BH 1A. All teams were instructed to evacuate the mine due to explosive levels of combustible gases at borehole BH 1A. All of the rescue teams evacuated the mine by 10:55 a.m.

Friday, April 9, 2010

At 12:13 a.m., MSHA approved a plan to re-enter the mine for exploration and recovery with two mine rescue teams. The plan objective was to explore the crossover area between TG 22 and HG 22. Two mine rescue teams entered the mine at 12:42 a.m. and traveled by rail to crosscut 78. The teams reached crosscut 78 at 1:23 a.m. and reestablished a FAB. One team stayed at the FAB as backup and one team traveled inby in the longwall track entry arriving at the mule train at 2:43 a.m. The FAB was advanced to the longwall headgate track entry just inby the longwall face. One team stayed at the new FAB and one team started exploring the Panel No. 2 Crossover between TG 22 and HG 22. At 3:36 a.m., the team had advanced approximately four crosscuts inby the FAB and measured 300 ppm carbon monoxide, 20.8 percent oxygen and 0.0 percent methane. The team donned their apparatuses due to the CO level. At 3:42 a.m. the team advanced to the TG 22 refuge alternative. This refuge alternative had not been deployed. The team returned to the FAB to reevaluate its exploration plan. The command center directed a team to continue exploration after the reevaluation was completed. By 4:12 a.m. the team had advanced approximately two crosscuts into the crossover and reported light smoke, 250 ppm carbon monoxide, 20.8 percent oxygen and 0.0 percent methane. The team advanced two more crosscuts into the crossover and encountered more smoke and 940 ppm CO. A fire was suspected in HG 22, and the team was instructed to return to the FAB. At 4:43 a.m., both teams were instructed to evacuate the mine, exiting at 6:12 a.m.

At 9:02 a.m., inert gas was injected into borehole BH 1A. At 2:32 p.m., Nitrogen trucks completed pumping into borehole BH 1A and changed to a nitrogen generator at 2:40 p.m. and continued pumping. A quantity of nitrogen equal to approximately twice the volume of the HG 22 mine workings had been injected into BH 1A. At 4:15 p.m., it was then determined safe for mine rescue teams to reenter the mine.

At 4:18 p.m., two mine rescue teams entered the mine to explore HG 22 and the longwall. At 4:28 p.m., two additional teams entered the mine. At 4:58 p.m., teams arrived at crosscut 78. At 6:17 p.m., teams arrived at the FAB, located at the longwall headgate track entry just inby the longwall face. At 6:33 p.m., the first team donned their apparatuses while advancing into the crossover. The first team advanced to approximately two crosscuts outby the mouth of HG 22 and measured 282 ppm CO, 18.0 percent oxygen and 0.2 percent methane. At 7:40 p.m., two additional mine rescue teams entered the mine to relieve the initial teams. At 8:01 p.m., the first team started retreating due to low oxygen levels in their apparatuses. At 9:18 p.m., the fourth team went under oxygen. At 10:10 p.m., a victim was found just outby crosscut 22 (three crosscuts inby the mantrip) in the No. 2 entry of HG 22. Another victim was found at crosscut 23 in the same entry at 10:15 p.m. At 10:21 p.m., a third victim was found in the same entry at crosscut 26. At 10:24 p.m., the team reached the HG 22 refuge alternative and found that it had not been deployed, then began retreating back to the FAB.

At 10:27 p.m., three mine rescue team members began searching the longwall for the remaining miner. At 10:50 p.m., the team on HG 22 returned to the FAB. At 11:04 p.m., the team on the longwall reported 23 ppm CO, 20.6 percent oxygen and 0.3 percent methane at shield 130 on the longwall. At 11:10 p.m., the team on the longwall reported 0 ppm CO, 20.8 percent oxygen and 0.95 percent methane on the tailgate end.

Two additional mine rescue team members were sent from the headgate toward the tailgate along the longwall face to search between shields for the missing miner. At 11:20 p.m., the last victim was found under debris near shield 3 and the rescue efforts ceased. At 11:24 p.m., MSHA and State personnel left the command center to inform the families that they had found the bodies of all missing miners.

Location of the Victims

The 29 victims died in five separate areas: the TG 22 crew was on its way out of the mine on a mantrip, the longwall crew was working along the longwall face, the HG 22 crew was in the process of boarding the mantrip at the end of its shift, a number of miners on the HG side of the longwall were doing maintenance work, and an examiner was waiting at the longwall mother drive.

William Lynch, Carl Acord, Benny Willingham, Robert Clark, Jason Atkins, Steven Harrah and Deward Scott were found on the TG 22 mantrip heading out of the mine at crosscut 67.

Rex Mullins, Nicholas McCroskey, Richard “Rick” Lane, Grover Skeens, Joel Price, Gary Quarles, Jr., Christopher Bell, and Dillard Persinger were on the longwall face.

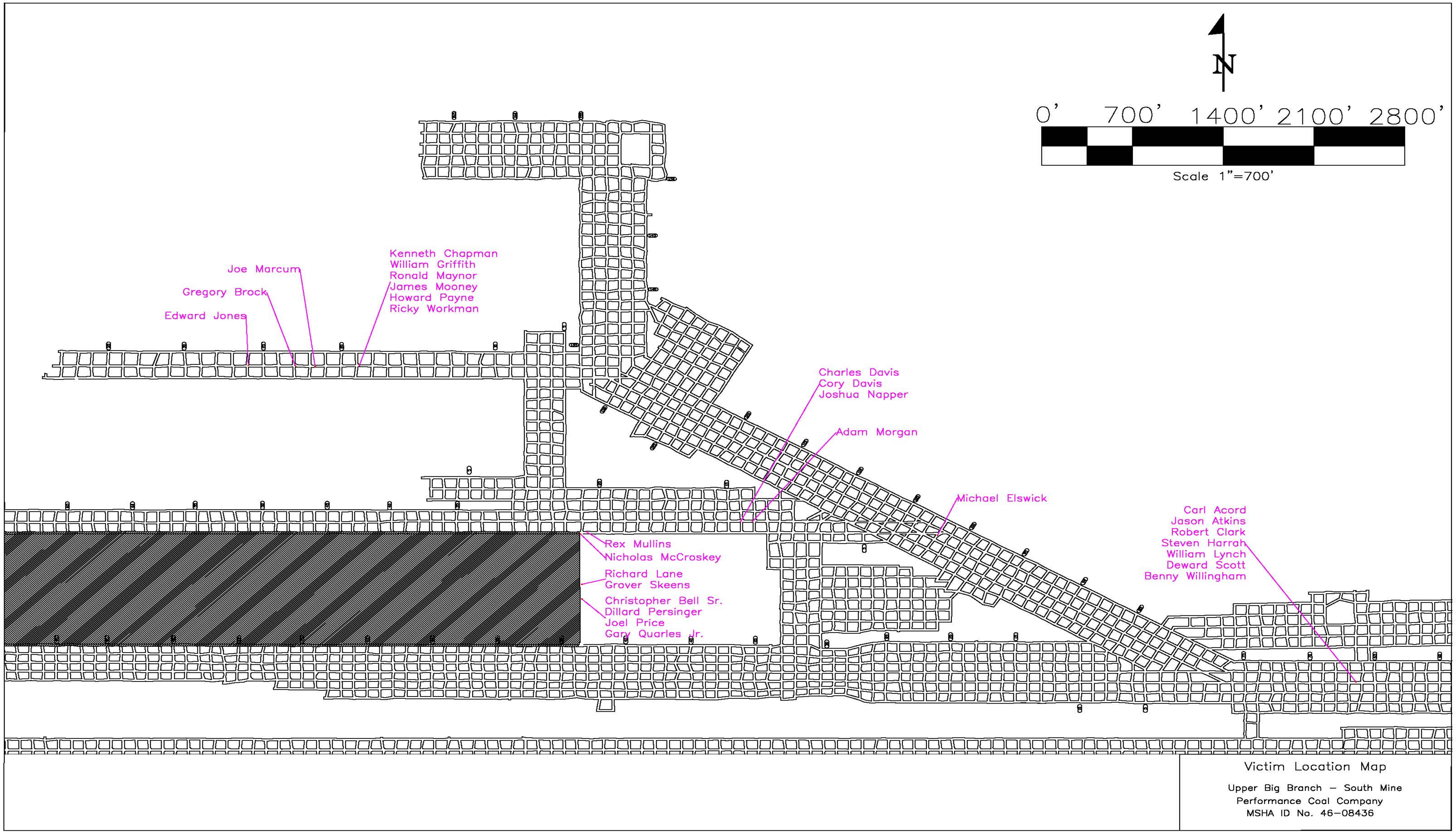
Ricky Workman, Howard “Boone” Payne, Ronald Maynor, James “Eddie” Mooney, Kenneth Chapman, and William Griffith were found on the mantrip in the HG 22 area. Located inby the HG 22 section but away from the mantrip were Joe Marcum, Gregory Brock, and Edward “Dean” Jones.

Cory T. Davis, Joshua Napper, Charles “Timmy” Davis, and Adam Morgan were on the headgate side of the longwall.

Michael Elswick was located in the North Glory Mains at the longwall mother drive.

Victim locations are depicted in Figure 1.

Figure 1: Victim Location Map



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Family Liaisons

Pursuant to the Mine Improvement and New Emergency Response (MINER) Act of 2006 and policies promulgated afterward, MSHA established a family liaison program to be able to effectively communicate information to families of miners who are victims or otherwise unaccounted for during a mine emergency. Mike Dickerson, serving as the lead UBB Family Liaison, traveled to the mine with Hardman and arrived at the Ellis Portal at approximately 5:00 p.m. on the day of the explosion. Charles Thomas, MSHA Deputy Administrator for CMS&H, contacted Norman Page, CMS&H D6 District Manager, at approximately 5:30 p.m. to request two additional family liaisons. Page instructed Kenneth Fleming, CMS&H Inspector, and James Poynter, CMS&H D6 Assistant District Manager, to travel to the mine. A Family Center was established at the company Safety Office at approximately 9:40 p.m. by Dickerson. Fleming and Poynter arrived at approximately 10:30 p.m. and reported to the Command Center for a briefing by Selfe. Dickerson met with Fleming and Poynter and briefed them on the scheduled times of the family briefings and introduced them to the Company Representative.

Joseph Main, Assistant Secretary of Labor for Mine Safety and Health, arrived at the mine site at approximately 10:00 a.m. on April 6 and, together with Stricklin and the family liaisons, met with the families of the miners to brief them on the progress of the search for their loved ones. The Family Liaisons remained on duty at the Family Center continuously through Saturday, April 10. They briefed the families every four hours and provided information relayed from the Command Center to the Family Center. The family liaisons maintained contact with the families throughout the rescue/recovery operations and investigation and assisted with many of the family briefings.

Recovery of Victims

Extensive damage caused by the explosion complicated the recovery of the victims. Rail travel was blocked inby crosscut 78 by debris on the track. Many ventilation controls were destroyed inby crosscut 75 of the Old North Parallel Mains. Potentially explosive levels of combustible gases were encountered several times during mine rescue attempts and some areas of the mine had an irrespirable atmosphere. Walking was hazardous because of debris in the mine entries. The area of the mine containing the victims was re-ventilated using temporary ventilation controls to permit the recovery to be conducted bare-faced. The logistics of the recovery were difficult; 22 victims were carried distances of up to 1.5 miles, victims locations were mapped, and forensic evidence was gathered prior to recovery of the victims.

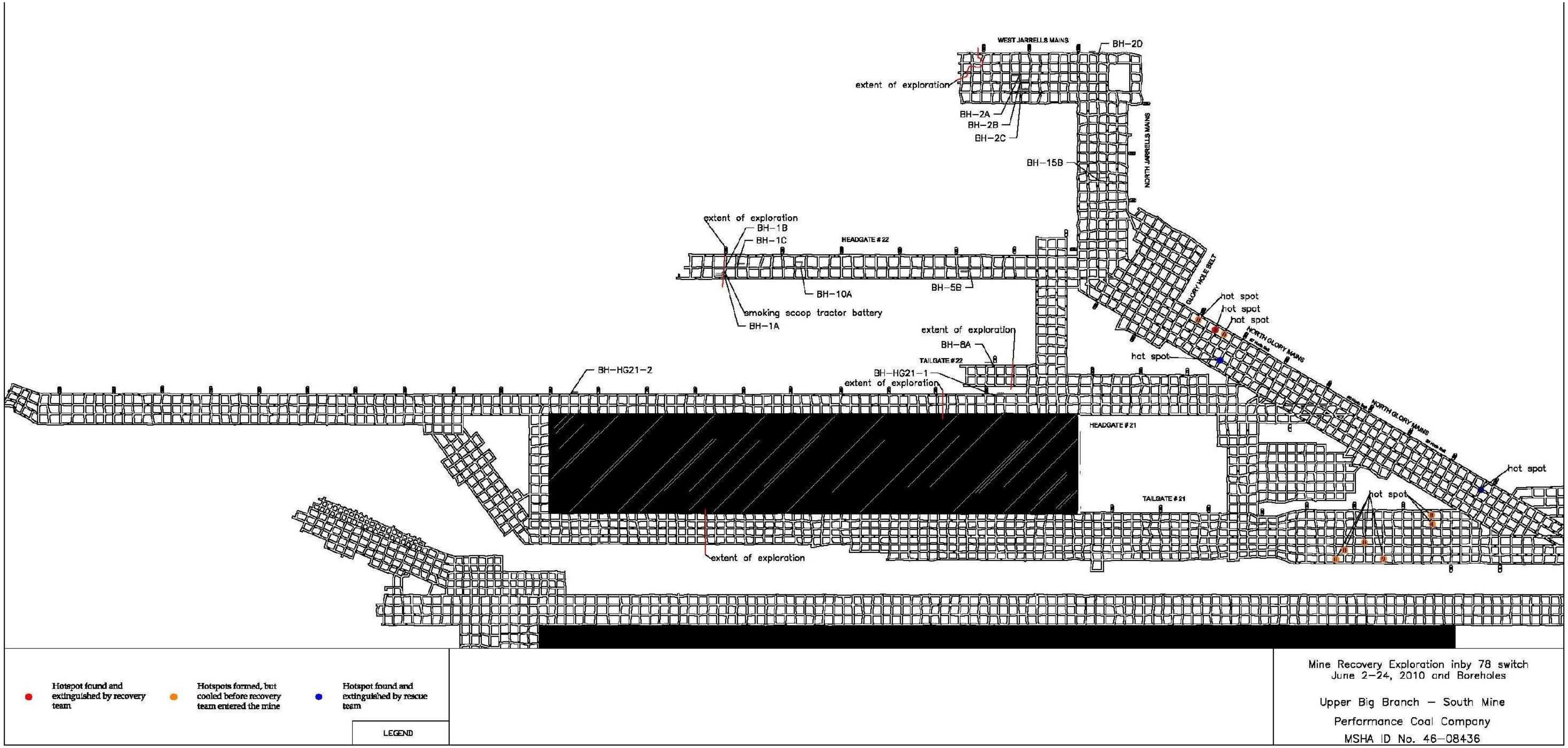
Multiple mine rescue teams worked from the time when the last victim was located at 11:20 p.m. on Friday, April 9 until all of the victims were recovered. On Tuesday, April 13, the last victim was removed from the mine at 12:57 a.m. and the last mine rescue team exited the mine at 3:30 a.m.

Mine Recovery Operations (April 13 - June 24)

Because the stability of the mine's atmosphere continued to be a cause for concern, Massey adopted (with MSHA and WVOMHST's concurrence) an approach for continuing monitoring at all existing sampling locations and drilling additional boreholes to provide monitoring locations in other areas of the mine. Monitoring continued from the North, South and Ellis Portal return entries, the Bandytown bleeder fan, borehole BH 1A, and from other boreholes as they were completed.

Several boreholes were drilled, some of which missed the intended mine entry, as shown on Figure 2. Other boreholes were stopped during drilling and never completed. See Appendix F for a description of each borehole drilled post accident at UBB.

Figure 2. Map of borehole locations and “hot spots” encountered during recovery exploration



On May 27, all parties agreed that the mine atmosphere had stabilized sufficiently to allow re-entry, pending the finalization and sampling of borehole "HG 21-1" near the longwall. Problems arose with HG 21-1, however, when the drill intersected an inactive area of a mine above UBB, causing a delay in the completion of the borehole until June 6. Nonetheless, because of the distance separating the longwall and the portals, exploration of the portal areas began on June 2, with the anticipation that borehole HG 21-1 would be completed prior to any exploration in the longwall area. All parties agreed that the mine atmosphere would continue to be sampled for stability during exploration and recovery work. PCC submitted a plan on June 1, 2010 and MSHA modified the Section 103(k) order on June 2 to allow the mine rescue teams to begin exploration and recovery. The plan required mine rescue teams to enter the North Portal and Ellis Portal and explore the track entries advancing toward each other. The teams explored the mine systematically, identifying hazards, such as ventilation inadequacies, water accumulations, and adverse roof conditions, and corrected these hazards as directed.

Another re-entry plan was submitted by PCC on June 7 and MSHA modified the Section 103(k) Order to allow for additional exploration of the mine. This plan allowed for an orderly exploration progressing through the entire mine. A potentially hazardous elevated temperature area ("hot spot") was found on the mine floor/coal rib interface in crosscut 118, between the No. 4 and No. 5 entry in the North Glory Mains. This hot spot required water to be piped from the surface down borehole 15B so that rescue team members could apply water in sufficient quantities to eliminate the hot spot hazard. Also, two additional hot spots identified by mine rescue teams after the explosion were checked and found to be at ambient mine temperature. Eight other areas in the mine were previously identified as having had elevated temperatures but had subsequently cooled to ambient mine temperatures. Six of these areas were found in Tailgate 1 North between crosscuts 11 and 24.

In HG 22 at crosscut 31, the teams encountered a personnel carrier battery that had smoke rising from it. To remove this possible ignition source, team members disconnected (cut) the negative battery lead from the battery charger to the battery to allow the battery to be moved. The battery was submerged in water at that location.

Mine exploration teams were not able to advance in Headgate 1 North inby crosscut 39½ or in Tailgate 1 North inby crosscut 87 because these areas were determined to be unsafe for travel. Therefore, no exploration occurred in the area of the mine inby those two points, which included the Bandytown fan shaft and the longwall bleeder dewatering system. Other areas of the mine, including parts of the TG 22 and HG 22 sections, were found to be flooded, requiring dewatering to make them accessible before the investigators could begin their work. On June 24, the mine rescue teams completed exploration of the travelable areas of the mine.

The UBB Accident Investigation team began their investigation on April 12, 2010; on June 25, 2010, the team began the underground portion of the investigation.

INVESTIGATION OF THE ACCIDENT

MSHA's accident investigation began on April 12, 2010. MSHA conducted a thorough investigation in the accessible underground areas of the mine affected by the explosion. The investigation included detailed mine mapping and collecting and analyzing evidence. MSHA prepared an investigation protocol in conjunction with WVOMHST to ensure the safety of the underground phase of the investigation; input was solicited from other investigative parties. A copy of the protocol is included in Appendix G.

Involvement with Other Investigations

The accident investigation involved six different investigative entities; MSHA, WVOMHST, PCC, the West Virginia Governor's Independent Investigation Panel (GIIP), the United Mine Workers of America (UMWA) and Moreland & Moreland, l.c., representatives of the miners. MSHA and WVOMHST led the investigation underground, with PCC, GIIP, and UMWA accompanying and assisting them.

WVOMHST and GIIP

Cooperation with WVOMHST began shortly after MSHA's accident investigation team assembled on April 12, 2010. MSHA and WVOMHST conducted interviews jointly. The two agencies also evaluated and approved action plans submitted by PCC. This cooperation was necessary to ensure a thorough investigation and the safety of the investigators. MSHA and WVOMHST established office space at the UBB Portals during the underground investigation to facilitate meetings and planning sessions, information sharing, and communication throughout their respective investigations. Additionally, MSHA cooperated with the GIIP, allowing it access to the MSHA/WVOMHST interviews.

Miners' Representatives

Miners separately designated both the UMWA and Moreland & Moreland as miners' representatives under Section 103(f) of the Mine Act. The UMWA began its involvement on April 23, 2010. UMWA representatives participated fully in the underground portion of the investigation. Moreland & Moreland began its involvement in the investigation on August 11, 2010.

Underground Investigation Teams

The underground portion of the investigation did not begin until the end of June because of hazardous conditions in the mine, including elevated CO concentrations, potential hot spots, and inaccessible areas. MSHA, accompanied by WVOMHST, GIIP, UMWA, and company representatives, mobilized several teams to conduct mine dust surveys, mapping, electrical, ventilation, geologic, flames and forces, evidence collection and inspection activities. In addition to the 105 accident investigation personnel involved with the on-site investigation, MSHA also utilized an additional 45 Technical Support personnel to perform testing and technical work and other personnel to guard the three portals during the investigation.

Mine Mapping Teams

Mine mapping began on June 29 and continued through November 18, 2010. Mapping served to document the mine conditions after the explosion and notate where evidence was found and collected underground. Mapping teams were usually comprised of one or two MSHA personnel, one WVOMHST member, one representative of the mine operator, one miners' representative, and, at times, one GIIP team member. Each mapping team produced a map for separate, referenced mapping areas. MSHA later compiled individual areas to produce a single composite map included in Appendix H. The mapping team conducted all mapping by the distance and offset method, from spad to spad. If no spad was available, the team used the center of an intersection as a reference point. The teams did not map the rib lines, except where inaccuracies in the base map prevented mapping of the objects. The teams made notations when objects appeared to sustain heat damage from the explosion. All team members signed and dated each completed map. The parties typically made copies of team maps at the conclusion of each shift and distributed them to the other investigation teams. The investigators sent up to ten teams when underground mapping was conducted.

Mine Dust Survey

MSHA takes a mine dust survey after every underground coal mine explosion to determine coking and the incombustible content of the post-explosion dusts. The test for coking can be used to determine the extent of flame that occurred during the explosion and help investigators to determine the fuel, ignition source, and origin of the explosion. The incombustible content can be used to establish the condition of the mine dust prior to the explosion.

Flames and Forces Team

MSHA assigned a "flames and forces" team the task of establishing the origin of the explosion, the ignition source, the extent of flame, and the magnitude and direction of primary explosion forces. This team went underground starting July 13, 2010. It consisted of MSHA and WVOMHST personnel, along with GIIP, UMWA and company representatives.

Electrical Teams

Electrical inspections began on May 13, 2010 on the surface area of the mine. The electrical team inspected all surface equipment located near the portals and the surface substations and checked all cables entering the underground mine to ensure the electrical equipment was properly de-energized and grounded. These activities were completed to ensure that the mine was safe from electrical hazards before beginning the underground accident investigation. A maximum of three electrical teams were used throughout the accident investigation, with two teams normally working inside the explosion area. The teams consisted primarily of personnel from MSHA and WVOMHST, but also included one or two company employees, along with a UMWA representative serving as observers. The first electrical teams went underground on June 28, 2010. One team with an additional MSHA Technical Support engineer worked outside of the explosion zone, re-energizing electrical circuits to pump water, install communication devices, and energize other electrical equipment. The team completed the electrical work outby the explosion zone by the end of October 2010. The electrical portion of the investigation in the explosion zone continued until May 4, 2011.

Geology Team

MSHA conducted geologic observations between May 2010 and December 2010. MSHA made surface observations where old contour strip mines, as well as the active Progress Pit strip mine, afforded outcrop exposure. MSHA also observed underground geological conditions in portions of the Castle Mine and the Black Knight II Mine.

Underground at UBB, there was one geology team composed of MSHA and WVOMHST, with observers from the mine operator and the UMWA. MSHA documented geological conditions in UBB by conducting multiple parallel traverses in various entries of Headgate 1 North and Tailgate 1 North, the Panel 1 and Panel 2 crossover, the HG 22 and TG 22 sections, and the North and West Jarrells Mains. MSHA made several traverses across the longwall face, with detailed observations conducted in the tailgate entry. MSHA also documented geological observations on maps and in photographs, which were further supported by the collection of rock and gas samples.

Ventilation Survey

On September 28, MSHA personnel started a mine ventilation air quantity and air pressure survey, with participation from representatives from WVOMHST, UMWA and the mine operator. This survey determined post-explosion air velocities in the mine using either vane anemometers with wands in the one-half area traverse method or using the smoke-cloud method with aspirators and chemical smoke tubes. Investigators then calculated air quantities from the determined velocities and corresponding area of the mine entry in which the velocity was determined. Investigators measured air pressure differentials between air courses and across regulators or partial ventilation controls using magnehelic gauges and digital manometers. Investigators also used altimeters which were used to determine the total pressure at specific locations within the mine.

Evidence Collection and Testing

During the course of the investigation MSHA obtained about 88,000 pages of documents, 1,028 maps, over 24,000 photos, 18 videos, and more than 1,050 separate pieces of physical evidence. MSHA collected evidence at UBB in accordance with the protocol set forth by MSHA in conjunction with WVOMHST. When available and requested, MSHA provided duplicate samples to all investigation parties (Appendix G). Evidence was tagged, photographed, and removed from mine property, accompanied by a "Chain of Custody" form or an "Itemized Receipt", as applicable. The MSHA Accident Investigation team provided PCC itemized receipts for evidence removed from the mine.

Photography

A photographer or group of photographers was frequently present during investigation activities by the accident investigation team. All parties involved during the investigation activities by individual teams were given the opportunity to request additional photographs and examine any evidence prior to its removal from the location. Photos taken were copied per PIL NO. 110-V-08 (Appendix I) which outlines the approved procedure for the copying of digital images from the SD (Secured Digital) card, contained in the camera, to a compact disc or hard drive memory for storage and filing during an accident investigation. MSHA provided a copy of these images to all investigation parties, along with a copy of the signed Photo Log.

Evidence Testing

<u>MSHA CMS&H Mount Hope and Standard Laboratories</u>

The MSHA Mount Hope National Air and Dust Laboratory and the private Standard Laboratories conducted analyses of mine dust surveys collected from the mine to assist investigators in determining the cause and origin of the explosion, the area affected by the flame of the explosion, and the incombustible content of mine dust throughout the sampling area. Each lab processed a total of 1,803 mine dust samples for incombustible content and the presence of coke. As samples were collected, each party accompanying the mine dust survey teams was offered a portion of the same sample collected by MSHA. After the collection team transported samples to the surface, investigators checked each uniquely identified sample against the collection sheet and gave the samples to a member of the evidence collection team, along with a collection data sheet signed by all members of the mine dust survey team.

Investigators then transported samples from the mine site directly to the Mount Hope laboratory for the initial analysis, following MSHA's chain of custody procedures throughout this transfer. The Mount Hope laboratory retained possession of the samples for the duration of the initial analysis test. MSHA stored the remaining portion (except for the small amount consumed during analysis) in a uniquely identified container, locked in a secure room within the laboratory, until investigators transported them to Standard Laboratories for a comparison analysis. A side by side comparison of the results from both laboratories showed that the variation of the results varied only slightly, by an average of only 1.82 percent in the incombustible content (Appendix J). Further evaluation of this data is explained in the subsection “Mine Dust Survey” located in the “Physical Causes of the Accident” portion of the report.

Electrical Testing

MSHA tested numerous physical pieces of evidence recovered from the mine. On a number of occasions, MSHA arranged for the manufacturer of the equipment to conduct the testing in MSHA’s presence. MSHA invited WVOMHST, GIIP, UMWA, Miners Representative and the mine operator to attend all of this testing. Throughout the testing, MSHA retained custody of the evidence.

Joy Manufacturing and Matric Limited Facilities

MSHA arranged for the testing of components removed from the longwall equipment with Joy Manufacturing (Joy), the manufacturer of the equipment, at Joy’s facilities. Joy performed tests on the following components:

- Joy Network Architecture (JNA) control units
- Chock Interface Unit (CIU)
- Automatic Chain Tensioner (ACT)
- Support Control Centre (SCC)
- Shearer Remote Controls

Approval and Certification Center (A&CC)

Investigators used the MSHA Technical Support Approval and Certification Center (A&CC) for testing of multiple items collected throughout the course of the investigation. A&CC testing included equipment checks against approved drawings, functional testing of equipment and safety systems, data recovery, and evaluation of evidence as potential ignition sources during detailed inspections. Investigators also documented grain size for material collected from spray nozzles in the longwall shearer.

State Electric Supply Company Facility

The State Electric Supply Company Facility was involved in the testing and data recovery of certain equipment manufactured by Allen-Bradley, including the PLC-5 and SLC 500 Processor Modules, the Panel View Operator Interface, and the Dataliner DL40 electrical equipment recovered from the mine.

SMC Electrical Products, Inc. Facility

Representatives of SMC Electrical Products used their facility for visual inspection, data recovery and functional testing of the Multilin 239 overcurrent relays, SMC SGF-25 relays, SMC ground fault relay display units, and Multilin SR735 overcurrent relay collected from the longwall track mounted equipment known as the "mule train." The testing performed by manufacturers' representatives of these items included visual inspection of the equipment, functional and data recovery.

Mine Safety Appliance Company (MSA) Facility

Investigators conducted data retrieval activities and a time-drift study of item PE-0118, a MSA Solaris hand-held gas detector, at this facility. The Solaris detector was damaged to the point where testing was not possible at A&CC. The visual inspection of the detector was conducted at A&CC.

UBB Mine Site

At the UBB mine site, members of the accident investigation team, with assistance of A&CC personnel, conducted data downloads from gas detection equipment used at UBB prior to the accident and during rescue activities. Present during the download procedure were WVOMHST and the mine operator. Miners representatives from the UMWA were afforded the opportunity to participate. MSHA established protocols for downloads of a Solaris gas detector (used at the mine prior to and after the mine explosion) and Industrial Scientific MX6 gas detectors (used during rescue operations) and invited the mine operator and members for each of the investigation parties to attend the downloads.

Gas Sampling

Investigators collected samples of gas emanating from fractures in the floor from locations on the longwall face and the development sections for chemical and isotopic analyses to determine the source of gas entering the mine. Investigators collected gas using an SKC permissible dust pump, as well as an Industrial Scientific MX6 handheld multi-gas detector with a built-in pump, filling 1-liter Teflon-coated sample bags. In standing water, investigators used a capped length of large-diameter poly-vinyl chloride (PVC) pipe, equipped with a tube fitting, to allow gas to accumulate for sampling. In dry conditions, investigators inserted copper tubes into floor fractures and packed them off with mud and debris to create a seal. Together, with the results of gas analyses obtained at Speed Mining, LLC's American Eagle Mine, investigators compared the results of gas analyses to samples of methane collected from wells in the vicinity of the mine.

Interviews

As noted earlier, MSHA and WVOMHST conducted interviews jointly, usually with the participation of GIIP. The agencies conducted 310 formal interviews before a court reporter, and 38 individuals were called back for additional testimony. To help facilitate the interviews, WVOMHST issued 116 subpoenas; the other witnesses appeared voluntarily. The Mine Act limits MSHA ability to issue subpoenas, only providing for subpoenas should there be public hearings. Nineteen individuals from Massey or PCC who received subpoenas from WVOMHST exercised their right under the Fifth Amendment of the U.S. Constitution to not testify. MSHA remains willing to interview any of these individuals, even after the release of this report, should any choose to voluntarily share information with the agency. Information from these individuals or others may prove important in better understanding the events leading up to the accident and how it occurred. Such additional evidence could result in MSHA being better informed and could lead MSHA to reexamine findings contained in the report..

PRACTICES AT UBB THAT LED TO THE EXPLOSION

The information in this section is based on testimony and physical evidence obtained during this investigation.

In the days, months, and years prior to April 5, 2010, PCC and Massey management set the stage for the explosion by allowing and encouraging mining practices that resulted in violation of federal law. PCC regularly hid hazards present in the mine from MSHA, noting some of them in one set of production and maintenance books, but failing to note them in required examination books that MSHA examined. PCC's failure to identify and correct the hazards of coal dust accumulations and inadequate rock dusting led to the coal dust explosion on April 5. PCC and Massey inadequately trained their examiners and foremen (and other miners as well), contributing to their failure to identify and correct hazards. In addition, PCC and Massey engineers themselves could not handle the engineering challenges present at UBB and made a series of mistakes that made the mine hazardous.

By April 5, an alarming number of accidents had occurred, many unreported to MSHA in violation of law. PCC illegally provided its employees with advance notice of MSHA inspections, severely limiting the effectiveness of the inspections. Additionally, PCC and Massey intimidated miners from voicing complaints, either internally or to MSHA.

Examinations

PCC regularly failed to properly examine the mine for hazards, putting miners at risk and directly leading to the April 5, 2010 explosion. MSHA regulations, codified at 30 CFR §§ 75.360- 75.364, make plain that a mine operator must examine certain areas of the mine on a weekly basis, as well as before and during each shift, for hazardous conditions. The operator must identify, record, and immediately correct the hazards. At UBB, examiners often did not travel to areas they were required to examine, or, in other cases, did travel to the areas but did not perform the required measurements. Examiners also failed to identify hazards when they did perform examinations. In many instances, management officials noted hazards in a production or maintenance record, but failed to record them as required by the Mine Act in the required book. The failure to properly record hazards denied MSHA and miners the opportunity to understand and assess the hazards and ensure that they were corrected before production resumed. Finally, even where examiners did identify and record hazards, the mine operator frequently did not correct them. Because of these practices, accumulations of loose coal, compacted coal, and coal dust built up over weeks and months to dangerous levels and provided the fuel for the April 5 explosion. Similarly, because of the operator's failure to identify, record and correct the hazard of insufficient application of rock dust, the rock dust that was present in the mine failed to halt the explosion. These are just a few of the hazards that were not corrected and contributed to the April 5 explosion.

Failure to Perform Examinations

On many occasions, PCC failed to conduct or complete required examinations prior to miners entering the mine or work areas. Several of these failures occurred in the 24-hour period prior to the explosion on April 5. For example, during the preshift examination for the midnight shift on April 4, the examiner responsible for examining the longwall face (who had never conducted a longwall preshift prior to April 5) failed to examine the face. The examiner only took an air reading at the intake to the longwall and examined to shield 1. The examiner failed to travel the length of the longwall face to examine for hazardous conditions, test for methane and oxygen deficiency, determine if the air was moving in its proper direction, or take air velocity measurements at shields 9 and 160. The midnight maintenance crew worked on the face as scheduled.

An examiner was responsible for examining the longwall tailgate entries on April 5 prior to the start of pumping work in those areas. The examiner permitted his pumping crew, comprising of two contract laborers, to travel with him as he conducted his examination, a practice which is impermissible under the regulations.

PCC failed to comply with the requirement that weekly examinations be performed once every seven days. Between December 29, 2009 and March 10, 2010, it was common practice for the examination of the return entry at the Bandytown fan to be conducted every eight to nine days.

Examiners routinely did not energize their multi-gas detectors when required during examinations, and the detectors often remained de-energized for extended periods of time during their shift.

On the day of the explosion, an examiner was required to perform a weekly examination on the longwall bleeder system. This bleeder was in the area behind the longwall that draws noxious gases and dusts away from the active areas and ultimately exhausts these contaminants through the Bandytown fan. After the explosion, investigators determined that the examiner's multi-gas detector had not been turned on since March 18, 2010, approximately two weeks prior to the explosion. As a result, during this time period, the examiner could not take adequate air quality measurements.

In addition, section foremen failed to keep their multi-gas detectors energized throughout their shifts. The longwall section foreman failed to energize his detector during the first part of the shift, from 8:45 a.m. to 11:08 a.m., on April 5.

PCC's examiners did not perform complete examinations by failing to take air readings required by the mine's approved ventilation plan. For example, PCC's weekly examiners did not take air quantity measurements at a required evaluation point in the longwall headgate entries because water had blocked access to the location. Rather than remove the water or establish an alternative measurement point, PCC simply failed to take measurements. Examiners did not take air readings in a number of other locations, including the Ellis Portal return air courses, the longwall section belt, the Ellis Portal belt/track, and measuring points inby the longwall headgate and tailgate.

Required examinations of dust control parameters for the longwall shearer were not being performed. Air measurements were not taken at proper locations to determine the actual quantity of air ventilating the longwall face. The air quantity in the longwall belt entry was not being measured. Water sprays, pressure and flow rates, were not being examined as required for each shift.

Failure to Identify Obvious Hazards

MSHA found hazardous conditions throughout the northern area of the mine (i.e., the area affected by the explosion), including:

Accumulations of Loose Coal[4], Coal Dust[5], and Float Coal Dust[6]

MSHA investigators found that PCC examiners failed to identify accumulations on the mine floor and against the ribs left from initial mining or roadway spillage, accumulations that had been scooped and placed in piles shown in Figure 3, and accumulations from rib sloughage. Accumulations were found consistently along every single air course. The location and placement of these coal accumulations indicated that they pre-dated

[4] Loose coal is defined as coal fragments larger in size than coal dust, as per 30 CFR 75.400-1(c).
[5] Coal dust is defined as particles of coal that can pass through a 20 mesh sieve, as per 30 CFR 75.400-1(a).
[6] Float coal dust is defined as coal dust consisting of particles of coal than can pass through a 200 mesh sieve (100 times smaller particles than those passing through a 20 mesh sieve), as per 30 CFR 75.400-1(b). Float coal dust is the most dangerous because it is easily suspended in the mine atmosphere and only requires a thin observable layer to provide the fuel for the propagation of a dust explosion.

the explosion. Miners working in these areas testified these accumulations existed prior to the explosion.

Figure 3. Accumulations of loose coal, coal dust, and float coal dust were measured up to 7 feet wide by 12 feet long by up to 4 feet in depth. These were found consistently along every single air course.

Rock Dust[7]

The MSHA Accident Investigation Team's mine dust survey revealed that 90.5 percent of the affected area[8] was inadequately rock dusted at the time of the explosion. Testimony indicated that the Longwall Tailgate entries, the crossover between HG 22 and TG 22, and the Glory Hole area were black or needed to be rock dusted. In addition evidence indicates that the Longwall Tailgate entries had not been rock dusted since the longwall went into production in September 2009. (The "Rock Dusting"

[7] Rock dust is defined as pulverized limestone, dolomite, gypsum, anhydrite, shale, adobe, or other inert material, preferably light colored, 100 percent of which will pass through a sieve having 20 meshes per linear inch and 70 percent or more of which will pass through a sieve having 200 meshes per linear inch, as per 30 CFR. Rock dust must be continuously applied in order to neutralize float coal dust, which inherently occurs during the mining process.

[8]The "affected area" is the area of the mine that was exposed to flame as indicated in Appendix Z.

section discusses in more detail PCC's inadequate rock dusting practices). Only the belt examination books listed inadequate rock dusting as a hazard; the other examination books from the working sections did not.

<u>Inadequate Roof Support</u>

PCC's roof control plan required two rows of posts or two 8' cable bolts in the No. 7 entry in the longwall tailgate as supplemental support. This requirement was intended to maintain adequate roof support in that entry. PCC only installed one row of posts in the entry as shown in Figure 4. Both the single row of posts and the resulting roof control issues were obvious; examiners testified that they did not like to travel in that entry due to the bad top. PCC never recorded the hazard in any of its examination books. Poor roof conditions led to a roof fall in the No. 7 entry, which likely restricted air flow coming off the longwall face, and allowed methane to accumulate prior to the explosion. The investigation indicated that this fall was present prior to the explosion; blackened dust from the explosion was present on the fall and could only have occurred after the explosion.

Figure 4. Photograph of Tailgate 1 North No. 7 entry showing only one row of posts installed. The approved roof control plan required two rows of 8' cable bolts or posts.

Failure to Record Hazards

PCC engaged in a practice of failing to record all hazards in books required to be made available to MSHA and any interested persons. Several witnesses testified that they felt pressured by mine management not to record hazards in the required examination books. PCC instead recorded certain hazards in its internal production and maintenance reports. These reports were prepared by shift or section foremen and provided to PCC upper management (including Massey Energy Company officials for the production reports). Some of the hazardous conditions described in this "second set" of books relate to conditions that existed at the time of the explosion. For example, Figure 5, which is an entry in a PCC maintenance book from March 1, 2010, indicated that eight sprays were removed from both the head and tail drum and the shearer was operated in that manner for the remainder of the shift. This information was not recorded in the required examination book.

Use Indelible Pencil or Ink

DAILY AND ONSHIFT REPORT
MINE FOREMAN OR ASSISTANT

Report shall be signed when made

Date 3-1-10 Shift Eve Area or Section Longwall

Violations and other Hazardous Conditions Observed and Reported

Location	Violation or Hazardous Condition	Action taken
1. Face	CH4 0% O2 20.8% None Observed	None
2. Roof Supports	" " " "	"
3. Power Center	" " " "	"
4. Chargers	" " " "	"
5. Track	" " " "	"
6. Travelways	" " " "	"
7. Barricade Station	" " " "	"
8.		

Examinations for Methane in Working Places

Location	Time	Methane Content	Location	Time	Methane Content
1. Face	4:45 PM	0%	11.		
2.	6:45 PM	0%	12.		
3.	8:43 Pm	0%	13.		
4.	10:42 Pm	0%	14.		
5.	12:40 AM	0%	15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Examinations for Methane in Return Aircourses

Location	Time	Methane Content	Location	Time	Methane Content
1. Return	5:50 Pm	0%	6.		
2.	7:48 Pm	0%	7.		
3.	9:48 Pm	0%	8.		
4.	11:45 Pm	0%	9.		
5.			10.		

Number of Bolts Tested

Number of Bolts Torqued Above Range Below Range

If majority of bolts tested in any working place falls outside approved torque range, state what action was taken

Remarks (Statement as to General Conditions of Mine or Area of Mine) discussed Lonwall dust & methane [redacted]

Performance
UBB Longwall
Monday, 3/1/2010
B Crew, Shift Chief

Equipment	Job Description	Estimated Time	Comments/Initials
ace Conveyor	Utilize the bretby gauge to check the bretby trough to insure bretby will clear. If not wide enough, repair and record locations where repairs were made. ____ Hang gauge at #5 shield when complete. (On-Shift)	20 minutes	TE
	Check slim line in cable handler, especially near couplings looking for fatigue do to movement, replace as needed. (On-Shift)	20 minutes	TE
	Did you put ACT in manual mode on your shift ____, if so explain why. Did you put yellow handle detent valve in and set to 1500 PSI? (On-Shift)	5 minutes	
eneral Longwall	Check oxygen and acetylene tanks. Record the number of empty oxygen tanks 1, full oxygen tanks 3, empty acetylene tanks 2, full acetylene tanks 5 (On-Shift)	10 minutes	TE
lonorail	Check cooling water manifold board confirm all flows are at least 8 gallons per minute, head#1, head#2, tail, crusher, stageloader #1 and stageloader #2 (On-Shift)	5 minutes	TE
	Check push-pull for leaks, repair as needed (On-Shift)	5 minutes	TE
ower Center	Verify that chirp alert is working at power center and splice box (On-Shift)	5 minutes	TE
aw Oil Tanker	Check oil level and record inches of oil, 24 inches, record name of foreman notified if less than 12 inches of raw oil in tanker, ____ name (On-Shift)	5 minutes	TE
hearer	Check cowl blade bolts, replace if more than one is missing (Pre-shift)	5 minutes	TE

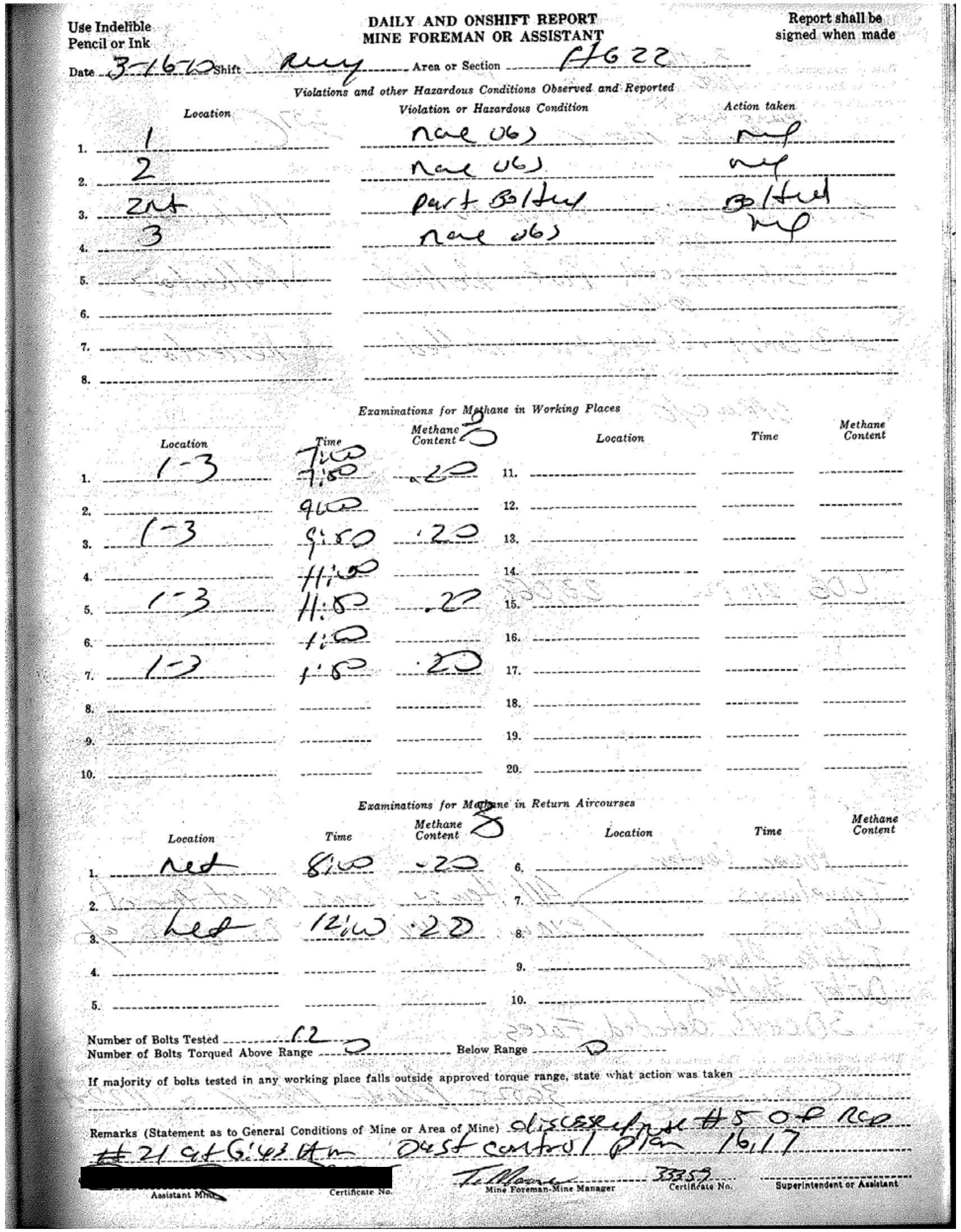
Added 5 gal oil to T/E ranging Arm
Had no water on either drum, cleaned several and stopped right back up, removed 8 on each end, ran like that rest of shift to try and Flush drums, told 3rd shift

Figure 5 . Excerpt from PCC Maintenance Report dated 3/1/2010.

Below is a list, separated by working section, of some of the hazards that were recorded in the production reports but were not recorded in the required examination records that were made available to MSHA. (Also see Figures 6 and 7, which follow.)

<u>HG 22:</u>

- “230 minutes [down time], intake air going in wrong direction off old intake.” January 7, 2010, day shift.
- “Lost air in face return had very little pull to it. Found return stopping out. Had to build back.” January 11, 2010, day shift.
- “Adverse roof conditions.” February 12, 2010, evening shift.
- “At 24 break between 1-2 top broke up 2’, 3’, 4’, 6 ½’ spot bolted with cable bolts. Adverse roof conditions 1-3.” February 16, 2010, day shift.
- “Adverse roof conditions 1-3. Bolting ribs.” (Production Report Noted: down 101 minutes-roof conditions). February 18, 2010, day shift.
- “No air lob [last open break]. Went to glory hole fixed problem where air was leaking, put curtains across return overcast+ fly pads going to old intake, found 5 stoppings with holes in them, finish stopping on return side + plaster.” February 23, 2010, day shift.
- “120 minutes [down time] holes in intake to get air to the section.” March 1, 2010, evening shift.
- “Inspector had section down low air. Shut down by inspector not enough air in lob only. Section down for low air.” March 2, 2010, day shift.
- “25 min reventelating [sic] to get methane out of # 3 1.5 % reduce to .30” down 60 minutes.” March 2, 2010, evening shift.
- “Lob [last open break] low air in it. Found problem outby double door open.” March 11, 2010, day shift.
- “Low air on lob. Doors outby going to back to HG 22 tail open 7:00-8:00. Adverse roof conditions coal streaks four? 5’ up.” March 16, 2010, day shift



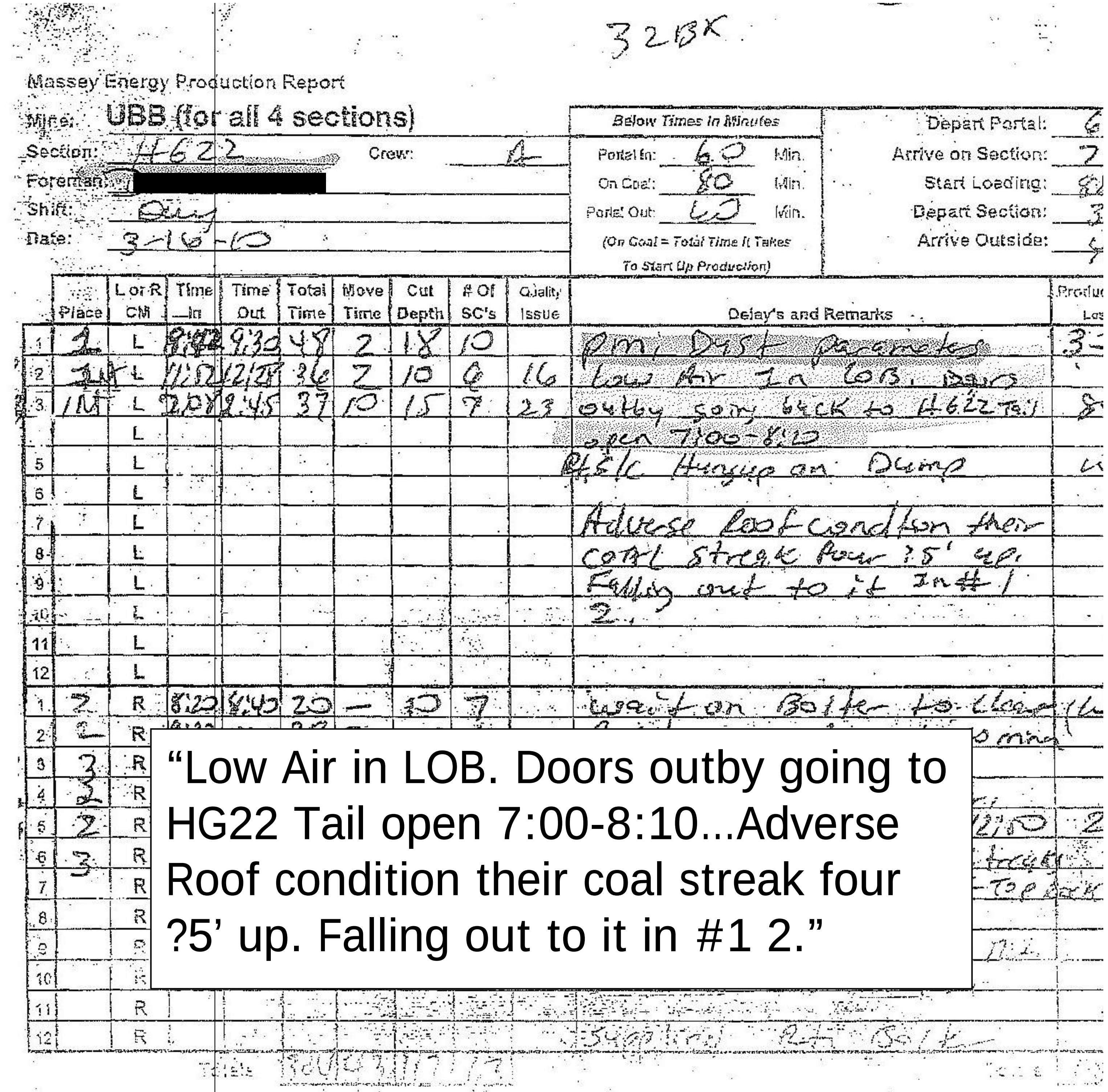


Figure 6. Comparison of HG 22 on-shift report and production report dated 3/16/10.

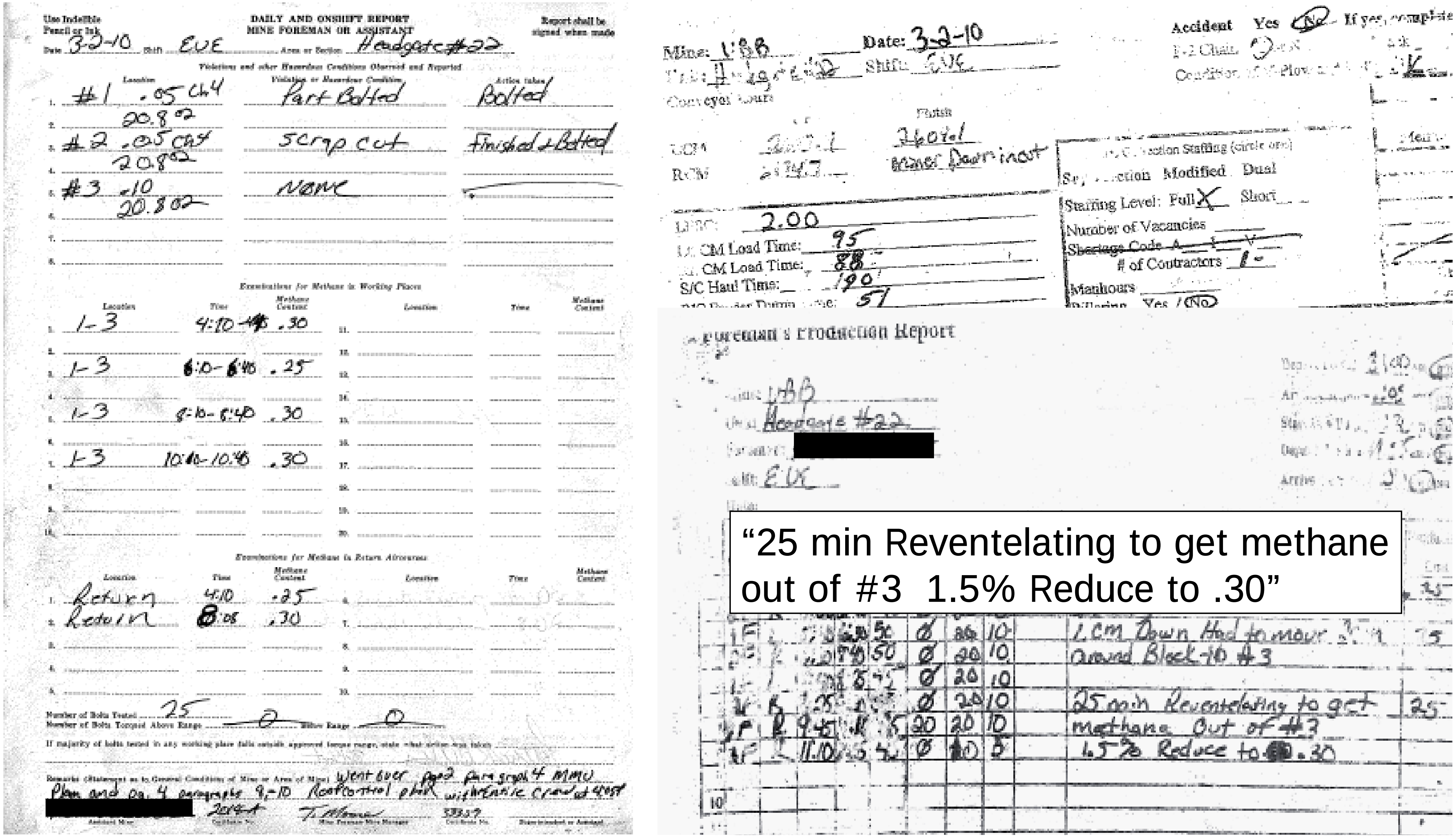


Figure 7. Comparison of HG 22 on-shift and production report dated 3/2/10.

TG 22:

- “Air coming up belt had to build airlock # 2 had about 24” of water for about 100 feet.” March 16, 2010, dayshift.

Headgate 1 North (Longwall):

- “Shot at Ellis punch out, set CO’s off.” September 30, 2009, evening shift.
- “Had a fall from #1 shield to about 15 foot outby crusher. Had to build cribs down by s/l and into LOB also the rock was in crusher and back to head was about 10 feet high 16 foot wide, crew had to drill and shoot rock up to 4 times to get to run. It took 45 minutes each time we had to drill and shoot. 180 minutes to drill and shoot.” December 4, 2009, evening shift.
- “No production took in 13 hp pump and put at supply doors, Both pumps on face were down. Had to put new discharge lines on both due to shields being pulled in and gob smashed both lines. Water was approx 8” from top of shields.” January 3, 2010, evening shift.
- “No production, 4 North belt tail went down while coming underground at 43 br, we went over to the belt head, and saw a lot of smoke, we got the water hose and started putting water on tail roller, I left 4 men at tail piece, I took 4 men to longwall to fix pump in swag.” January 10, 2010, evening shift.
- “Water gets bad cutting from head back to 115 while pump is running while cutting.” January 18, 2010, evening shift.
- Maintenance report “the tip sprays that need to be every 20 shields, most are not working.” March 6, 2010, “A” crew,

Failure to Correct Hazards

PCC engaged in a practice of failing to correct recorded hazards. For example, belt examination records repeatedly indicated that the belts needed to be cleaned and/or dusted. From March 5, 2010 through April 5, 2010, examiners recorded, but did not correct, the following hazardous conditions for the six conveyor belts where the explosion propagated:

- HG 22 #1 belt - 15 consecutive shifts reflect the belt needed cleaning and dusting with no corrective action taken. Of 90 producing shifts, 83 percent of the shifts reflect the belt needed cleaning and 96 percent of the shifts reflect the belt needed dusting.

- TG 22 #1 belt - 24 consecutive shifts are recorded needed cleaning and 18 shifts needed dusted, with no corrective action taken. Of 73 producing shifts, 92 percent of the shifts reflect the belt needed cleaning and 99 percent of the shifts reflect the belt needed dusting.
- TG 22 #2 belt - 14 consecutive shifts are recorded needed cleaning and 18 shifts needed dusted with no corrective action taken. Of 54 producing shifts, 48 percent of the shifts reflect the belt needed cleaning and 78 percent of the shifts reflect the belt needed dusting.
- North #6 belt - six consecutive shifts are recorded needed cleaning and 15 shifts needed dusted with no corrective action. Of 90 producing shifts, 100 percent of the shifts reflect the belt needed cleaning and 86 percent of the shifts reflect the belt needed dusting.
- North #7 belt - 3 consecutive shifts are recorded needed cleaning and 21 shifts needed dusted with no corrective action taken. Of 90 producing shifts, 36 percent of the shifts reflect the belt needed cleaning and 97 percent of the shifts reflect the belt needed to be dusting.
- Longwall Belt - six consecutive shifts are recorded needed cleaning and 15 shifts needed dusted without any corrective action taken. Of 89 producing shifts, 67 percent of the shifts reflect the belt needed cleaning and 83 percent of the shifts reflect the belt needed dusting.

During the underground investigation, MSHA identified accumulations in over 50 locations along the conveyor belts. These accumulations were allowed to pile up below and around the belt and belt structure, and along portions of ribs that were not cleaned up during initial development. Examples of this are shown in Figures 8 and 9. The size and number of these accumulations demonstrate that the hazards existed for a long period of time.


Figure 8. Accumulations of loose coal with the top of the pile flattened due to rubbing the moving belt.

Figure 9. Accumulations of loose coal built up to the point that the belt roller is turning in the accumulations.

Another example taken from production reports demonstrated poor roof conditions:

- January 5, 2010: “return #1 entry off of 2 section, bad top, cut down both ribs and breaking around bolts, 54-55 bk.”
- January 23, 2010: “bad top in return going out Bandytown at 53-55 bk, is cut down both ribs and busted up in the middle and falling out.”
- February 23, 2010: “bad top in return next to overcast, spad no. 23960, going out old 2 section and 1 section return.”

These records indicate PCC's failure to take corrective action. Examiners testified that the repetition of the hazards in the books was based on a failure to correct the hazards, rather than a failure to record corrective action.

In addition, the examination record book from January 5, 2010 to March 31, 2010 for airways inby Ellis switch documents more than 75 separate instances of hazardous conditions. Only six hazardous conditions were recorded as corrected. The documented hazards ranged from adverse roof conditions to the presence of rock and material in the travelways.

Inadequate Training

MSHA found widespread deficiencies in PCC's efforts to comply with its approved training plan. The training plan, approved March 29, 2007 pursuant to 30 C.F.R. § 48.3(a), described several training programs, including those for experienced miner training, task training, and annual refresher training. MSHA interviewed miners and reviewed various PCC and contractor training functions that included plans, classes, curriculum materials, and records. MSHA reviewed employee training files covering the two-year period from April 5, 2008 to April 5, 2010, compiled from employee and contractor labor employee lists, for compliance with Parts 48A and 48B of the approved training plan.

PCC failed to provide any training records for 30 miners as required by 30 C.F.R. §48.6, including PCC President Chris Blanchard and another top company official. Based on the information available, MSHA found that 112 miners either did not receive experienced miner training or received incomplete experienced miner training; 44 miners did not receive task training before performing the task as mobile equipment operators or performing other new job tasks; and 21 miners did not receive annual refresher training. In addition, 22 miners received experienced miner training from individuals who were not MSHA-approved instructors. Nine different individuals certified these miners' training records despite not being MSHA-approved instructors.

PCC was aware of many of these deficiencies because Massey Coal Services, a subsidiary of Massey Energy Company, performed an audit in September 2009 and identified a number of training deficiencies in PCC's efforts to comply with its approved training plan. These deficiencies included PCC's failure to provide experienced miner training and task training to a number of individuals, including several miners who worked on the longwall. As of April 5, 2010, PCC had failed to correct or address most of these deficiencies and Massey Coal Services had failed to take any steps to ensure that PCC corrected the deficiencies.

Experienced Miner Training

Training records and interview testimony indicated that 112 miners either did not receive experienced miner training or received incomplete experienced miner training. The miners who failed to receive experienced miner training received hazard training only or no training; this group of miners included members of the longwall crew that were transferred to UBB from Logan's Fork in 2009.

All miners received Massey Initial Training (MIT) when they started working for PCC. On May 5, 2010, MSHA observed the MIT program conducted at the Marfork Coal Company (Marfork) training center. The training lasted approximately three hours and was predominantly related to Massey policies. After the MIT program, the instructor completed a MSHA Form 5000-23 (record of training) for individuals in the training session as having received the experienced miner training. When interviewed, the instructor stated that prior to April 5, the courses of instruction consisted mostly of Massey policy.

The MIT program covered only one subject (self-rescue and respiratory devices) of the 12 subjects listed in their approved training plan and required in 30 CFR Section 48.6(b). The MIT program ignored 11 subjects:

- Introduction to work environment
- Mandatory health and safety standards
- Authority and responsibility of supervisors and miners' representatives
- Entering and leaving the mine; transportation; communication
- Mine map; escapeways; emergency evacuation; barricading
- Roof or ground control and ventilation plans
- Hazard recognition
- Prevention of accidents
- Emergency medical procedures
- Health
- Health and safety aspects of the tasks to which the experienced miner is assigned

The MIT program deferred to the individual operator (i.e. PCC) to complete the other requirements of experienced miner training, including the introduction to the work environment. It was determined that 112 of these employees did not receive this training as required.

MSHA determined that PCC's failure to train its miners in hazard recognition contributed to the conditions which were involved in the explosion on April 5. The miners' lack of training in hazard recognition was corroborated by the existence of extensive accumulations of loose coal, coal dust, and float coal dust which went unidentified and uncorrected prior to the explosion. In addition, testimony and underground observations corroborated that miners were not aware of the requirements of the roof control and ventilation plans. Many miners had no knowledge of the 1997 explosion, which involved an ignition of gas in the gob near the tailgate side of the longwall face behind the shields in the 2 West Longwall panel, nor of the 2003 and 2004 methane feeders, all of which shared characteristics with the April 5, 2010 explosion. Knowledge of past accidents is a required part of training and is a crucial part of accident prevention.

Task Training

Training records and interview testimony indicated that 44 miners did not receive task training before performing the task as mobile equipment operators or performing other new job tasks, including those related to performing preshift, on-shift, and weekly examinations, working on the rock dusting crew, and working on the longwall during production shifts. PCC's failure to train its miners in a number of these tasks contributed to the conditions which were involved in the explosion on April 5. A number of preshift and belt examiners testified that PCC never trained them how to perform such examinations, which means they did not receive training on specific hazard recognition and roof control and ventilation plans. PCC did not train a number of rock dusting crew members on the amount of rock dust which must be applied to a given area. PCC did not provide task training to certain individuals on the longwall crew on the operation and maintenance of the longwall shearing machine.

Annual Refresher Training

Training records and interview testimony indicated that 21 miners did not receive annual refresher training over the past two years. In 2009, three miners did not receive annual refresher training, while in 2010. Eighteen miners did not receive annual refresher training. PCC conducted its annual refresher training in March, 2010. Many hazardous conditions and practices which existed prior to the annual refresher training persisted up until the time of the explosion and contributed to the explosion.

Other Training Deficiencies

PCC's training records and miner testimony indicated additional deficiencies:

- Under 30 C.F.R. § 48.9, mine operators must retain copies of training certificates for various lengths of time. PCC failed to provide any training records for 30 miners, including PCC President Chris Blanchard and another top company official. Based on PCC's failure to provide these training records, it is unclear whether these 30 miners received any of the required training.

- Under 30 C.F.R. §48.3(g), certain training courses "shall be conducted by MSHA approved instructors." 23 miners received experienced miner training from individuals who were not MSHA-approved instructors; nine different individuals certified these miners' training records despite not being MSHA-approved instructors.

- Ten members of management were designated as "responsible persons" as of April 5, 2010, but there were no records to indicate they had received the training required by Section 75.1501(a)(2).

- PCC provided the names of six individuals who had received training for the examination and sampling of seals, as required by Section 75.338. The mine seal examination record books, covering the dates from June 29, 2009 through April 5, 2010, showed that 17 individuals signed the books indicating they had examined seals. The training records showed that only two of the 17 employees received the training. One of the individuals had not received the annual training under Section 75.338 which was due in January 2010.

- PCC identified five employees that operated the AMS frequently. AMS operators are required by Section 75.351(q)(2) to travel to all working sections underground every six months in order to retain familiarity with the underground mining system at their operations. During an interview, one of the five employees stated that he had not been to a production section in three years.

- PCC stated "all members are qualified AMS operators as the AMS system and its operation are specifically covered during annual refresher training." The operator did not have sufficient time allotted in the annual refresher training or the equipment necessary to train the AMS personnel.

Contractor Training Issues

<u>David Stanley Consultants, LLC (DSC), Contractor ID YBV</u>

MSHA approved training plans for DSC, covering Part 48, Subpart A, Subpart B, Part 75, and Part 77, on July 28, 2006. MSHA interviewed certain DSC employees and also reviewed employee training records covering the two-year period from April 5, 2008 to April 5, 2010, for compliance, identifying numerous deficiencies. These deficiencies were included in the deficiencies listed above.

On June 15, 2010, MSHA observed a training session conducted at the Marfork training center by James Gump, Director of Operations and Safety for DSC. The attendees were going to work at various Massey Energy Company mines for DSC. Gump provided training by using an outline which did not cover the course materials required by Section 48.6 (training of experienced miners), as specified in DSC's approved training plan. The instructor did not have available for review the mine ventilation plans, roof control plans, clean-up and rock-dusting plans, mine maps, mine transportation and communications, or health and safety of the task to which the new miner would be assigned or other required course material. Nonetheless, the instructor completed a Form 5000-23 for each attendee indicating they received experienced miner training, even though they did not receive complete training.

<u>Mountaineer Labor Solutions, LLC (MLS), Contractor ID T025</u>

MSHA approved training plans for MLS, covering 30 CFR Part 48 and §§ 75.160 and 77.107, on January 23, 2008. MSHA interviewed certain MLS employees and also reviewed employee training records covering the two-year period from April 5, 2008 to April 5, 2010, for compliance, identifying numerous deficiencies. These deficiencies were included in the deficiencies listed above.

The records, certified by Brian Buzzard, owner of MLS, indicated that experienced miner training had been conducted. MSHA determined that Buzzard had no training material on escapeway maps, ventilation plans, roof control plans, first aid manuals or first aid equipment. Buzzard did not have training models for the SR-100 SCSR or other course material for training experienced miners, as required by Section 48.6 and stipulated in the MLS approved training plan.

Engineering Issues

Interviews with Massey engineers reflected their confusion and unfamiliarity with the mine. PCC utilized engineering services from a Massey-affiliated engineering facility known as "Route 3 Engineering." These services included surveying, mapping, and mine design. Engineers included Chief Engineer Paul McCombs, UBB Resident Engineer Eric Lilly, Matthew Walker, Heath Lilly, and Raymond Brainard.

A number of Route 3 engineers testified that they had limited mining experience and rarely went underground at UBB. The licensed engineer who certified mine maps was more familiar with tax issues and long term planning for Massey, rather than the specific underground conditions of the mines in question.

Route 3 engineers submitted 13 proposed UBB ventilation plan revisions that were denied by MSHA D4 between September 11, 2009 and April 5, 2010. In connection with these denials, MSHA identified fundamental deficiencies in plans and on maps such as missing regulators, missing stoppings, missing air directions, missing air quantities, and other regulatory deficiencies. A more detailed description of the plans submitted can be found in the sections entitled "Recent Revision to the Approved Plan and Map" and "Disapproved Revision to the Ventilation Plan and Map" under Ventilation Plan later in the report. The number of revisions and disapprovals are an indication of the lack of planning and inadequate engineering practices employed by this operator.

Engineers testified that they did not know who was in charge of ventilation at UBB. When interviewed, Walker stated that there was not a specific person responsible. Without a clearly specified person responsible, ventilation changes were made without planning and foresight.

Intimidation of Miners

The Mine Act grants the right to request an immediate inspection when they have reasonable grounds to believe that a violation of the Mine Act, a mandatory health or safety standard, or an imminent danger exists. MSHA encourages miners (or their representatives) to do so via a toll-free hotline (1-800-746-1553) or on MSHA's Web page under Online Tools (Report a Hazardous Condition) <MSHA Hazard Complaint>. They may also report hazardous condition complaints directly to an MSHA inspector. Despite the recognition by many miners of hazards throughout UBB, no one had made a complaint to MSHA since

June 8, 2006. MSHA did not receive any complaint related to underground hazards at UBB prior to the accident.

Miners were routinely intimidated by Massey and PCC managers who created a culture in which production trumped all other concerns. Foremen were required to regularly report their production status to PCC and Massey management, as well as “downtime” reports for when production stopped.

Because of this culture, miners testified that they were reluctant to make a safety complaint to their superiors, or pursue a complaint beyond merely mentioning it to their foreman. Miners did not alert MSHA of hazards prior to April 5, 2010. Even though miners knew of safety problems at the mine, they did not make complaints or report the safety problems because they believed they might lose their jobs as a result.

A scoop operator testified that miners “know not to say anything because they know they'll probably get fired by the bosses.” He noted that even with air problems they were having, “you felt like you couldn't really say anything, because you know if you did, you'd probably be fired.”

A shuttle car operator testified that his boss instructed him not to speak to MSHA inspectors.

A foreman testified that Massey retaliated against miners who made complaints by assigning them to the hoot owl shift or to a mine with low coal.

A purchasing agent testified that mine management would threaten to fire foreman when they called out and reported that they were down because of insufficient ventilation, “He would say we was stupid, that the guys are stupid, call up there and fire them. He wanted them in the coal in a few minutes.” The purchasing agent further testified when asked about managements’ attitude when unusual problems such as water shutting down the longwall for a couple of weeks, “…tell them guys to get the coal, we got to get running. It got to the point where I’d reach for the phone---we got caller ID. I’d reach for the phone and my hand would shake. ….I was at the end of my rope almost.”

Similarly, another UBB miner, testified: “…they (miners) were scared if they took the time to ventilate that way it should be, whether they would be or not, they were scared they’d be fire or gotten rid of or taken off of that job and put on something that might not be as good for them as working on the face.” He further stated, “…you knew that you better go ahead and mine the coal or --- the atmosphere around Massey was, you know, you just keep your mouth shut and do it if you want to keep your job.”

Massey established a toll-free number for miners to internally make safety and health complaints. However, some miners testified that they were reluctant to use this phone number because they feared retaliation.

In addition, testimony established that upper management at PCC threatened foremen and miners who took time to make needed safety corrections. An employee testified that upper management threatened to fire crews when they stopped production and that Massey CEO Don Blankenship himself pressured management to immediately resume production. A foreman testified that he heard Mine Superintendent Everett Hager yell at victim Edward “Dean” Jones, a Section Foreman on HG 22, who had stopped production to fix ventilation problems. Hager relayed that President Chris Blanchard stated that “if you don't start running coal up there, I'm going to bring the whole crew outside and get rid of every one of you.” Another foreman testified that Hager threatened to fire him for stopping production and working on ventilation.

These were not idle threats. Miner testimony indicated that a top company official suspended a section foreman, who had delayed production for an hour or two to patch up leaking stoppings so that the minimum air quantity in the approved ventilation plan was available on the continuous miner section. Another foreman testified, miners who tried “to do the right thing” were “usually the people that [got] kicked in the teeth for it.”

This culture of intimidation deprived MSHA of miners’ voices. Under the Mine Act, miners play an important role in identifying hazards. The Code of Federal Regulations (30 CFR) calls for all hazards to be recorded in a book available for inspection at the surface. Section 105(c) of the Mine Act specifically recognizes the potential for a mine operator to discourage the reporting of hazards and protects miners from discrimination when they report an alleged hazard. Under the Mine Act, miners may refuse to work in unsafe or unhealthy conditions and may withdraw themselves from the mine for not having had required health and safety training.

Advance Notice of Inspections

Section 103(a) of the Mine Act provides that no advance notice of an inspection shall be provided to any person. Despite this statutory prohibition, many miners testified that PCC or Massey personnel on the surface routinely notified them prior to the arrival of inspectors. A large number of UBB miners testified that they knew in advance when inspectors were in the mine because of communication from the surface.

A UBB security guard testified that he had been instructed to call and alert personnel at the mine once MSHA inspectors were on the property. One dispatcher testified that the guard shack alerted him “every time” inspectors came on the property.

Dispatchers testified that they regularly called foremen and miners on the radio or mine phone to alert them of MSHA inspectors’ presence. Several dispatchers stated that upper management had instructed them to give advance notice of inspectors to miners; if a dispatcher failed to do so, there would be consequences. A dispatcher characterized giving advance notice as simply part of the dispatcher’s “job.”

A former belt construction worker testified, “When they hit the bridge at Mont Coal, the security guard would come up through the repeater, tell the mine manager that they was coming, then the calls went out through the sections to be ready to make sure you were legal, rock dust, whatever. It was every time that anybody was coming to that mines.”

PCC would also make ventilation changes in advance of the inspector’s arrival on the section, redirecting air and sending it to the section where the inspector was headed. A foreman testified that mine managers would call out for more air on the section where the inspector was headed, although miners only had a short time to make changes and the work was sometimes “chaos.” An examiner testified that PCC would send miners to adjust regulators and direct air to the section where the inspector headed, even though this reduced air in other parts of the mine where miners were working. Miners testified that they noticed more air on their section before the arrival of the inspector. A shuttle car operator testified that his crew would hang curtains more tightly and make sure they had air in the face.

This advance notice gave foremen and miners the opportunity to alter conditions and fix hazards prior to MSHA’s arrival on the section.

If they were unable to correct hazards, miners testified, the foreman would shut down the working section. As a result, the MSHA inspector could not observe safety problems during production. Because of PCC’s practice of providing advance inspection notice, inspectors seldom saw the way the mine actually was operated. Advance notice limited the effectiveness of MSHA’s inspection efforts at UBB.

On October 26, 2011, Hughie Elbert Stover, PCC’s former head of security, was found guilty by a jury sitting in the United States District Court for the Southern District of West Virginia of a felony count of making false, fictitious and fraudulent statements to MSHA. Stover had falsely testified in his interview with the MSHA accident investigation team that UBB had a policy prohibiting security guards from providing "advance notice" of MSHA inspections; however, evidence indicated that he himself had directed guards to provide such advance notice. He was also found guilty of a second felony count of obstructing justice by ordering a miner to dispose of documents wanted in the accident investigation.

Mine Accident Incidence Rate

Accident rates for the period between 2006 and 2009 are summarized in Table 1, and compared to the national rate for all underground, bituminous coal mines. MSHA audited these accident records and determined that the accident rate for UBB was significantly higher than had been reported by PCC, as shown in Table 1. Table 2 documents the enforcement actions taken by MSHA from 2006 through 2010, based on information contained in MSHA’s Data Retrieval System. In addition, PCC and Massey’s underreporting of accident data denied MSHA the opportunity to properly investigate and assess accidents and hazards at the mine.

Table 1. Accident Incident Rates after Audits

Calendar Year	Non-Fatal Days Lost (NFDL)		
	UBB Prior to Audit	UBB After Audit	National
2006	5.55	5.55	4.79
2007	2.41	2.89	4.74
2008	6.07	11.50	4.26
2009	5.81	10.24	4.04
2010	4.16	5.82	3.58

Table 2. Citations, Orders, and Safeguards Issued at UBB.

Calendar Year	103(k) Orders	104(a) Citations	104(d)(1) Citations	104(b) Orders	104(d)(1) Orders	104(d)(2) Orders	104(g)(1)	107(a)	314(b)
2006	**2**	**148**	**1**	**4**	**11**	**5**	**0**	**2**	**0**
2007	**0**	**269**	**0**	**1**	**0**	**0**	**0**	**1**	**0**
2008	**2**	**189**	**1**	**0**	**1**	**3**	**1**	**0**	**1**
2009	**1**	**460**	**1**	**4**	**1**	**48**	**1**	**1**	**0**
2010*	**0**	**117**	**0**	**1**	**0**	**6**	**0**	**0**	0

* - Through April 5, 2010 prior to the explosion

Inspection History (1/1/09 to 4/5/10)

Regular Inspection (E01)

MSHA conducts four quarterly inspections at underground coal mines each year, with the fiscal year beginning with quarter 1 in October and ending with quarter 4 starting in July. As has been noted, the advance notice given of inspections, coupled with PCC and Massey's intimidation of miners, hampered MSHA's effectiveness in conducting its inspections. Nonetheless, the number of violations issued to UBB and the number of hours that MSHA inspectors had to spend at UBB (inspecting, citing violations, and ensuring that violations were abated) trended upward in the five quarters leading up to

April 5, 2010 as indicated in Table 3. MSHA issued more orders under Section 104(d) of the Act (“unwarrantable failure” violations, which indicate higher negligence and gravity than some other types of citations) at UBB than at any other coal mine in the country in fiscal year 2009.

Enforcement actions issued during regular inspections (E01) pursuant to Section 103(a) of the Mine Act for the time period from the second quarter of 2009 through the third quarter of 2010, are listed by quarter and summarized in Table 3. The data is sourced from MSHA’s Mine Data Retrieval System.

Table 3. Regular Inspection History at UBB.

E01 Event No.	FY Inspection Quarter	No. of Citations	No. of Orders	MMU Time (hours)	Outby Time (hours)	Surface Writing Time (hours)	Surface Time (hours)	Total Hours at Mine
4119932	2009-2	91*	1*	67.50	127.75	34.25	36.00	265.50
4119936	2009-3	119*	16*	90.75	175.75	45.25	52.00	363.75
4119293	2009-4	149*	23*	129.25	196.00	62.75	140.75	528.75
6288652	2010-1	58*	9*	151.25	206.75	30.25	104.00	492.25
6286108	2010-2	101*	7*	91.00	174.50	42.50	111.75	419.75
6284327	2010-3	5	1	4.00	1.50	3.00	11.75	20.25

* - Vacated issuances are not included in the Data Retrieval System (DRS) reports; subsequent to the DRS report, there was one citation or order vacated each of these five quarters (three 104(a) citations and two 104(d)(2) orders.

Tables K-1 and K-2 in Appendix K detail the violations issued during 2009 and 2010 at UBB. During this period, there were 49 violations of 30 CFR 75 subpart E (75.400’s), relating to combustible materials and inadequate rock dusting, conditions which ultimately played a role in propagating the coal dust explosion.

Spot Inspections (E02)

Spot inspections are based on the provision of Section 103(i) of the Mine Act, which states that:

> Whenever the Secretary finds that a coal or other mine liberates excessive quantities of methane or other explosive gases during its operations, or that a methane or other gas ignition or explosion has occurred in such mine which resulted in death or serious injury at any time during the previous five years, or that there exists in such mine some other especially hazardous condition, he shall provide a minimum of one spot inspection by his authorized representative of all or part of such mine during every five working days at irregular intervals.

UBB was placed on a 10-day spot inspection cycle on July 15, 2009. On April 2, 2010, the mine was placed on a 5-day spot inspection schedule because the mine liberated over one million cubic feet of methane within a 24-hour period. Table 4 provides the quarterly spot inspection history from January 1, 2009 to April 5, 2010.

Table 4. Spot Inspection History for UBB.

FY Inspection Quarter	E02 103(i) spot inspections	Citations Issued	Orders Issued
2009-2	6	12	0
2009-3	6	12	0
2009-4	9	6	5
2010-1	10	3	1
2010-2	9	8	0
2010-3	0	0	0
Total	40	41	0

Longwall Citation History

The active longwall at the time of the accident was at the 1 North Panel, which was activated in September 2009. Table 5 provides a summary of enforcement actions for the longwall panel.

Table 5. Types and Number of Enforcement Actions
for 1 North Panel between September 1, 2009 and April 5, 2010

Type of Enforcement Action	No. Issued
104(a) non-S&S citation	23
104(a) S&S citation	6
104(b) order	1
104(d)(2) order	6
Total	36

PHYSICAL CAUSES OF THE ACCIDENT

Methane was Allowed to Accumulate on the Tailgate End of the Longwall

An explosive mixture of gases was allowed to accumulate in the vicinity of the shearer which was located at the tailgate end of the longwall. There were several failures that allowed this mixture to exist. The air current at the tailgate end of the longwall and in the T-split was inadequate to dilute and render harmless, and carry away additional methane when the floor feeder occurred. The mine not only had a history of floor gas outbursts on the longwall face, including events that occurred in 2003 and 2004, but also experienced an explosion on the face and in the adjoining tailgate in 1997, which management failed to consider. A detailed discussion of these events is provided in the section entitled, "Outburst History at UBB", below. Examiners were unable to conduct examinations as required in the longwall tailgate entry (No. 7 entry) of the 1 North Tailgate because the operator failed to ensure that this entry was properly supported. The failure to properly support this entry is also important because it affected the ventilation such that it was not sufficient to dilute and render harmless, and carry away explosive, noxious and harmful gases, dusts, smokes and fumes.

The Explosion Began as a Methane Ignition that Originated Near the Tailgate and Transitioned into a Coal Dust Explosion

The investigation team determined that the explosion was a methane ignition, which led to a methane explosion and then transitioned into a coal dust explosion. The methane ignition resulted in a fire that could not be controlled by the miners at the shearer, forcing their evacuation. The fire likely burned behind the shields for up to two minutes before entering the T-split of No. 7 Entry in the Tailgate. Upon entering this area, the fire came into contact with an explosive mixture of methane. The resulting methane explosion propagated through the first outby crosscut before the methane was consumed. However, the methane explosion suspended and ignited float coal dust and coal dust, and the propagation of the coal dust explosion commenced. The flame zone from the coal dust explosion was extensive. If all the flame throughout the workings had resulted from the ignition of methane, then the explosion pressures would have exceeded the constant volume explosion pressure of about 120 psi in all areas of the explosion zone, which they did not[9]. This indicates that the explosion was the result of coal dust propagation and not of methane alone.

The team carefully considered other possibilities, such as an explosion fueled only by methane, an inundation from a gas well, or a seismic event, but ruled them out due to lack of supporting evidence for these theories. The results of the team's mine dust survey, the explosion pressures observed in the mine, a review of the limited amounts of methane detected prior to and after the accident, testimony from interviews, and examination records all indicate that the explosion resulted from a methane ignition/explosion transitioning into a coal dust explosion.

The first step in determining what kind of explosion occurred is to understand where the explosion traveled and the "footprint" it left. Investigators determined that the flame associated with the explosion traveled throughout the northern section of the mine. A mine map showing the extent of flame, along with the incombustible contents and the quantity of coke in the mine dusts at each sampled location underground is contained in Appendix Z. Based upon the flame path, investigators concluded that the level of methane necessary to extend flames into those areas would have resulted in pressures that would have caused far more damage than was actually observed. A methane inundation originating near the tailgate also would have extended flame into more areas than it did (for example, across the longwall face, which suffered only limited heating during the accident). Finally, there was only a limited quantity of methane detected pre- and post-explosion, which was not consistent with a massive inundation of methane.

The Methane Explosion Originated in the Tailgate Entry Near the Longwall Face

The investigation team, along with independent experts, analyzed mine dust samples, looking for coking to determine where flames traveled; the impacts of heating on objects; and pressures, calculated by using affected objects as data points and running finite element computer models to determine the path of the explosion. This evidence pinpoints where the flame traveled.

MSHA's flames and forces team conducted an extensive examination of the underground areas affected by the explosion. The team also conducted work outby the Ellis Switch, as well as in all inby areas, including the 1 North Panel crossover entries.

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[9] NIOSH research has indicated that a constant volume explosion pressure of 120 psi can be exceeded with the ignition of methane accumulations that are more than 165 feet in length.

The flames and forces team considered all available evidence, including the direction of primary explosion forces, the location of victims and mining machinery after the explosion, the deposition of dust, the effects of the explosion on materials and equipment, the extent of flame, and the direction and magnitude of all explosion forces. The origin of the explosion was determined to be located at the intersection of the active longwall face and the No. 7 entry of Tailgate 1 North. This location is just inby crosscut 48. The mine map included in a subsequent section of this report addresses the direction of the primary forces and the origin of the explosion.

The Extent of the Explosion is Consistent with that of a Coal Dust Explosion

<u>Mine Dust Survey</u>

The investigative team took 1,803 mine dust samples as part of its mine dust survey underground. Investigators sent all 1,803 samples to MSHA's Mount Hope National Air and Dust Laboratory, which conducted an Alcohol Coke Test on the samples to determine the degree of coking. The exceptionally large number of mine dust samples containing coke, along with the magnitude of explosion forces, is indicative of a coal dust explosion rather than an explosion fueled entirely by methane.

All 1,803 samples were sent to MSHA's Mount Hope National Air and Dust Laboratory, where the incombustible content and degree of coking were determined. The incombustible content provides an indication of the pre-explosion conditions in the affected area of the mine, while the coking indicates the area affected by the flame of the explosion.

A mine dust survey was performed in the area affected by the explosion. Of the 1353 samples collected in the affected area, 90.5 percent were non-compliant.

Analysis results indicate that 1,412 (1,105 in intake and 307 in return entries) out of 1,803 (>78 percent) samples were not compliant with incombustible requirements in place at the time of the explosion. Analysis results indicate that 924 (684 in intake and 240 in return entries) of 1,137 (>81 percent) band samples were not compliant.

Mine dust samples were taken in return entries of nine sampling areas. The average incombustible content in all nine areas was less than 80 percent, with a range from 43.9 percent to 63.2 percent. The return entries in these nine sampling areas were rock dusted inadequately.

Mine dust samples were taken in intake entries of seventeen sampling areas. Sampling areas 1 through 6 showed average incombustible contents exceeding 65 percent, with a range from 68.6 percent to 79.9 percent. Sampling areas 7 through 17 showed average incombustible contents of less than 65 percent, with a range from 46.2 percent to 58.3 percent. The intake entries in these 11 sampling areas were rock dusted inadequately.

Taken in context with physical evidence observed and collected underground, the Alcohol Coke Test also indicated the extent of the flame. The flame engulfed the Tailgate 1 North, entered the Headgate 1 North, turning both inby and outby. It also entered HG 22 (via the crossover entries) and turned both left and right. The flame that turned left was consumed in HG 22; the flame that turned right entered the North Glory Mains, the Glory Hole Mains, the North Jarrells Mains, and the West Jarrells Mains. A full discussion of the extent of the flame is included under the subsection "Flame Travel" later in the report.

The Pressures and Flame Generated by the Explosion

The flame extent and the pressures generated by the explosion are consistent with a coal dust explosion not a massive methane explosion. For a methane explosion to have covered the area where flame passed at UBB, it would have generated pressures far in excess of what was observed and calculated for this explosion.

MSHA estimated that the explosive accumulation of methane that was eventually ignited contained approximately 300 cubic feet of methane. When diluted with air to 10 percent, this volume of methane would form an explosive volume of 3,000 cubic feet.

Importantly, the flame of an explosion generally involves a volume that is approximately five times the volume of the initial methane accumulation. The flame from this initial methane explosion affected a volume of about 15,000 cubic feet, or a linear distance of approximately 140 feet, based on the dimension of the mine openings where the ignition occurred. The methane explosion propagated away from the longwall face. With a flame speed of approximately 300 feet per second, the methane explosion would have extinguished in about ½-second while generating a maximum pressure of about 4 pounds per square inch (psi).

The flame zone that actually occurred at UBB, however, was far greater than 15,000 cubic feet; it contained a volume of about 31 million cubic feet. This flame zone can easily be achieved in a coal dust explosion that generates limited pressure. To cover 31 million cubic feet of the mine from a methane-only explosion, considering a flame extension of five times, the initial explosive methane accumulation would have to have been about 6,200,000 cubic feet. This volume of methane would have completely filled nearly 52,000 linear feet of entry. The ignition of such a volume of methane in an underground mine could have resulted in a detonation with possible explosion pressures exceeding 600 psi, many times greater than what was calculated at UBB. The ignition of such a large hypothesized accumulation of methane would have resulted in explosion forces that greatly exceed forces that actually occurred underground.

The investigation team also concluded that the absence of flame on the longwall indicated that the explosion was not a methane-only explosion. On April 5, 2010, underground activities proceeded until the time of the explosion. At the time of the explosion, the HG 22 crew was boarding a mantrip to exit the mine at the end of their shift. The TG 22 crew left their section and traveled to just outby 78 switch. The crew at the longwall was not finished with their shift, as they changed out at the face about an hour later, around 4:00 p.m.

During the investigation, 18 mine dust samples were taken from various shields across the longwall face. These samples were all subjected to the Alcohol Coke Test (to be explained in greater detail later in this report). The results indicate that flame did not travel across the longwall face. The evidence of lack of flame along the face indicates that neither suspended coal dust nor explosive quantities of methane existed across the face. It is expected that any inundation of significant volumes of methane at the shearer would result in methane accumulations, both in the tailgate entries and on the tailgate side of the longwall.

There Was Only Limited Detection of Methane Underground Prior to the Accident and During the Rescue

Investigators also ruled out a massive methane inundation based on the relatively modest levels of methane liberated, according to pre- and post-explosion measurements.

Records of examinations that occurred in the shifts prior to the accident do not indicate that significant methane was present in the active workings. A post-explosion evaluation of methane detectors does not indicate that methane was present in significant concentrations in the active workings immediately prior to the accident. The methane monitors on the tail of the longwall and on the shearer did not de-energize electrical power, which would have occurred at 2 percent methane. Information collected from the handheld gas detector located at shield 83 did not record elevated methane levels prior to the explosion. Handheld gas detectors carried by Chris Blanchard and another top company official, two hours after the explosion, recorded a maximum methane level of only 0.3 percent at approximately two crosscuts of the longwall face in the tailgate entry.

Additionally, on April 5, a rescue team member advanced to shield 120 on the longwall face. He did not report any sound emanating from the longwall face or the tailgate entry which would have indicated a large volume of gas release. Nor did he report elevated levels of methane along the longwall until he reached shield 120, where he reported 2.0 percent methane. At this time the airflow was disrupted severely from the explosion, and a large-volume gas release would have contaminated the face and tailgate of the longwall. Taken together, these facts indicate that the magnitude of the gas release was likely in the order of hundreds of cubic feet per minute, rather than a massive inundation.

The autopsy reports show that methane was not found in any examined body tissue for 22 of the victims. Of the 7 victims who did have methane in some tissue, two were on the longwall and five were on or near the mantrip in HG 22. The methane found in these victims is most likely due to decomposition given the fact that their bodies were recovered from the mine more than five days after death. The methane found in the body tissue cannot be used to quantify accurately the amount or concentration of methane that was breathed or for how long. The lack of methane in the remaining 22 victims suggests that methane was not present at any of their locations at the time of the accident.

Analysis of Methane Liberation at the Bandytown Fan

Measurements at the Bandytown fan indicated higher liberation of methane post-accident than what was recorded during pre-accident mining. Investigators determined that likely came from floor fractures, as well as a product of combustion generated by the explosion itself.

The volume of methane liberated from a coal mine is dependent on several factors including gas reservoir characteristics of the coal seam and the surrounding strata, type of mining, rate of mining, depth of overburden, and the existence of geologic structures. Methane can be released into a mine during the cutting of coal, through mining-induced fractures, and through pre-existing fractures and joints in the coal, roof and floor strata. The liberation rate may vary, depending on conditions encountered and the rate in which coal is being extracted. There may be several different sources from which the gas enters the mine. Some of these sources include coal seams, gas bearing shale and sandstone formations, and adjacent abandoned or active mines. The concentrations of hydrocarbons and other gaseous components can vary, dependent on the source.

Generally, a coal seam contains gas composed mostly of methane with trace amounts of other hydrocarbons and is referred to as coalbed methane. The coal seam is the source and reservoir of coalbed methane. Rock strata, such as shale, may contain gas composed of methane with higher concentrations of the heavier hydrocarbons than coalbed methane. A combination of these gases is commonly referred to as natural gas. The rock stratum may be a reservoir and/or source of natural gas. Sealed and worked-out areas in mines may contain gas mixtures other than coalbed methane.

Pre-Accident Methane Liberation

During each MSHA quarterly inspection of the mine, inspectors collected air samples in all of the return entries where air exited the mine and in each of the working section return entry(s). Air samples were analyzed by MSHA's Mount Hope National Air and Dust Laboratory located in Mount Hope, West Virginia. Air quantities were measured to determine the total daily quantity of methane liberated from the mine and each working section. Table 6 shows the total methane liberation rate for the two quarters preceding the accident. The samples collected as part of the 2^{nd} quarterly inspection revealed the total methane liberation rate from the mine was 741 cfm, consisting of 681 cfm from the Bandytown shaft and approximately 60 cfm from the remaining portion of the mine.

Table 6. Methane liberation in Q1 and Q2 2010 for various mine areas.

Location	**Methane Liberation FY 10 Qtr. 1**	**Methane Liberation FY 10 Qtr. 2**
East Mains	10,217 cfd	11,212 cfd
North Portal	0	75,246 cfd
South Portal	0	0
Bandytown Fan	1,155,583 cfd	981,052 cfd
Bandytown Air Quantity	448,200 cfm	374,893 cfm
Total CH_4 Liberation (cfd)	1,165,800 cfd	1,067,510 cfd
Total CH_4 Liberation (cfm)	809 cfm	741 cfm

*cubic feet per day (cfd), cubic feet per minute (cfm)

The results of MSHA's September 26, 2010 ventilation study revealed a balanced airflow quantity at the Bandytown fan of 297,000 cfm. The pre-accident airflow quantity at the Bandytown fan was determined to be approximately 301,000 cfm. It was concluded, based on the ventilation study, that the air quantity was approximately 301,000 cfm at the time the air samples were collected during the previous quarterly inspection. Adjusting the methane liberation rate to the lesser air quantity resulted in a determination that the methane liberation from the Bandytown fan was approximately 547 cfm. In January, 2010, MMU-040 was mining in the Panel No. 1 Crossover and on January 13, the methane liberation for MMU-040 was determined to be 5.0 cfm. On March 2, 2010, MMU-040 began developing the "new" TG 22 and on March 7, the methane liberation was determined to be109 cfm. Therefore, the methane liberation rate exiting Bandytown fan would have been approximately 651 cfm, but could have been more if the liberation rate from HG 22 or the longwall had increased.

As discussed earlier, the methane detector used by the examiner responsible for examining the bleeder system had not been turned on since March 18, 2010. Methane concentrations prior to the accident may have increased undetected from March 18, 2010 to the time of the explosion because of the examiner's failure to measure methane in the bleeder system after that date. Gas released from floor fractures contained small amounts of hydrogen, which would have registered as carbon monoxide on the examiner's detector. Detecting this mixture may have provided another means of early detection if an adequate and complete examination had been performed.

Post-Accident Methane Liberation

The first reported measurements of gas concentrations at Bandytown fan were at 5:30 p.m. on the day of the explosion. These concentrations were measured with a handheld multigas detector and reportedly indicated 18.3 percent oxygen, 2.3 percent methane and >7,000 ppm carbon monoxide. Tests performed on the same model of the instrument revealed that a catalytic diffusion sensor (methane) measured all combustible gases in an atmosphere that was mixed with carbon monoxide, hydrogen, and methane. Investigators concluded that the methane and carbon monoxide concentrations indicated by the detector were elevated inaccurately due to cross-sensitivity issues on the carbon monoxide and combustible sensors. Carbon monoxide and hydrogen are combustible gases and were measured by the sensor; tests revealed that the carbon monoxide electrochemical sensor was influenced by hydrogen. The carbon monoxide electrochemical sensor on the handheld multi-gas detector used cannot distinguish between carbon monoxide and hydrogen.

Beginning at 8:30 p.m. on April 5, 2010, air samples were collected regularly at the Bandytown fan for analysis using a gas chromatograph, which is not susceptible to the cross-sensitivity of gases. Figure 10 contains a graph depicting methane liberation rate versus carbon monoxide concentrations for samples collected from Bandytown fan from April 5 – 30, 2010. Sample results indicated that the total volume of methane that exited at the Bandytown fan at 8:30 p.m. was about 1,250 cfm. The methane liberation rate declined to 890 cfm by 5:00 a.m. on April 6, 2010.

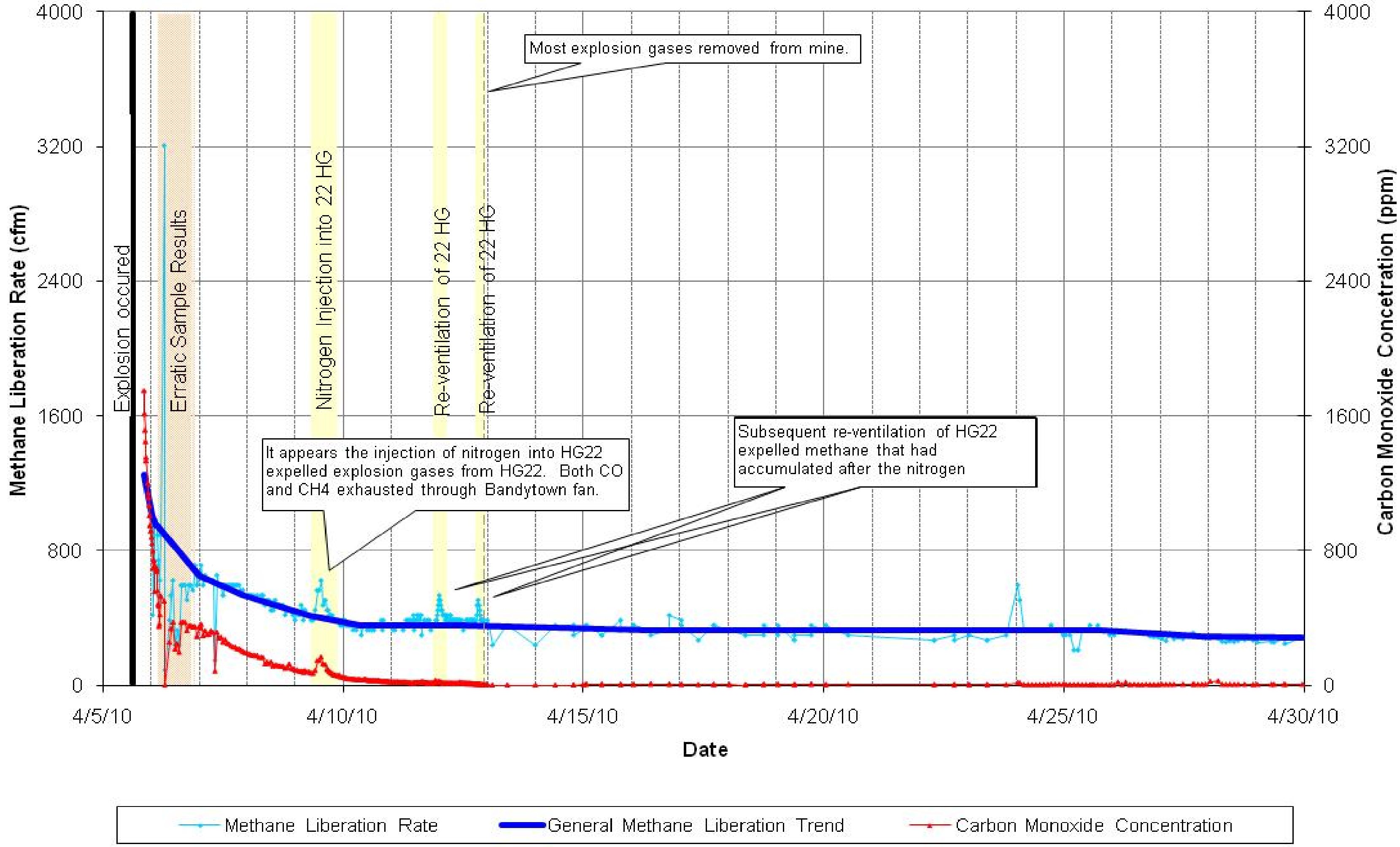


Figure 10: Methane Liberation Rate versus Carbon Monoxide Concentrations for Samples Collected from Bandytown fan from April 5 – 30, 2010

A single sample, collected at 6:40 a.m. on April 6, 2010 and analyzed by the gas chromatograph, indicated an increase in methane, ethane and carbon dioxide while carbon monoxide, hydrogen, acetylene, and ethylene decreased slightly. Analysis of air samples collected after the explosion indicated normal declining trends. The apparent short-lived change in the concentrations of methane, ethane and carbon dioxide could not be explained conclusively.

From April 8 to April 27, the total methane liberation declined to a rate of 288 cfm. In fact, by April 13, most of the gases produced from the explosion were removed from the mine as indicated by low concentrations of fire gases, such as carbon monoxide and hydrogen.

MSHA relied on the normal methane liberation (651 cfm) that was calculated for the 2nd quarter inspection and measurements collected on TG 22 in March, 2010. MSHA further assumed that the minimum liberation rate exhausted through the Bandytown fan was that which occurred during the steady post-explosion condition, which was reached on April 27, 2010 (288 cfm).

After the explosion on April 5, the methane liberation rate from the active workings was higher than the liberation rate during normal mining. Following the explosion, all gases in the mine atmosphere inby Ellis switch were removed from the mine through the Bandytown fan. The removed gases included normal methane liberation from the active workings, methane from the mined out portion of the longwall panel, methane expelled from seal sets 8 through 15, methane and other gases produced as a result of the explosion and gases released from floor fractures on the longwall. Information was not available to quantify the contributions to the total excess methane from the individual sources.

Figures 11 and 12 show graphical depictions of methane liberation rates from the Bandytown fan, based on information collected beginning 8:30 p.m. on April 5, 2010. The curve represents the total methane exhausted from the Bandytown fan from 8:30 p.m. on April 5, 2010 to April 30, 2010. The blue shaded area shown on Figure 11 represents the amount of methane exhausted as compared to the pre-explosion methane liberation. This represents the minimum amount of excess methane exiting Bandytown fan during the sampling period after the explosion. Figure 12 depicts the excess methane exhausted as compared to the post explosion steady-state methane liberation. This represents the maximum amount of methane exiting Bandytown fan during the sampling period after the explosion. Because the rate at which methane liberation from mining declines to the steady state non-mining rate is unknown, the actual amount of excess methane removed from the mine post-explosion would be between the two amounts shown on the graphs.

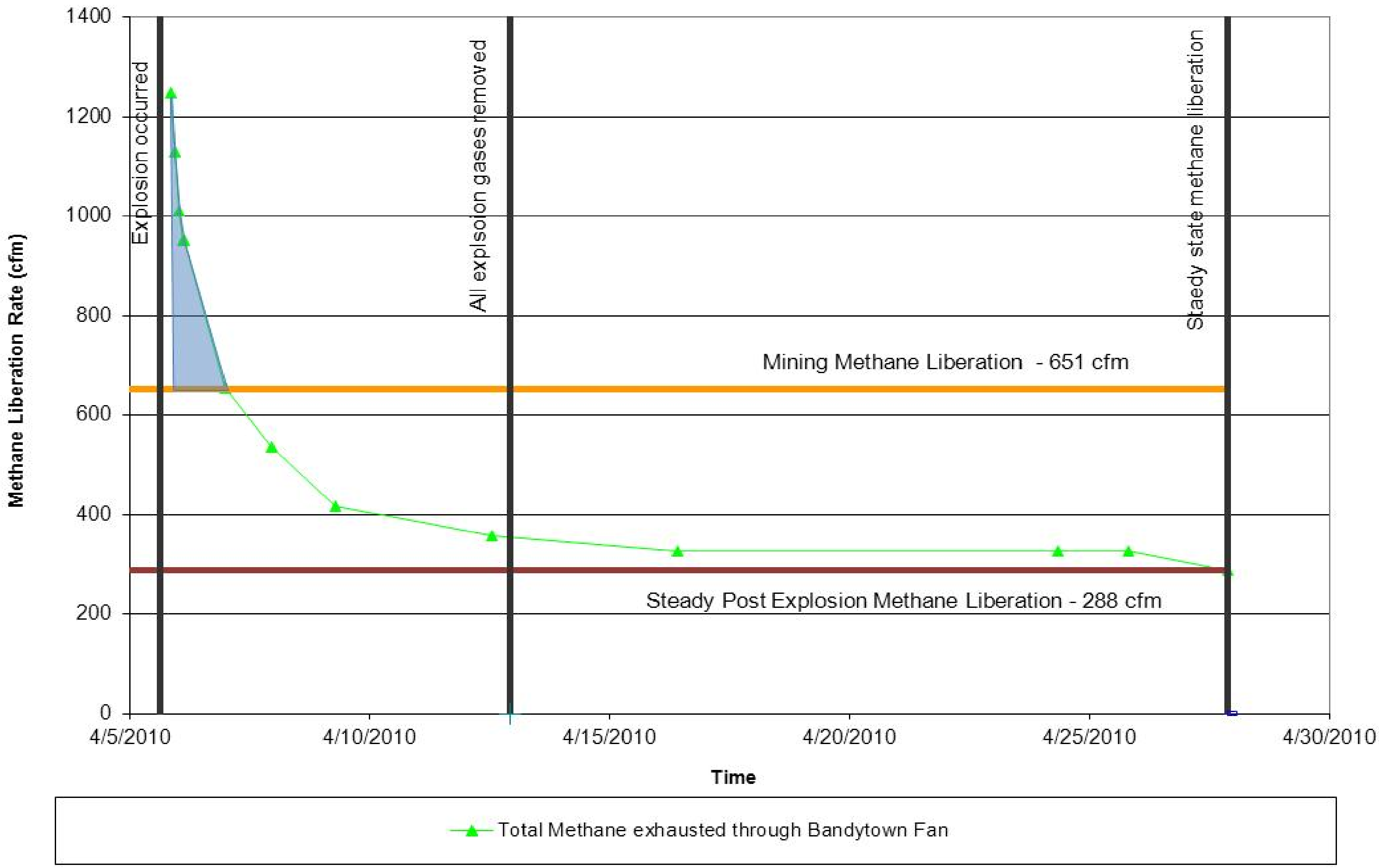


Figure 11. Graph of methane that was exhausted through the Bandytown fan for the period between April 5 and April 30, 2010. The area shaded in blue represents methane in excess of pre-explosion liberation levels.

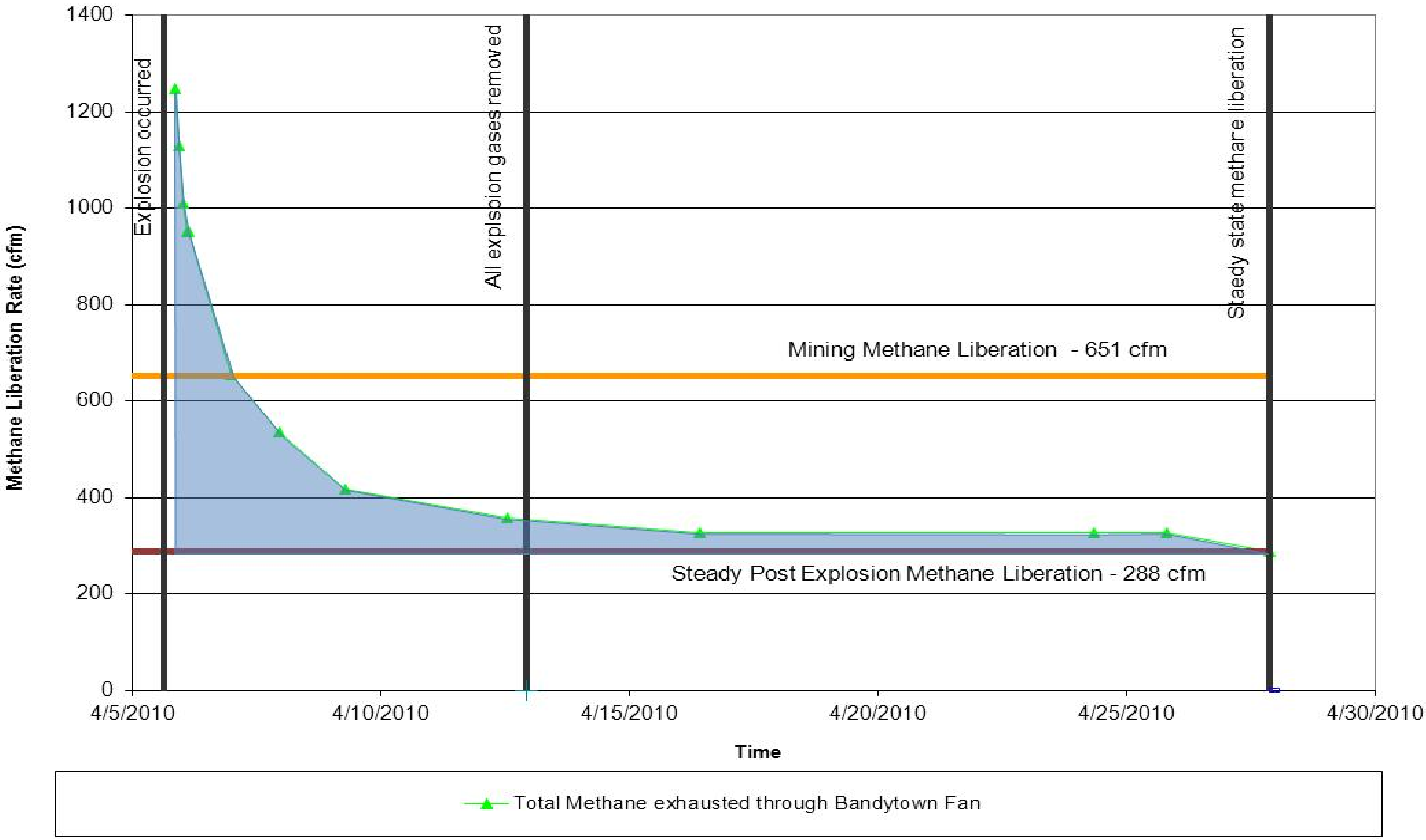


Figure 12. Graph of methane that was exhausted through the Bandytown fan for the period between April 5 and April 30, 2010. The area shaded in blue represents post-explosion methane versus steady state liberation levels.

Source of Gas Measured at the Bandytown Fan

The gas measured at the Bandytown fan likely came from floor fractures, as well as from the explosion itself. A portion of the excess methane measured at the Bandytown fan was likely to have been emitted from floor fractures, in which a gas shale formation was the source, especially since fractures were found on the longwall in the area of shields 160 and 170. (These fractures, and the geological conditions which created them, will be discussed in the next section.) Shale matrix permeability is extremely low and gas production typically requires natural or hydraulically induced fractures. Reservoir pressure is sub-normal, typically ranging from 1,000 to 2,000 psi.

An abundant volume of gas could exist as gas in shale formations, but a small volume may exist as free gas in a naturally occurring fracture system. The amount of free gas available is dependant on the extent of the fracture system, which is associated with geologic structures. The liberation rate from the fracture depends on the volume and pressure of the gas in the fracture system and on the size of the opening where the gas was released. The liberation rate can vary in magnitude from tens to thousands of cubic feet per minute of methane. Turbulence created by gas flowing through a small opening generates sound. Previous high volume gas releases from floor fractures in the 2003 and 2004 inundations resulted in loud noises that have been described as sounding like a “jet engine.”

Prior methane inundations at UBB and other mines operating in the Eagle seam resulted in mining disruptions. Generally, the affected area would be localized at the point of gas discharging from the floor fracture, and the gas release would dissipate within a few days. The volume and pressure of gas contained in the fracture system and the size of the floor fractures were relatively small, which limited the volume of gas that was released into the mine.

Another source of methane measured at the Bandytown fan was the explosion itself. Research has shown that methane is a product of combustion that can occur during a coal dust explosion. The formation of products of combustion is typically related to the concentration and type of fuel that is ignited The critical concentration of coal that would be entirely consumed during a combustion reaction without producing methane is 0.123 ounces per cubic foot. When igniting suspended concentrations of coal dust at 2 ounces per cubic foot, over 1 percent methane can result as a product of combustion. It is likely that similar coal dust concentrations were ignited throughout the explosion zone. Consequently, significant quantities of methane were likely produced in this manner.

The Explosion Was not Caused by Cutting into a Gas Well

The investigation team considered the hypothesis that one of the working sections mined into a gas well, but ruled this out for lack of supporting evidence. Investigators reviewed several sources of data to identify any gas wells not included on PCC’s official mine map. The team reviewed the WVGES “Oil and Gas Wells of West Virginia” website, which graphically displays known locations of gas wells, and compared it to the U.S. Geological Survey (USGS) topographic map. Investigators also searched the West Virginia Department of Environmental Protection's (WVDEP) "Oil and Gas Well Information" website to obtain additional information about known gas wells. The WVDEP and WVGES systems and the mine map did record all wells indicated on the USGS topographic map.

The investigation team also conducted several traverses in the field to confirm the absence of wells above the faces of the 1 North Panel longwall, HG 22 and TG 22, and the West Jarrells Mains. The investigation team found no evidence of well structures, pipes, or drill pads above the faces of the 1 North Panel or development sections.

The investigation team met with members of Equitable Gas, along with a representative of WVOMHST, regarding the gas well (API 005-00810, shown on the mine map as Well No. 7645) isolated by a barrier on the North Jarrells Mains. The well was of interest because of its close proximity to the underground workings and the observation that, according to production records maintained by the WVDEP, the well displayed an apparent significant increase in flow rate beginning in the summer of 2008. Prior to 2008, the well exhibited a fairly consistent flow of approximately 200-500 thousand cubic feet of gas (mcfg). No production was reported for February through March of 2008. Beginning in July 2008, production records indicated a radical increase of over 1,200 mcfg, a rate that was maintained through most of 2009, with a gradual decrease toward the end of the year.

Company personnel indicated that the metering device on the well was found to be non-functional in early 2008. Company personnel indicated that the meter had been replaced in the winter of 2008 after which time a much higher production rate was being recorded. The change in recorded gas volume from the well was due to faulty equipment.

The investigation team also met with representatives of EXCO-North Coast Energy Eastern, the current controllers of natural gas resources on property corresponding to the HG 22 and 1 North Panel areas. Maps at EXCO-North Coast Energy Eastern's Maben, WV office did not show any additional gas wells, besides those already identified by review of information available from Equitable Gas, the WVDEP, or the WVGES.

As a result of this investigation, the team ruled out an existing gas well as the source of the methane/natural gas.

A Seismic Event Did not Cause the Explosion

The investigation team considered the hypothesis that a seismic event triggered the explosion. Based on data supplied by the USGS, two rare seismic events occurred in southern West Virginia in the weeks preceding the UBB explosion. Because they occurred prior to the explosion and many miles from the mine, the investigation team ruled them out as playing any role in these events.

The first was a 2.9 Richter Scale magnitude event that occurred on March 27, 2010 in Logan County, approximately 27 miles away from UBB. The shallow depth and location in a historically bump-prone area of West Virginia suggests that the seismic event represents a coal pillar bump, rather than an earthquake. The investigation team's review of old mine maps, downloaded from the WVGES, identified an old mine with extensive pillared works within one mile of the plotted location of the seismic event. The extensive pillared works in the abandoned mine surrounded large, square barrier-style pillars that may have experienced rapid failure after decades of degradation to reach a critical size.

The second seismic event occurred on April 4, 2010 in Braxton County, approximately 60 miles from the face of the 1 North Panel. Despite the seemingly close temporal relation between the April 4 seismic event (5:19 a.m.), and the April 5 explosion (3:02 p.m.), the 60-mile interval and 34-hour time difference does not support any recognizable relationship between the two events (Appendix M).

Seismographs monitored by the WVDEP's Office of Explosives and Blasting recorded surface blasting shots conducted on April 5, 2010 (Appendix N). The locations of surface blasts were plotted in a GIS, using coordinates provided by the WVDEP Office of Explosives and Blasting along with the times of surface blasting. Four surface blasts were recorded, approximately 2 ½ miles from the face of the 1 North Panel, but the earliest was over one hour after the 3:02 p.m. time of the explosion.

The Geochemistry of Natural Gas and Coal Bed Methane

As discussed above, investigators concluded that the explosion was a natural gas/methane ignition and explosion which transitioned into a coal dust explosion, rather than an explosion solely fueled by natural gas/methane. Investigators also concluded that the methane that triggered the initial ignition and explosion derived from natural gas, rather than coal bed methane. The information below describes how investigators determined that the source of the explosive mixture came from floor feeders on the longwall face.

MSHA collected gas samples from four locations: UBB, Speed Mining LLC's American Eagle Mine, and gas wells producing from the Greenbrier Formation and Marcellus Shale within seven miles of the 1 North Panel. The hydrocarbon content and stable isotope ratios were compared and plotted on discrimination diagrams to determine the sources of gas entering the UBB mine (Appendix O).

MSHA collected gas samples at different times from floor feeders located behind the shield pontoons on the longwall face at shields 160 and 170. The immediate vicinity of the floor feeders was characterized by a distinctive smell similar to that noted at the American Eagle Mine. Investigators registered high values of methane and carbon monoxide. The samples were characterized by gas content of 40.61% (90.15% normalized to 100% hydrocarbons) methane, 2.7% (5.99%) ethane and 1.21% (2.68%) propane, as well as 0.135% (0.3%) and 0.188% (0.41%) iso-butane and n-butane, respectively; 0.04% (0.08%) and 0.0202% (0.04%) iso-pentane and n-pentane, respectively, and; 0.018% (0.04%) hydrocarbons, including or heavier than hexane. The sample also contained 0.279% hydrogen and no carbon monoxide; however, a hand-held methane detector indicated the presence of several hundred parts per million of carbon monoxide. Although subsequent analyses indicated that no carbon monoxide is actually present in any of the samples, a carbon monoxide reading of several hundred parts per million may be a proxy for hydrogen, which the handheld detector is incapable of discerning from other fire gases. These samples are chemically and isotopically very similar to those collected from the American Eagle Mine and are representative of organic shale-derived thermogenic gas, rather than biogenic gas derived from coal.

MSHA collected samples from small feeders emanating from the floor, throughout the HG 22 and TG 22 sections. Analytical results indicate a different kind of gas than that sampled at longwall shields 160 and 170 or at the American Eagle Mine. In contrast to those samples, which contained significant ethane and other heavier hydrocarbons, the HG 22 and TG 22 samples were characterized by methane content of 75-78 percent, with only 0.01-0.02 percent ethane and insignificant or non-detectable contents of C_{2+} hydrocarbons. Furthermore, the samples contained no hydrogen and during the sampling process, the handheld gas detector indicated no carbon monoxide.

Methane Accumulations that Led to the Explosion

As covered in the previous section, MSHA investigators concluded that the most likely scenario initially involved a methane ignition. The ignition source was located at the shearer. This section explores how the methane likely entered the mine and how PCC and Massey's failure to abide by the roof control plan likely contributed to the methane accumulation that led to the initial methane explosion.

PCC's mining progressed into a geological fault zone that was a reservoir and conduit for methane. Indications of this fault zone prior to April 5, 2010 include methane outbursts at the mine in 2003 and 2004, a methane explosion in 1997, and problematic ground conditions. When mining progressed into the fault zone beneath deep overburden, existing fractures in the zone dilated and released previously trapped methane.

On April 5, 2010, gas was released from the fault zone as a floor feeder near the back of the shields, characterized by a flow rate of several hundred cubic feet per minute. The intersected expression of the fault zone conduit was represented by a series of fractures between shields 160 through 171, on the tailgate side of the face, where the longwall shearer was operating at the time of the explosion. During the investigation of the longwall, investigators found that methane was emanating from these fractures. Investigators concluded that these fractures supplied the methane that started the April 5 explosion. This methane likely migrated a short distance into the tailgate entry, where it accumulated.

PCC's roof control practices contributed to the accident, by failing to adequately support the tailgate entry as required by the roof control plan. PCC failed to either set two rows of posts or install two 8' cable bolts down the tailgate entry. Prior to the explosion, the roof of the tailgate entry caved inby the face, restricting the airway through the next inby crosscut, referred to in ventilation terms as the T-split. This failure to install required support contributed to a roof fall in the tailgate entry behind the shields that allowed methane from the floor feeder to accumulate. The tailgate roof fall inby the face restricted airflow to the extent that it was not possible to dilute the additional gas inflow behind shields 160 through 171. On April 5, a small portion of this gas volume ignited, most likely on the fringe of a gas body, providing the initial explosive energy to suspend float coal dust in the tailgate entries that allowed transition to a coal dust explosion.

Geological Background

Geology and Previous Mining

Near the 1 North Panel, the Eagle seam is a single coal bed 26-40 inches in thickness that is sometimes separated into two benches by a several-inch-thick sandstone parting. Although the coal seam is considered to be 4 ½ feet, actual mining height is approximately seven feet. The seam is overlain by brown-to-black shale or medium-grained, white sandstone where the shale is absent. Where shale is present in the immediate roof, bedding-parallel faults are sometimes present. In other areas, bedding-parallel movement is indicated by pinched-off teardrops of sandstone entrained in coal, as well as by small thrust faults that disrupt the sandstone binder. Coal cleat (naturally occurring parallel planes) is commonly indistinct although it is roughly parallel to the locally dominant joint orientations of N 70-80° E and N 10° W. Uncommon joint orientations of roughly N 45° E and N 35-55° W are also present but are localized to restricted zones.

The mine floor is generally hard and consists of a 3 to 10-inch thick layer of medium-grained white sandstone. Floor heave is generally widespread and is characterized by slabs of sandstone cantilevered up to define jagged brows with several inches of offset, forming rootless cracks that bottom out in more easily deformed mudstone and sandy shale (Figure 13). Less commonly, floor heave is localized along structural geologic zones of weakness defined by joints, pot-outs, and slickensides.

Figure 13. Cantilevered slab of floor sandstone forms broken brow with rootless, open aperture fracture. This style of floor heave is typical throughout Tailgate 1 North, the Panel 1 crossover and adjacent rooms, TG 22, and HG 22.

The UBB workings are variably overlain by up to six mined coal seams. The Eagle seam is separated by an interburden that ranges between 8-20 feet from the approximately two-foot thick Lower (Little) Eagle seam. In the 1 North Panel, the Little Eagle seam is 10 feet below the Eagle seam at the Panel No. 1 crossover. Core holes in the crossover area indicate a strata sequence comprised of 0.5-2.4 feet of gray shale, 5.5-5.7 feet of gray sandstone and finally 2.5-4.2 feet of gray sandy shale progressing downward from the base of the Eagle seam.

The face of the 1 North Panel is beneath approximately 1,075 feet of overburden at mid-face, with maximum overburden of 1,275 feet encountered near the start-up room at the back of the panel. Review of mine map overlays indicates that a remnant pillar configuration is present above the southern quarter of the current position of the longwall face, characterized by two rows of pillars flanked by gob represented by split pillars in the Powellton seam (determined to be the No. 2 Gas seam by the West Virginia Geologic and Economic Survey (WVGES)), 170 feet above. Three thick layers of massive sandstone, each 20-30 feet, are present between the Eagle and Powellton seams, although floor heave and roof potting in UBB can often be correlated to remnant pillars surrounded by gob in the overlying Powellton seam. Additionally, there are several other mined coal seams above; see Figure 14 below.

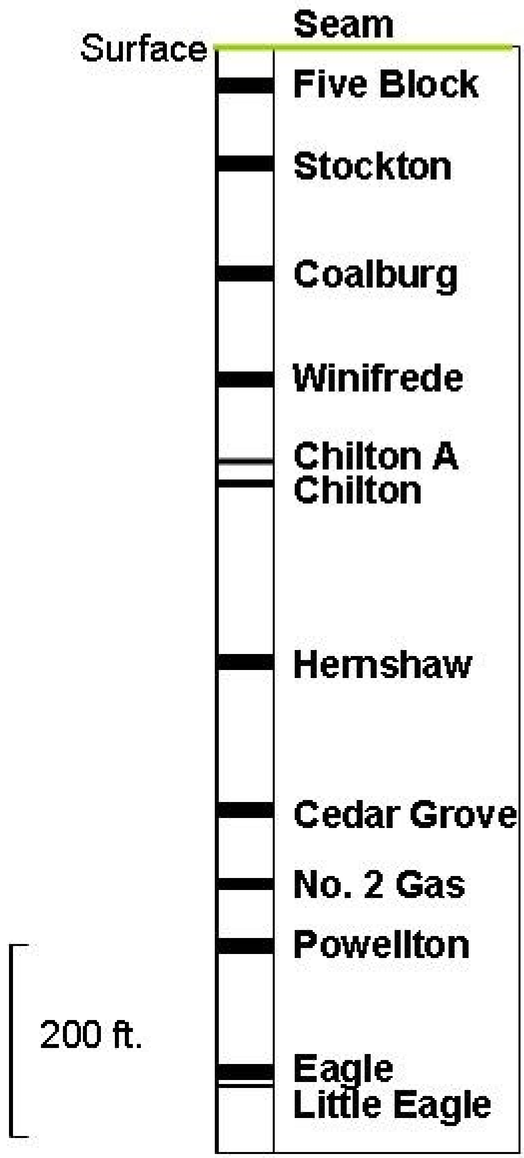


Figure 14. Stratigraphic column of coal seams present above the 1 North Panel longwall face. Note that WVGES names are offset, beginning with the Powellton.

Outburst History at UBB

As a result of a gas outburst from a 240-foot long floor fracture at mid-face of Longwall Panel 17, MSHA conducted a ground control evaluation at UBB in 2004 (MSHA Technical Support, Roof Control Division Memorandum 04AA34, dated March 4, 2004). Formation of the fracture was associated with floor heave that tilted the shearer away from the coal face, a loud thump commonly associated with failure of sandstone in the roof (according to mine personnel), and longwall shields that were taking weight and yielding at mid-face. A gob/solid boundary in pillared works of the overlying Powellton seam was located directly over the outburst area. The overburden depth at the outburst site was 1,155 feet.

In the 2004 outburst, the shearer had been down for 20 minutes prior to the event and the face was idle. MSHA inspection notes on February 8, 2004 documented that the measured intake air to the longwall was 72,000 cubic feet per minute (cfm). The measured velocity at shields 17 and 160 was 340 feet per minute (fpm) and 210 fpm, respectively. On June 28, 2004, the measured intake air to the longwall was 79,040 cfm, according to inspection notes. The measured velocity at shields 17 and 160 was 542 fpm and 375 fpm, respectively. MSHA concluded, in June 28, 2004 notes, that the ventilation plan required minimum intake air quantity of 60,000 cfm and a velocity at shields 17 and 160 of 300 fpm and 175 fpm, respectively.

Mine personnel reported that a similar event had occurred on July 3, 2003 on the adjacent, previously mined Longwall Panel 16 at an overburden depth of 1,175 feet. Witnesses described this outburst as a high pressure event with voluminous gas released, comparable to the sound of a jet engine. MSHA indicated, in January 29, 2003 inspection notes that the measured intake air to the longwall was 70,297 cfm in the last open crosscut (LOC) and 45,798 cfm in the conveyor belt entry. UBB's senior mining engineer in 2004 concluded that at overburden depths exceeding 1,100 feet, especially beneath barrier pillars in the overlying Powellton seam, sufficient stress might be transmitted to the longwall shields at mid-face, where stress is already theoretically highest, to fracture a critical interburden thickness of 12 feet between the Eagle and Lower Eagle (Little Eagle) coal seams, thereby releasing the methane outburst. The longwall coordinator in 2004 also reported that shield monitoring data indicated the shields in the center of the face went into yield just prior to the event.

An MSHA CMS&H D4 accident investigation report indicated that an explosion occurred in January 1997 in the 2 West Longwall Panel, which was the first longwall panel of the first longwall district. MSHA determined that the event involved an ignition of gas in the gob on the tailgate side of the face behind the shields. Witnesses reported hearing what they thought was a roof fall behind the shields, followed by a bright red glow and smoke coming from behind the shields. Other witnesses reported seeing an arcing flash in the gob behind the shields after the apparent roof fall. Witnesses also reported that the caving or falling material sounded much more intense than usual. The longwall foreman at the beginning of the shift measured 450 fpm air velocity at shield 17 and 345 fpm at shield 160.

In discussions with MSHA during the 2004 investigation, the mine's senior mining engineer indicated that degasification wells were planned for the next longwall panel (Panel 18) in an attempt to bleed off any gas prior to encroachment of the longwall face. The mine had already constructed interburden thickness maps between the Eagle and Lower Eagle seams, and had constructed a structure contour map for the surface of the Lower Eagle seam, in an attempt to identify structural highs beneath which gas may have accumulated. Subsequent to that investigation, members of the Roof Control and Ventilation Divisions of MSHA Technical Support attended a meeting with UBB and D4 personnel to discuss additional outburst mitigation measures. During the current accident investigation, it was determined that the mine did not have a degasification plan and the measures discussed in 2004 had not been implemented. However, the mine map indicates that Panel 18 was terminated short of its intended length. This termination coincides with a projected (imaginary) diagonal line connecting the 2003 and 2004 outburst locations.

Eagle Seam Outbursts

MSHA D4 personnel indicated to MSHA investigators that the only other known example of methane inundation reported in the Eagle seam, besides UBB, occurred in the Horse Creek Eagle Mine, located approximately six miles southeast of UBB. Witnesses interviewed during the 2004 UBB investigation also reported that floor bursts had occurred at the Harris No. 1 Mine. An engineer from Harris No.1 Mine indicated to investigators that the floor was prone to fracturing and releasing varying volumes of gas in conditions of higher overburden, although he stated that voluminous, high pressure "jet engine" style outbursts had not occurred. During the course of the UBB accident investigation, several gas floor feeder events occurred at Speed Mining, LLC's American Eagle Mine in the same seam, located 15 miles north-northeast of UBB; MSHA investigated these events.

UBB has a Geological Fault Zone, which Serves as a Conduit for Methane

Description of the Fault Zone

The investigation team concluded that a fault zone trends N 40° W across UBB, and dips 30° to the northeast (Figure 15). This is based on: 1) the locations of gas outbursts or explosions in 1997, 2003, and 2004, discussed above; 2) underground observations conducted at UBB in the 18 Headgate during the 2004 investigation; 3) extensive underground observations conducted between July 2010 and October 2010; 4) the face positions of Longwall Panels 11 and 12 when they were terminated; 5) observations of structural features in the overlying Powellton (Castle Mine) and Coalburg (Black Knight II Mine) seams; and 6) observations of structural features on the surface. To understand the conditions associated with the initial gas release, it is also critical to understand the interplay between the fault zone, the depth of overburden, and the redistribution of stress caused by longwall mining.

The fault zone passes through the 2003 and 2004 gas outburst locations and the 1997 explosion, and projects through the face of the 1 North Panel, TG 22 development section, and West Jarrells Mains, as well as intersecting the HG 22 development section. This indicates a strike (compass bearing of geological feature) length of at least 4.5 miles. Mapping on the surface and in mines above the Eagle Seam indicates that the fault zone extends from the Eagle seam to the ground surface. The fault zone is interpreted to represent a ramp-and-flat system, in which the fault rides along the surfaces of weak strata such as coal before periodically cutting up across more competent layers. Individual structures within the fault zone include drag folds, bedding plane faults, reverse faults, and overturned anticlines (A-shaped geological folds) that exhibit a strike of N 40° W in or directly above the coal seams. Zones of vertical jointing, which also strike N 40° W, are present in thick sandstone layers that overlie the coal seams. The zone also localizes linear pot-outs in the roof and zones of floor heave (Figure 16).

Investigators interpret the fault zone to represent a conduit for methane migration into the Eagle seam from a reservoir that was ultimately sourced in organic-rich Devonian shale. PCC and Massey stopped several longwall panels along the projected fault zone.

Another factor (discussed further below) in the release of methane appears to be the overburden present above the fault zone. While other panels mined through the fault zone without experiencing a methane outburst, those panels encountered overburden depths much less than 1,000 feet within the fault zone. The panels that experienced methane outbursts encountered overburden values of over 1,150 feet. It appears that several longwall panels, including Longwall Panels 11, 12, and 18 and Longwall Panels 16 and 17, were terminated in the vicinity where the projection of the fault zone intersected the 2,000-foot topographic contour. This corresponds to between 1,125 and 1,200 feet of overburden, depending on seam elevation (Figure 17).

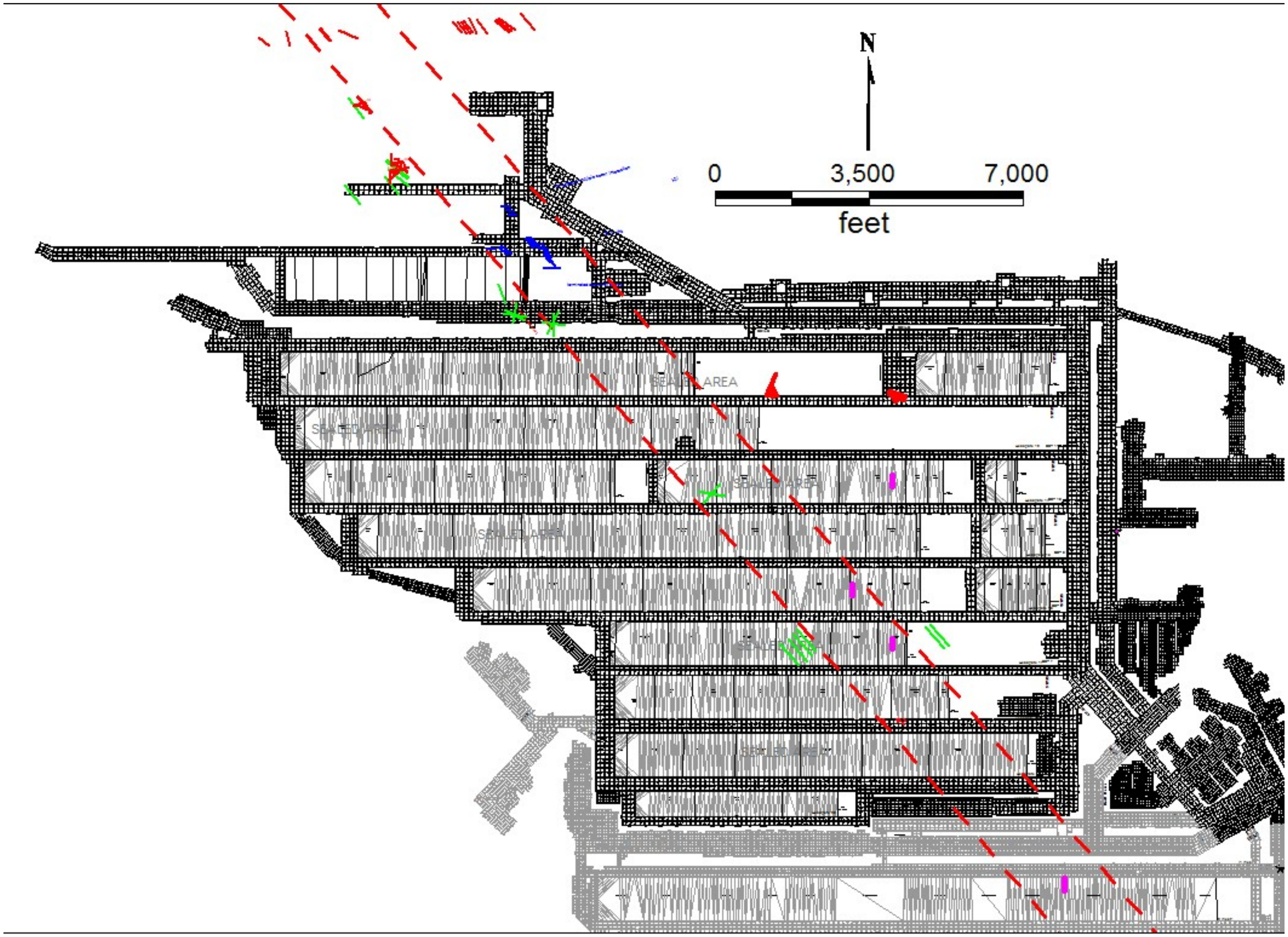


Figure 15. Upper Big Branch Mine with projected fault zone, and locations of joints (green, blue), slickensides (red), and floor burst locations (purple) used to constrain the location and trend of the fault zone.

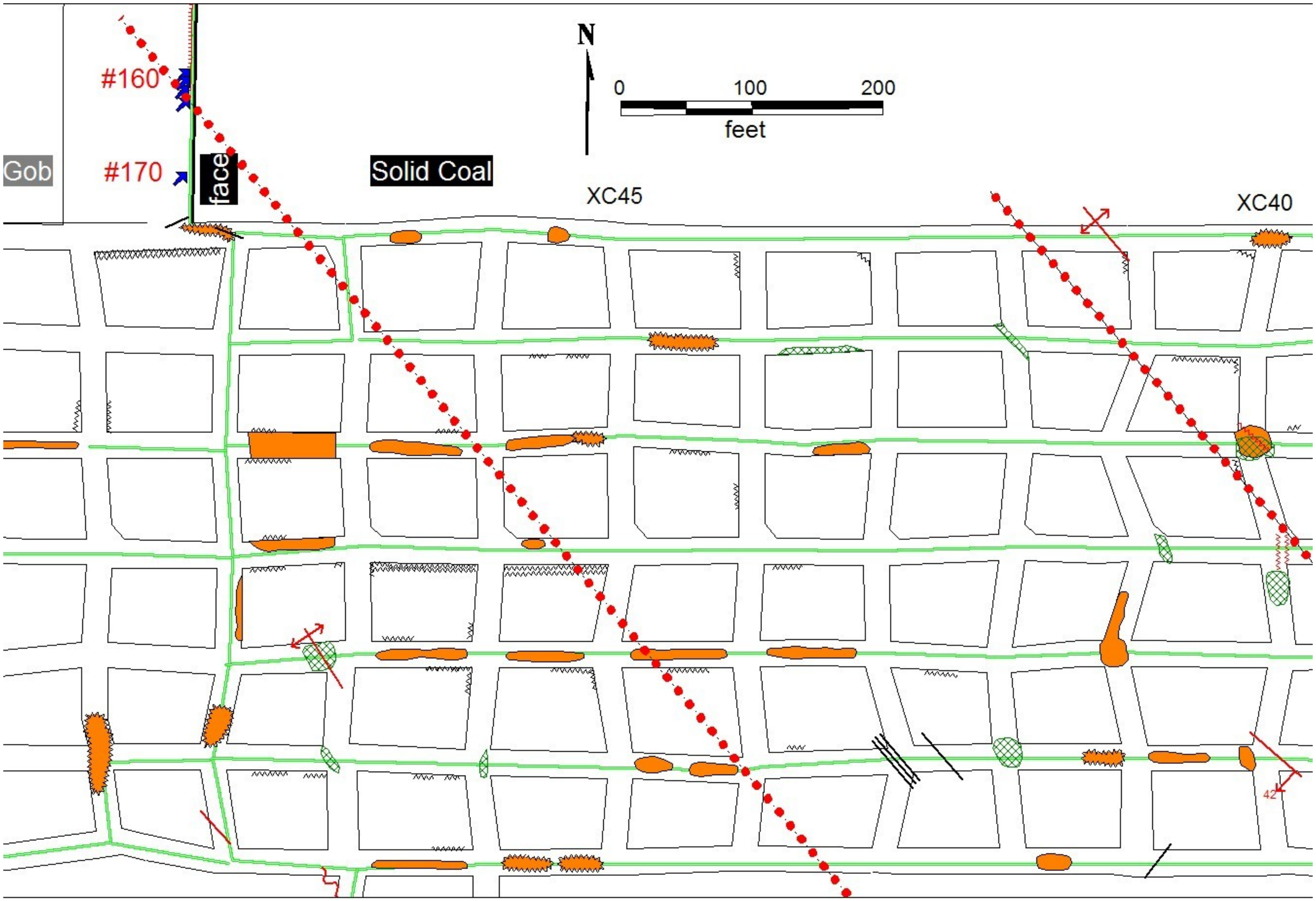


Figure 16. Detailed mapping in Tailgate 1 North, showing trend of floor heave (orange), joints (heavy black lines), pot-outs (green hatch), rib sloughing (jagged lines), and slickensides (red lines) projecting into the longwall shield 160-171 gas feeder zone. Heavy red, dashed lines indicate individual fault zone projections. Blue arrow symbols represent floor feeders inby longwall face.

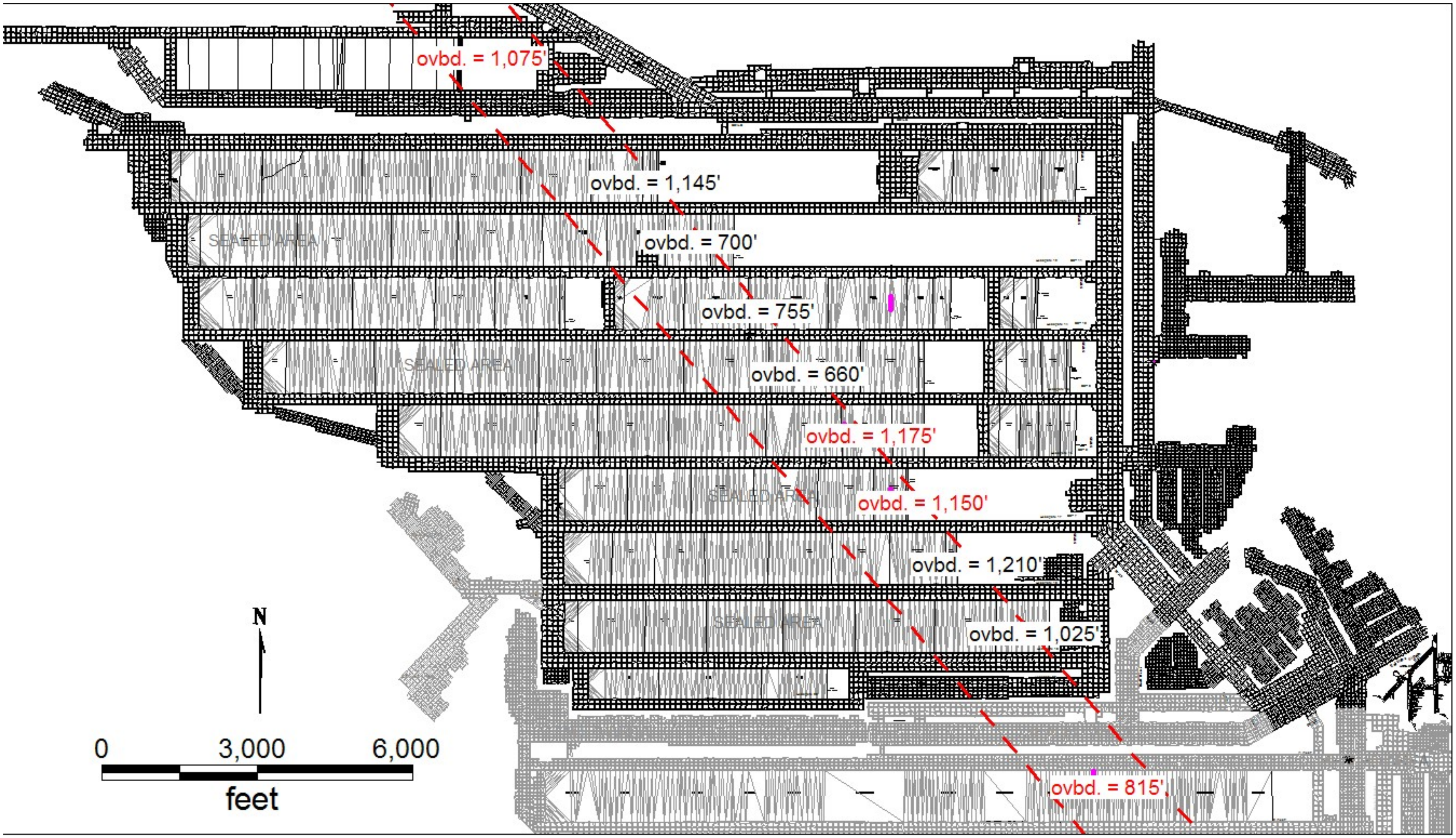


Figure 17. Panels in which outbursts or explosions occurred are highlighted in red and lie along projected fault zone. Several panels were terminated upon intersecting the fault zone. Panels that encountered overburden of only 660-755 feet appear to have crossed the fault zone without incident, suggesting a critical overburden depth of 1,150 feet related to stress.

The Role of Overburden and Stresses in Opening the Fractures

MSHA investigators explored whether overburden and stresses were a determinative factor in causing the outbursts. The evidence indicated that stress alone did not cause the outbursts, but did play a role in dilating the fractures along a fault zone. Nor did stresses cause a fracture to extend all the way down to the Little Eagle seam (the seam below the Eagle seam). Rather, mining into the fault zone beneath a critical depth threshold, corresponding to a stress value, represents the necessary condition to dilate the fractures in the fault zone and release the trapped methane into the mine.

Overburden Stress

MSHA investigators contracted an independent expert, Professor Keith Heasley of West Virginia University, to perform a LaModel (boundary element model) analysis of UBB to assess the effect of multiple seam interaction and overburden stress on mine stability and to assess whether a critical stress threshold might be associated with gas outbursts.

Dr. Heasley's model was used to assess the in-situ (in place) stress on the Eagle seam prior to mining to identify any high-stress areas and to assess any correlation between high stress areas and floor gas outbursts. Figure 18 represents a map of in-situ stress on the Eagle seam, including the vertical stress derived from the weight of overlying rock combined with stress associated with multiple seam interaction with the overlying Powellton seam mining. Although there appears to be a loose correlation between in-situ stress exceeding 1,200 pounds per square inch (psi) and the locations of the 2003 and 2004 gas feeder events, they are not associated with the highest stress values of 1,800 psi or greater.

At the time of the April 5 explosion, the longwall face was beneath a narrow swath of greater-than-1,200 psi stress associated with two rows of remnant pillars flanked by gob or thin, split pillars. Therefore, the documented outburst locations do not correspond to the highest stresses (>1,800 psi), and therefore, do not appear to be entirely stress-driven.

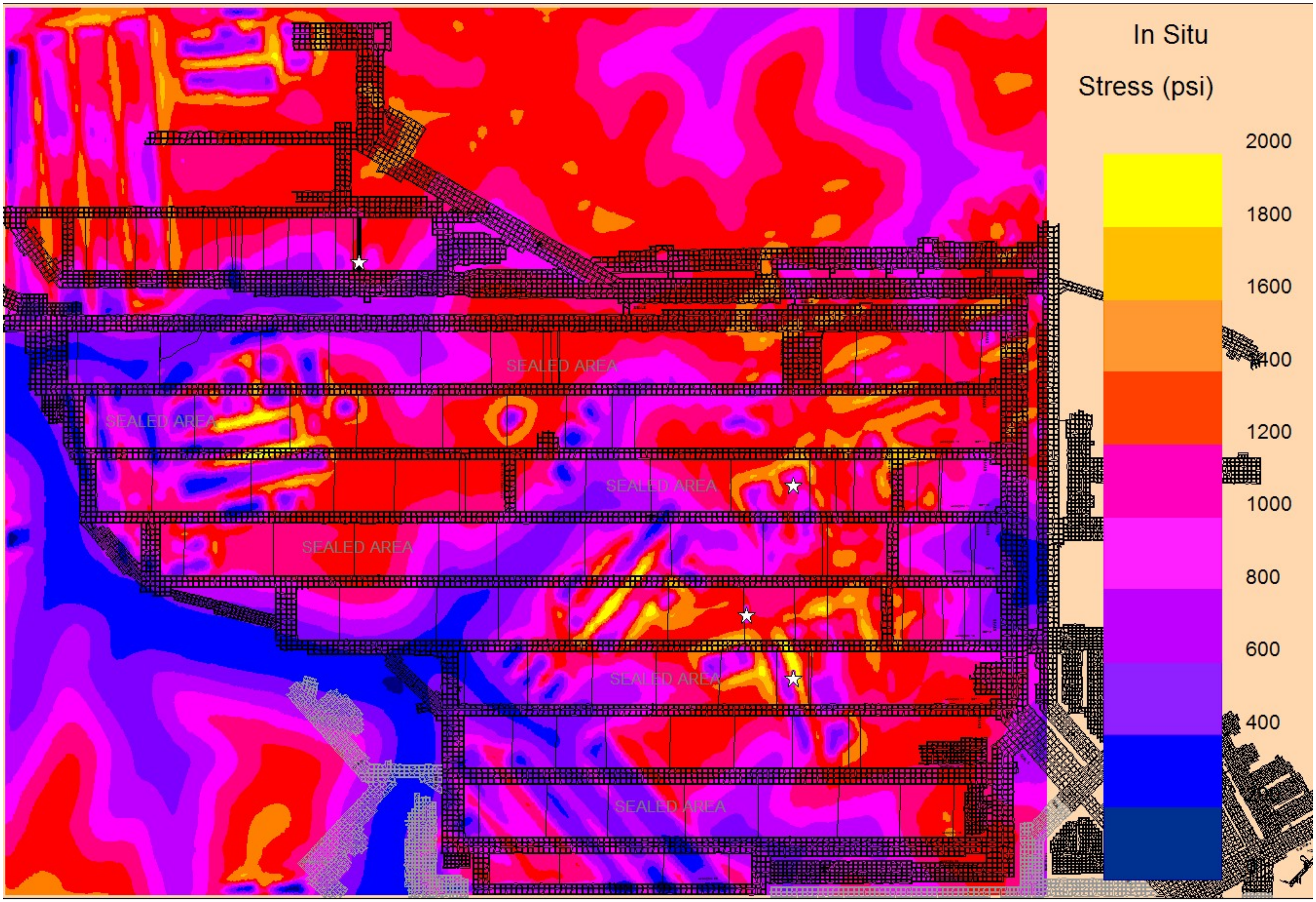


Figure 18. Map of in-situ stress on the Eagle seam, incorporating stress attributable to overburden and multiple seam interactions with the Powellton seam. White stars indicate locations of gas outbursts, with heavy black line on 1 North Panel (label), representing April 5, 2010 face position. Bright yellow patches represent >1,800 psi, with subsequent colors spaced at 200 psi intervals.

The Mine Floor and the Little Eagle Seam

The accident investigation team constructed cross sections of longwall panels where face ignitions or gas outbursts occurred previously, for analysis using the $Phase^2$ two-dimensional finite element modeling program. This approach differs from the boundary element model in that it is capable of incorporating geologic structures and can model the effects of mining in the floor. In contrast, the boundary element model calculated pre-mining stresses on the Eagle Seam as a result of depth and overlying mining configurations. Although there is insufficient information available to constrain all input parameters, investigators used the finite element models conceptually to visualize stress distributions associated with longwall mining beneath remnant barriers and weakened geologic zones. The models were also used in a semi-quantitative way to assess whether sufficient mining-related stress could be generated to cause failure of the approximately 10-foot interburden between the Eagle and Little Eagle coal seams, and the depth to which stability of the rock mass might be affected.

The models indicated that sufficient compressive stresses are not generated by mining to cause failure of the 8-10 feet of strata between the Eagle and Little Eagle seams. Thus, the interpretation following the 2004 event that high stress was driving the shields into the floor at mid-face and causing the rock to fail does not appear to have been correct. The models did, however, indicate that rock strength in the intervening strata is commonly reduced to failure virtually everywhere along the panel as the face advances. Therefore, if it were assumed that the source of the gas were the Little Eagle seam, and that stress was the only controlling factor, gas outbursts should occur continuously as the intervening strata is fractured. This is not the case, because the outbursts are rare events that occur at specific locations.

The models suggest that passage of the longwall face can be expected to impart stresses of several thousand psi to the strata several feet beneath the longwall face. The stresses can also be expected to routinely reach the Little Eagle seam below. As the longwall face passes, the gob floor is expected to be subjected to tensile stress as confinement is removed. Passage of the longwall face is expected to disturb both vertical and shallowly dipping joints for significant depths below the Little Eagle seam. Because some modeled panels had low strength factors at virtually every face position, outbursts cannot be explained solely in terms of stress acting on continuously lateral strata.

The Role of the Fault Zone

Having a low strength factor in the interburden (the interval of rock between the Eagle and Little Eagle seams), thus, did not by itself explain the outbursts. Investigators examined the role of the fault zone in generating outbursts.

Investigators simulated the fault zone with a 100-foot thick zone, consisting of vertical joints, that dips 30° across the stratigraphic sequence (rock layers), resulting in an intercept width of 200 feet for each layer of strata (Figure 19). This configuration matches closely the geological observations, i.e. intact rock hosting widely spaced joints or other geological structures within the shallowly dipping fault zone. Simulated vertical joints were spaced 20 feet apart within the 30° dipping zone and given a friction angle of 28°, with no tensile strength or cohesion. Joint ends were specified as being open at excavation boundaries.

Areas outside the fault zone did not incorporate joints, and when the simulated longwall face position was 250 feet inby the April 5, 2010 position, strength factors less than one extend only a calculated five feet into the floor, approximately halfway to the Little Eagle seam (Figure 20 and 21). When the longwall face had reached its April 5, 2010 position, such that the 30°- dipping fault zone was cantilevered over the face, zones of tension extend a predicted 25 feet into the floor along joint zones, and a zone of strength factors less than one extends 15 feet into the floor. This fully encompasses the Little Eagle seam and intervening interburden to the Eagle seam, with the zone extending beneath the Little Eagle seam for a short depth.

Thus, investigators concluded that the most likely explanation for the failure mechanism associated with the gas inflow at shields 160-171 is that mining into the fault zone beneath the two rows of remnant barriers at over 1,000 feet of depth resulted in a unique overlap of factors that caused the development of tension zones along pre-existing geologic structures for a calculated 25 feet into the floor.

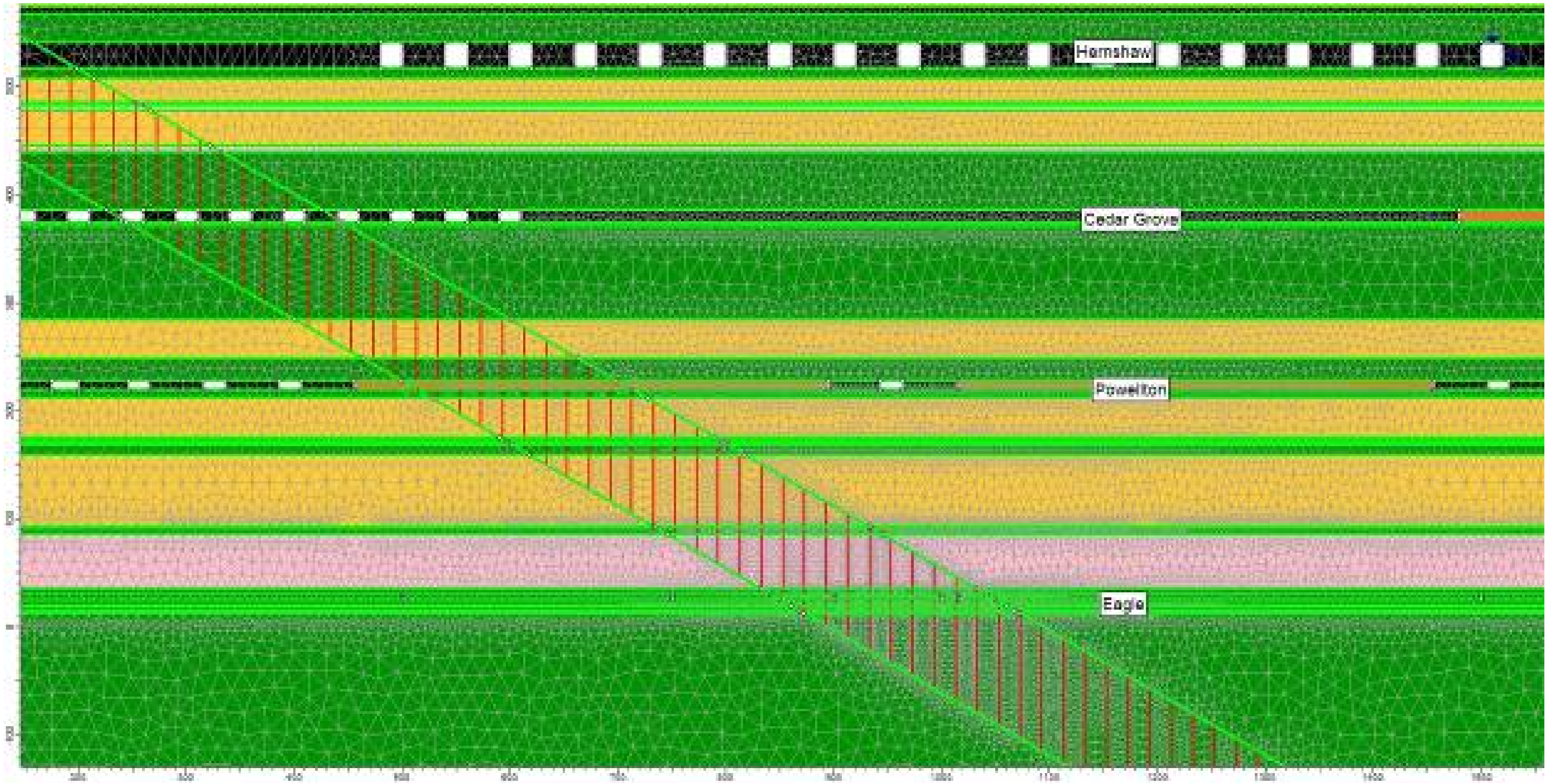


Figure 19. Stratigraphy in Rocscience showing incorporation of 30° dipping fault zone that is comprised of vertical joints spaced 20 feet apart for 1 North Panel cross section.

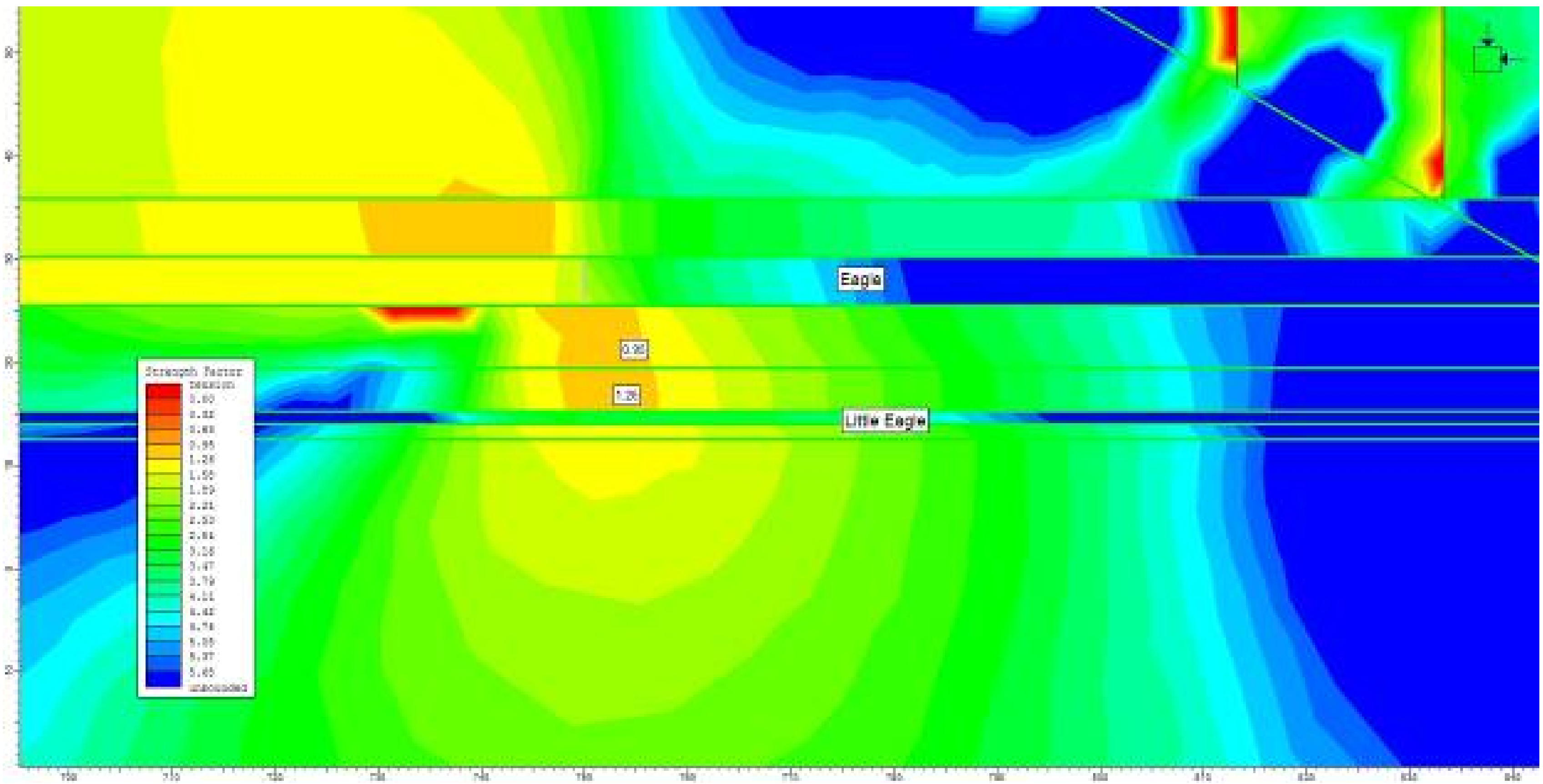


Figure 20. Distribution of strength factors when 1 North Panel longwall face is 250 feet inby the April 5, 2010 face position, outside the projected fault zone. Strength factors less than one are calculated to extend only five feet into the floor beneath the face.

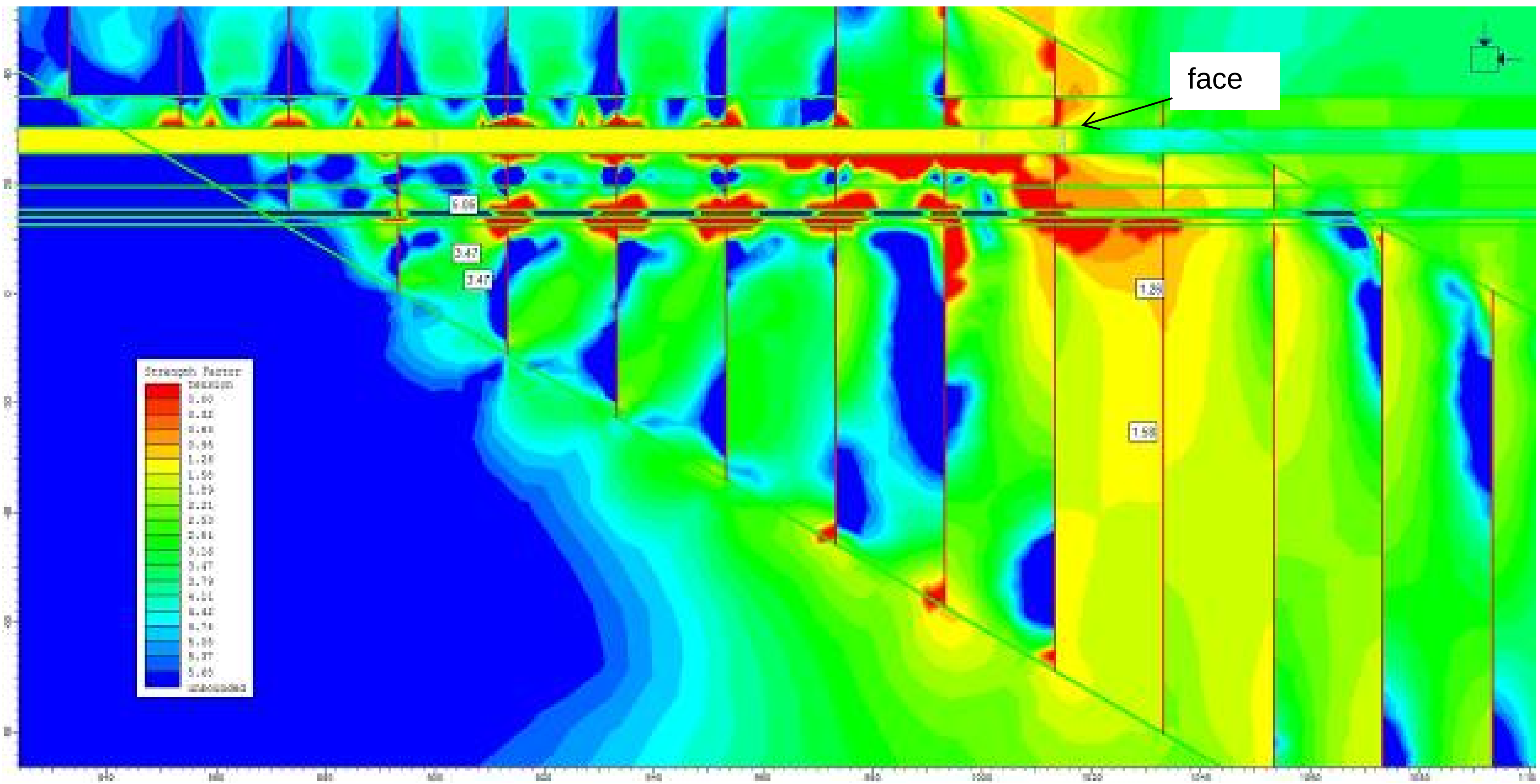


Figure 21. Distribution of strength factors when the 1 North Panel longwall face is at its April 5, 2010 position. Zones of tension are developed along joints below the Little Eagle seam, with large swath of strength factors less than one extending 25 feet into the floor, which encompasses the Little Eagle seam and underlying strata.

Methane Likely Migrated from Behind the Shields to the Shearer

During the investigation of the longwall, methane was found to be emanating from the mine floor in several locations near the tailgate end of the longwall face between shields 160-171.

As discussed later in the report, methane was present at the longwall shearer, where the initial methane ignition occurred. (It was also present at Tailgate 1 North, where the localized methane explosion occurred; this will also be considered later). MSHA investigators devised a test to observe the path the gas may have traveled as it was being released into the ventilating air stream. This test aided investigators in conceptualizing how a plume of gas from a point source behind the shields might enter the airstream and travel into the tailgate. The test also helped to assess how the plume would interact with the methane sensors mounted on the longwall shearer and tailgate drive.

The conditions on the longwall at the time of the test were different than in the moments prior to the explosion. Full details related to the ventilation system on April 5, 2010 are not presently known, as discussed elsewhere in this report. Additionally, the airflow volume and velocity crossing the face was different than reported in company examination books and the information called out of the mine for the record books.

Despite these limitations, however, the test is a useful way to visualize how air might have traveled in the shield walkway, behind or through the shields, and in the tailgate. The test involved releasing chemical smoke near the location of the fractures in the mine floor, and tracking the path the smoke traveled. Figure 22 shows the shearer, methane sensors, and shield locations. Investigators used video equipment to document the results of the tests on the longwall face and in the tailgate entry.

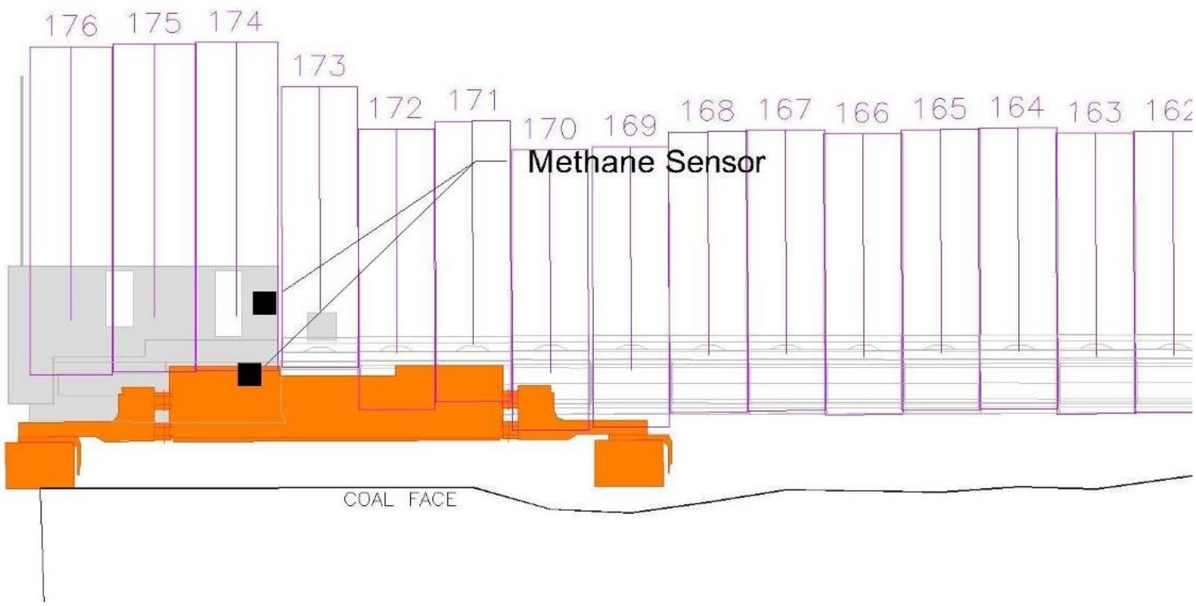


Figure 22. Diagram of UBB longwall face, showing locations of methane sensors mounted on the shearer and on the tailgate drive.

The first series of tests consisted of releasing smoke on the longwall face, with video equipment in the tailgate entry recording the path of the smoke. Investigators first released smoke behind shield 160. The smoke traveled downwind behind the shields until it reached an area where the gob had fallen tight against the shields, near shield 164. The smoke migrated from behind the shields out into the walkway and panline. The smoke moved downwind in the air current, traveling over the shearer, tailgate drive, and the methane monitor sensors.

Investigators released smoke behind shield 170, first in light amounts and then in heavy amounts. In both tests, the smoke traveled behind the shields to shield 173. At shield 173, a portion of the smoke traveled behind the shields and out into the tailgate entry. The rest of the smoke came out of the shields into the walkway. The smoke traveled toward the tail and over the shearer, toward the tailgate drum. The smoke did not pass over either of the methane monitor sensors. Smoke was observed traveling over the tailgate drum of the shearer and into the tailgate entry. Smoke was also observed entering the back of the canopy on shield 176. The smoke traveled through the canopy toward the face. It exited the canopy through a hole near the shield tip. Tests were also performed by releasing smoke in the walkway at shield 176. This smoke also traveled into the tailgate entry and across the tailgate drum of the shearer.

Smoke was then released behind shield 170 and the path of the smoke was recorded. Again, the smoke traveled across the shearer without passing over either of the methane sensors.

Although these tests cannot determine conclusively what happened on the day of the accident, the observations indicate that there may have been air flow paths by which gas, entrained in the air stream, migrated to the longwall shearer and did not encounter either of the two methane sensors mounted on the longwall shearer and tailgate drive.

A Roof Fall in Tailgate 1 North Restricted Airflow, Likely Allowing Methane to Accumulate

The roof control plan in effect at the time of the accident includes a number of diagrams that refer to roof bolting or support, indicating that the tailgate entry of the longwall panel was required to have either two rows of 8’ cable bolts, or two rows of wood posts or hydraulic jacks installed between primary supports for a distance of 1,000 feet outby the face. However, underground observations revealed that two rows of cable bolts had not been installed in the Tailgate 1 North (also known as Tailgate 21) and that only a single row of posts was installed along the solid block of coal.

The failure to install appropriate tailgate support is significant because observations indicate that crosscut 49, the next crosscut inby the face, had already caved-in prior to the face reaching crosscut 48 and before the explosion based on debris on the fall rubble (Figure 23). PCC’s failure to install either two rows of posts or two rows of eight foot cable bolts for support restricted the airflow in the tailgate entry inby the longwall face and contributed to the inability to adequately ventilate the tailgate area, which is discussed in the next section.

Figure 23. Caved roof in tailgate entry, as viewed in crosscut 49, which represents the next crosscut inby the face. Coatings of soot on the fallen rubble, juxtaposed against small pieces of freshly fallen, white sandstone, indicate that the intersection had caved prior to the explosion.

MSHA's Ventilation Surveys and Analysis

To explore the ventilation of the mine, MSHA investigators considered underground observations, interviews, and documents, including submitted plans, maps, record books, production reports, company ventilation studies, fan charts, and MSHA inspector notes. Higher level company officials, who should have had detailed knowledge of the ventilation system, declined to be interviewed and exercised their Fifth Amendment rights. It should also be noted that both Headgate 1 North from inby crosscut 39, as well as Tailgate 1 North from inby approximately crosscut 80, were inaccessible to the Bandytown fan because of deteriorated ground conditions. Although air readings based on company examination books are given in the following discussion, multiple inconsistencies and deficiencies were found in the books in a number of areas, including air measurements and quantities.

As stated earlier, ventilation controls for the area inby 78 switch were almost completely destroyed by the explosion. As a result, mine rescue teams had to reestablish ventilation prior to recovering the victims. The teams built framed mine brattice checks across the 7 Tailgate 1 North entries between crosscuts 11 and 12, the three connecting entries at the intersection of the intake rooms to the North Glory Mains, and across the Headgate 1 North entries to better direct air into HG 22, TG 22, West and North Jarrells Mains. Additionally, check curtains were constructed in the HG 22 section, TG 22 section, North Jarrells Mains and West Jarrells Mains to establish a ventilation circuit to ventilate the inby portion of these areas. Those controls were in place during the investigation.

Ventilation controls were also damaged outby 78 switch to the Ellis Portal. Some of those controls were repaired prior to the ventilation survey. Other small changes were made in the mine to the UBB/Lower Big Branch (LBB) area, changes which were taken into account for their impact on the system's ventilation. Considering the existing mine's ventilation system, the inaccessible areas in the Headgate 1 North and Tailgate 1 North toward Bandytown fan, and the unlikelihood that the ventilation system would be restored to pre-explosion conditions, MSHA investigators conducted an in-mine ventilation survey.

On September 9, 2010, preliminary information was gathered on the Bandytown, North, and South fans in anticipation of conducting a ventilation survey. On September 28, a mine ventilation air quantity and air pressure survey was started at the mine by MSHA personnel. A total of 33 teams collected information over a ten-day period. Representatives from WVOMHST, the company, and UMWA representatives of the miners participated in the investigation.

Investigators determined air velocities in the mine using vane anemometers with wands in the one-half area traverse method or using the smoke-cloud method with aspirators and chemical smoke tubes. Investigators measured mine opening dimensions to determine the area. Investigators then calculated air quantities from the measured velocities and corresponding calculated area of the mine entry in which the velocity was measured. Investigators measured air pressure differentials between air courses and across regulators or partial ventilation controls using magnehelic gauges and digital manometers. The fan air quantities were based upon underground anemometer measurements in the mine.

Investigators used Wallace & Tiernan altimeters to determine the total pressure at specific locations within the mine ventilation system. MSHA compiled and balanced this information to provide a computer model of the mine ventilation system, suitable for developing computer mine ventilation simulations.

Overview of the Mine Ventilation System

The mine had four sets of portals and a shaft, described briefly below:

- The North Portal consisted of five drifts. There was one blowing fan intake drift, two air drifts with track in one (air exiting) and two return drifts.
- The South Portal consisted of five drifts. There was one blowing fan intake drift, one intake drift with a stopping in place, two track haulage air drifts (air exiting), and one return drift.
- The Silo Portal consisted of four drift openings. There were two return drifts and two air drifts with belt in one. Air exited at all locations.
- The Ellis Portal consisted of five drift openings. There was one return drift, three air drifts with track in one and belt in another, and one intake drift. Air was actually exiting through the belt/track drift entries, according to witness testimony.
- The Bandytown return shaft was a 16-foot diameter shaft with an exhausting fan.

There was a 10-foot diameter coal transfer shaft, known as the Glory Hole, which connected UBB and the Castle Mine. This shaft was no longer in service at the time of the accident. It was abandoned and had been partially filled with coal and debris. Its effect on ventilation between the two mines was negligible.

UBB was ventilated with two blowing fans and one exhausting main mine fan. The North Portal blowing fan was a Joy, Model Number 12065D, Serial No. MF4110, ten-foot axial vane fan. The fan was operated with a 1,000-horsepower, 4160 volt, 900 revolutions per minute (rpm) motor. Figure 24 is a copy of the North fan chart which was on the fan pressure recorder when the explosion occurred and shows the fan was operating at about 4.8 inches of water gauge (in. w.g.).

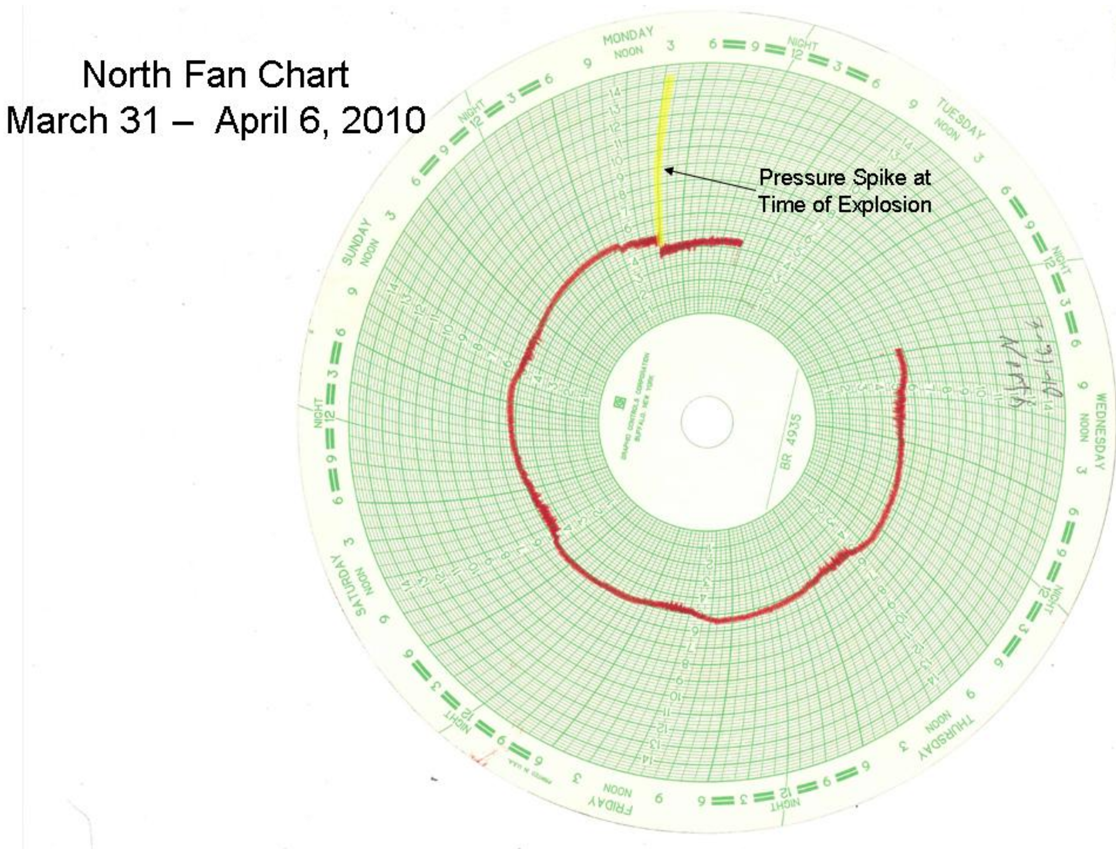


Figure 24. Chart for North Fan, showing pressure spike at time of explosion.

The South Portal blowing fan was an Industrial Welding Buffalo, six-foot diameter axial vane fan. The fan was operated with a 200 horsepower, 480 volt, 1,200 rpm motor. Figure 25 is a copy of the South fan chart which was on the fan pressure recorder when the explosion occurred and shows the fan was operating at about 1.4 in. w.g.

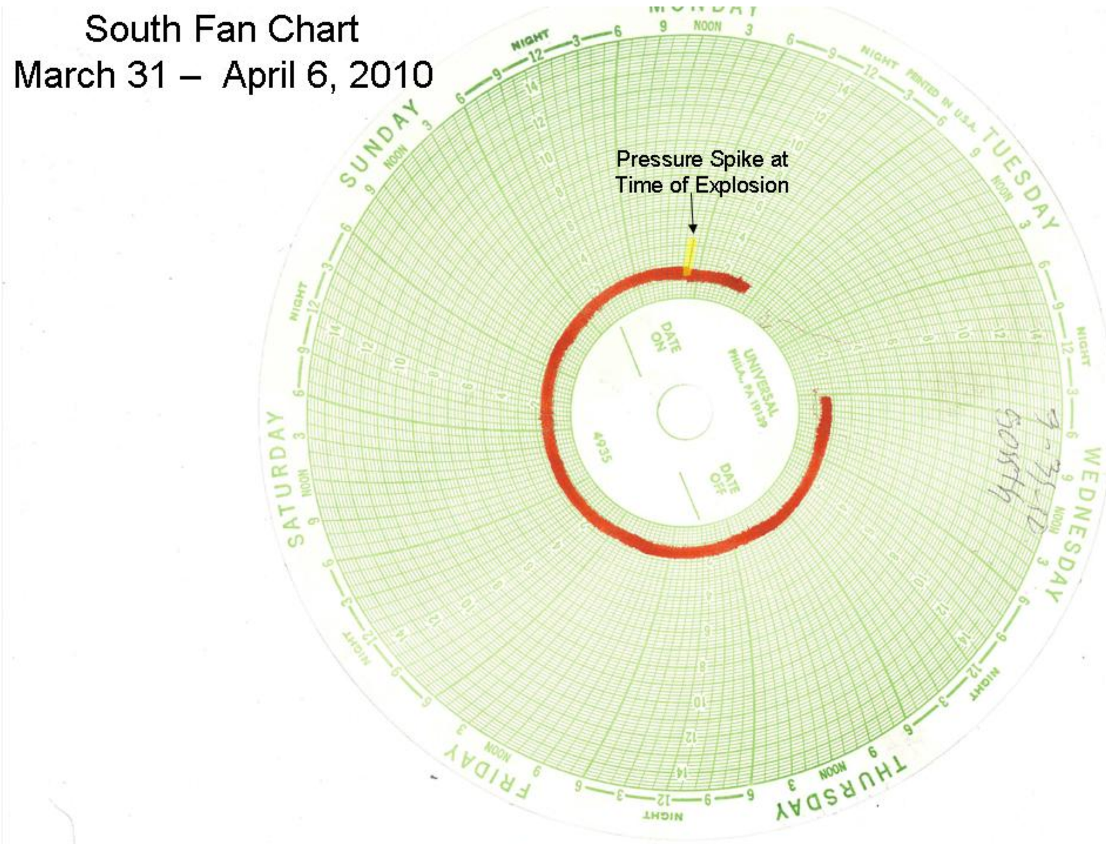


Figure 25. Chart for South Fan, showing pressure spike at time of explosion.

The Bandytown exhausting fan was a Robinson, Model Number DA-97AF1029-116, Serial No. 208-167, eight-foot centrifugal fan. The fan was operated with a 2,000 horsepower, 4160 volt, 890 rpm motor. Figure 26 is a copy of the Bandytown fan chart, which was on the fan pressure recorder when the explosion occurred and shows the fan was operating at about 5.5 in. w.g.

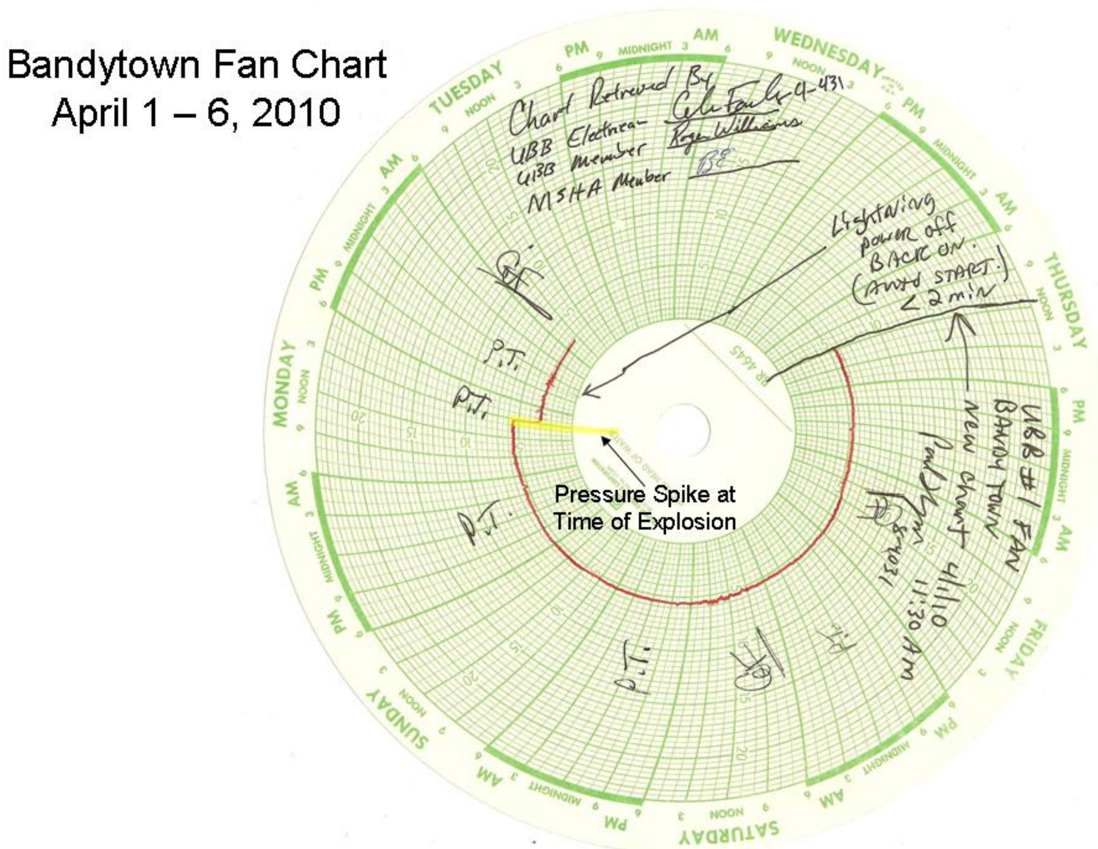


Figure 26. Chart for Bandytown fan showing pressure spike at the time of the explosion.

Although the fan charts shown in Figures 24 to 26 were not aligned correctly on the pressure recorder to correspond with actual time, each fan chart shows the pressure spike from the explosion. The North fan recorded a spike of over 9 in. w.g. over its normal pressure of 4.8 in. w.g. The South fan recorded a spike of 2 in. w.g. over its normal pressure of 1.4 in. w.g. The Bandytown fan spike went downward off the chart because this fan was exhausting and the pressure spike was positive. The magnitude of the spike cannot be determined but it was greater than the fan operating pressure. Several small variations in fan pressure were noted on the Bandytown fan chart following the explosion, although persons who were underground during that time reported no additional explosions.

The North area hosted the longwall and two continuous mining sections. The southern, UBB/LBB portion of the mine, which hosted one active and one inactive continuous mining section, was ventilated by the North and South blowing fans. The North fan provided the majority of intake air to the Ellis switch area. However, the Bandytown exhaust fan provided most of the ventilating pressure for the affected area. Near the Ellis switch intersection, the air was joined by air from the Ellis Portal. The intake from the North fan was regulated at this point, to assure the intake of air at Ellis Portal. This marked the transition from the blowing system of the North and South fans, to the exhausting system of the North area. The South fan had almost no influence over the North area.

Airflow in a separate air course to ventilate seals (intake and return air courses), on the South side of Old North Mains in the North area, was induced by the blowing ventilation system. The air from this split exited the mine at the North Portal. Prior to the explosion, all of the air from the area inby 78 switch exited from Bandytown fan.

Longwall Development Sections

The HG 22 and TG 22 sections were developed with three entries, ventilating each of the sections with a single split of air. The preshift examination record book for the HG 22 section (MMU 029-0), at 3:20 a.m. on the day of the accident, indicated that the quantity of air measured in the last open crosscut was 18,848 cfm. The preshift examination record book for the TG 22 section (MMU 040-0), at 2:10 p.m. on the day of the accident, indicated that the quantity of air measured in the last open crosscut was 32,360 cfm. Weekly air measurements recorded by the mine examiner for TG 22 were considerably higher; a measurement of 61,310 cfm was recorded on March 30, 2010. The reason for this inconsistency is unknown.

1 North Panel

The 1 North Longwall section (MMU 050-0) was ventilated with three entries on the headgate side. A majority of witnesses indicated that prior to the accident, the belt air was being directed to the longwall face, and although no air quantity measurements were recorded for the belt entry, testimony indicated that the belt air quantity was approximately 10,000 cfm. The preshift examination record book for the day of the accident indicated a measured quantity of 56,840 cfm and face velocities of 776 fpm at shield 9 and 513 fpm at shield 160. It is likely that the recorded longwall preshift quantity measurements indicate only the intake air portion of the total air that ventilated the longwall face.

The tailgate consisted of seven entries near the face location. Two of these entries were a main return from the longwall development sections. The tailgate air courses consisted of five entries, all of which were ventilated with air that had ventilated the belt entries.

The longwall panel being mined was directly in front of the bleeder fan. It would be highly unlikely that airflow across the longwall face would have been disrupted by minor changes to the system.

Barrier Section

The active continuous mining section in the South (LBB area) of the mine was called the Barrier Section (MMU 062-0). A section foreman's testimony indicated that the section had changed from a dual-split ventilation system to a single-split ventilation system three to four weeks prior to April 5, 2010.

Portal Section

This deactivated section (MMUs 066-0 and 067-0) was put in a non-producing status on March 30, 2010.

Reconstruction of Ventilation Prior to the Accident

Ventilation controls for the area inby 78 switch were almost completely destroyed in the explosion. In order to determine the location of the ventilation controls, and the air flow direction, the investigation team used the mine maps, stopping remnants and debris determined by mine mapping, as well as witness testimony. Although ventilation control locations were verified underground where possible, determination of the control type was often not possible. A map based on the available information depicts the area inby 78 switch as it was believed to be prior to the accident, and shows ventilation controls, and airflow directional arrows with recorded quantities where available, and when the measurement location could be determined (Appendix P).

The in-mine survey determined an air quantity of approximately 297,000 cfm reported to Bandytown fan. Records indicated that the fan had not been altered since the explosion and was not affected by the explosion. The operating point for the fan was determined from the underground measurements, and the pressure indicated on the fan chart during the pre-survey (6.45 in. w.g.). The pressure taken from the fan recording chart during the survey was compared with the fan pressure recorded on the chart prior to the explosion (Figure 26). The operating point was plotted on a fan performance curve for Bandytown fan. A curve was drawn through the operating point and the pre-explosion pressure was used to determine the quantity at the fan prior to the explosion. The fan performance curve is shown in Figure 27.

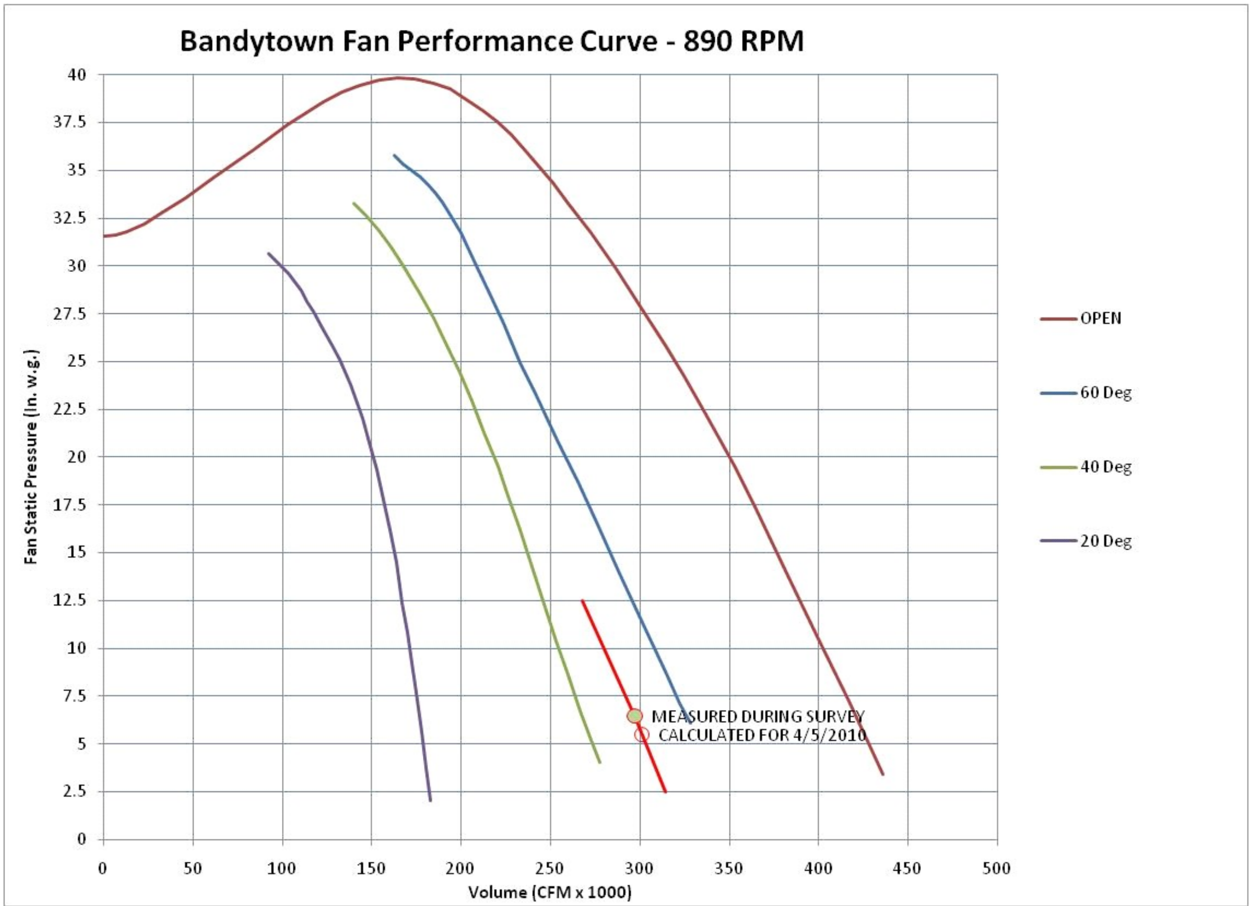


Figure 27. Graph of air volume versus fan static pressure, defining the Bandytown fan's performance curve.

The measurement recorded in the record book for Bandytown fan was approximately 400,000 cfm. The air quantity reporting to Bandytown fan during the survey was measured several times by the respective investigation teams as described in the underground mapping protocols, using careful area measurements, individually calibrated anemometers with wands, and the one-half area traverse method. This method is more accurate than typical day-to-day air quantity measurement methods used by mine personnel.

After constructing a computer model of the mine's surveyed ventilation system, a simulation was developed to recreate the ventilation system employed at the mine prior to the explosion. An average friction factor was developed from measurements in North Mains and Old North Mains, in the area of the Nos. 4 and 5 belts. A stopping leakage resistance was obtained from the literature for "average stoppings." Average mine entry dimensions of 7 ft. by 19 ft. was assumed. The air course and ventilation control location were determined from mine maps, stopping remnants, debris, and testimony. The opening sizes of some regulators were assumed due to lack of information. The accuracy of the simulation is imperfect, because of the limited information, as discussed in the report section entitled "Examinations," and because of the destruction of the ventilation controls in the affected area. Nevertheless, simulations gave insight into the expected effects of changes to the system.

The simulation of the mine prior to the explosion indicated that the HG 22 section was ventilated with 26,700 cfm in the return, TG 22 was ventilated with 63,600 cfm in the return and the longwall had an intake face quantity of 67,700 cfm. The model indicates quantities close to those believed to exist prior to the explosion. While the quantities are not exact, the model should reflect the general effect of major changes.

Several variations of the simulation were constructed in order to explore the effects of changes to the system. A simulation was made of the effect of leaving open the equipment doors near 78 switch. The results from the simulation indicated that there would not have been a significant effect on the longwall and TG 22 section air quantities and a small increase in air quantity (approximately 7 percent) in HG 22 from the change. Simulations with equipment doors at HG 22 open likewise did not significantly affect the longwall quantity.

An examination of the ventilation system indicated a change that would have a large effect on the face quantity would be leaving the Tailgate 1 North equipment doors open. The results of the simulation indicated that the face quantity would have been approximately cut in half while over 150,000 cfm short circuited directly to the fan. However, the fan pressure dropped over 2 in. w.g. in that simulation. If this scenario had occurred, the resulting fan pressure change would have been recorded on the fan pressure chart. No such change was observed on the fan pressure chart. Similarly, a simulation was made with the Tailgate 1 North equipment doors half open. The longwall face air would have cut by approximately a third and the fan pressure decreased by 1.5 in. w.g. Again, no such change was observed on the fan pressure chart.

A simulation was made to examine the effect of constructing the longwall headgate regulating doors. The simulation results indicated that the longwall quantity decreased approximately 19,000 cfm and HG 22 increased approximately 5,000 cfm. The preshift examination record books indicated that the longwall quantity decreased approximately 18,000 cfm and HG 22 increased approximately 4,000 cfm.

The “T-split”

During the ventilation survey, investigators determined that the air at the tailgate end of the longwall to be splitting both inby and outby the longwall face in the tailgate entry. This is commonly referred to as the T-split. The two crosscuts adjacent to the pillared area inby the face were found to have a total of 5,100 cfm exiting. This was with the face quantity at less than half of what was reported prior to the explosion. The flow as reported by examiners on the face would have increased the quantity of air at the T-split above 5,100 cfm.

It is important to have a functioning T-split because the air moving inby the face clears the area inby the longwall tail of contaminants and encourages airflow through and behind the last several shields, back away from the face. The solid gob shield plate size affected the overall air flow into the tailgate entry and gob.

While the T-split was likely adequate during normal mining, investigators concluded that it did not provide enough airflow to safely dilute the amount of methane released prior to the localized methane explosion. Investigators also concluded that the origin of the localized methane explosion was in the T-split area at the longwall tailgate. Additional support in the tailgate, resulting in a greater air quantity in the T-split inby the face, would have provided increased dilution capacity for a methane influx prior to the localized methane explosion.

Typically, roof support is installed in the tailgate entry to maintain an open area to provide a flow path back from the face to the bleeder entries. In the case of UBB, the plan called for two rows of floor to roof supports or two 8' cable bolts. As noted earlier, it was observed that no cable bolts and only one row of propsetters (supports) was installed. The additional supports would have aided in keeping an airflow path open behind from the face, creating a larger air quantity in the T-split.

The Methane Ignited at the Shearer, then Created a Methane Explosion in Tailgate 1 North

An ignition source must contain sufficient temperature or energy to ignite methane. Methane can be ignited by a minimum ignition temperature of approximately 1,000º F. For comparison, this is the temperature where components in an electric circuit may begin to glow. In addition, the minimum ignition energy for methane is 0.3 millijoule.

MSHA determined that the cutting bits on the tail drum of the longwall shearer likely generated hot streaks on the sandstone roof or floor. These hot streaks can exceed the ignition temperature of methane. Investigators concluded that this was the most likely ignition source. MSHA also examined potential ignition sources deriving from faulty or non-permissible electrical equipment, and other physical items, but ruled them out as an ignition source after testing hundreds of items. MSHA also found that other sources (such as a roof fall or friction generated by the pan line) were not likely ignition sources.

This ignition of methane did not begin to propagate immediately. The flame from the ignition burned near the longwall tailgate for a short period of time, approximately two minutes. The methane ignition then triggered a localized methane explosion in the Tailgate 1 North.

Frictional Ignition from the Longwall Shearer

Once the methane reached the shearer on April 5, the poorly maintained longwall shearer likely caused an ignition. The shearer was cutting into sandstone at both the roof and the floor and the mineral content of the sandstone posed a high potential for a frictional ignition. Two of the cutting bits on the tail drum had worn flat and had lost their carbide tips. The conditions of these bits thus had a high incendive potential. The abrasion of the cutting bits striking the sandstone likely created hot streaks.

Additionally, the “last line of defense” against an ignition, the water spray system, was effectively absent because seven water sprays were missing from the tailgate drum of the shearer. A maintenance report (Figure 5) from March 1, 2010 indicates that sprays were intentionally removed in order to flush the tail drum of sediment from poorly filtered river water and other debris. Subsequent testing by MSHA revealed that with the seven sprays missing, the water pressure on the remaining sprays dropped to 0 psi and the water spray system was unable to cool the cutting bits and surrounding rock surfaces and push methane away from the shearer bits.

The Sandstone Had a High Potential for Frictional Ignition

Underground observations indicated that the tail drum was cutting sandstone in the roof and floor, while the head drum was cutting sandstone in the floor. Accordingly, MSHA collected samples of the roof and floor from the tailgate side of the 1 North Panel face for petrographic analyses (Appendix Q). Based on the mineral contents determined by thin section petrography, the samples were plotted on the diagram below for comparison with the incendivity index developed for rocks in Australian coal mines (Figure 28).

The sandstone that the longwall shearer was cutting into on April 5 had a high potential for frictional ignition. The layers of coarse siltstone, which contain high mica content, plot in Category 1, indicating a low potential for frictional ignition. In contrast, the sandstone plots in Category 4 indicating a high potential for frictional ignition. The floor sandstone very nearly plots in the Category 5 zone, because of its high quartz content. Compared to the sample collected from the roof, the floor sample contains much greater quartz, and is characterized by a much greater degree of grain interlocking. Rocks with an incendivity index of 4-5 were shown in tests to have a high potential for frictional ignition, for rock-on-rock and metal-on-rock ignitions.

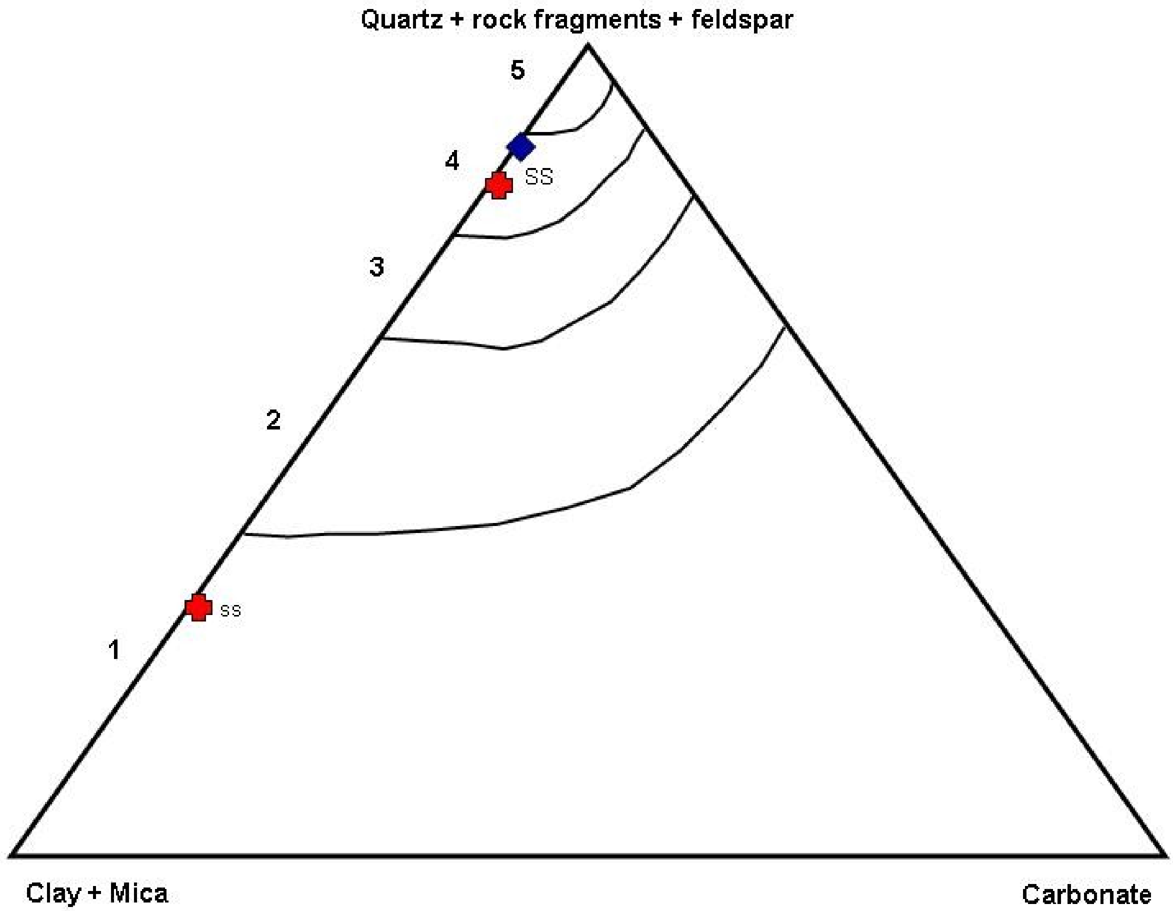


Figure 28. Diagram showing relation of UBB roof (red crosses) and floor (blue diamond) sandstone (SS) and siltstone (ss) to contour lines of incendivity index.

<u>Cutting Bits can Generate "Hot Streaks"</u>

In the laboratory, frictional ignitions have been initiated by metal-on-rock and rock-on-rock contact. To initiate a methane explosion, a minimum of time, temperature, and surface area of a source are required in order to heat the necessary minimum volume of gas to a sufficient temperature.

Experiments involving metal-on-rock friction have shown that combustible concentrations of methane can be ignited by "hot streaks," which are smears of metal found on rock where the metal has been heated near its melting point. Sandstone, which the longwall crew was mining at the time of the explosion, generates hot streaks.

In addition, experiments have revealed that bit surface area is significantly related to the incendive potential of a hot streak. Large wear flats on the cutting bits are more likely to cause an ignition, especially when the carbide tip has worn off and as little as 3 mm of the steel shank has been abraded away (Figure 29).

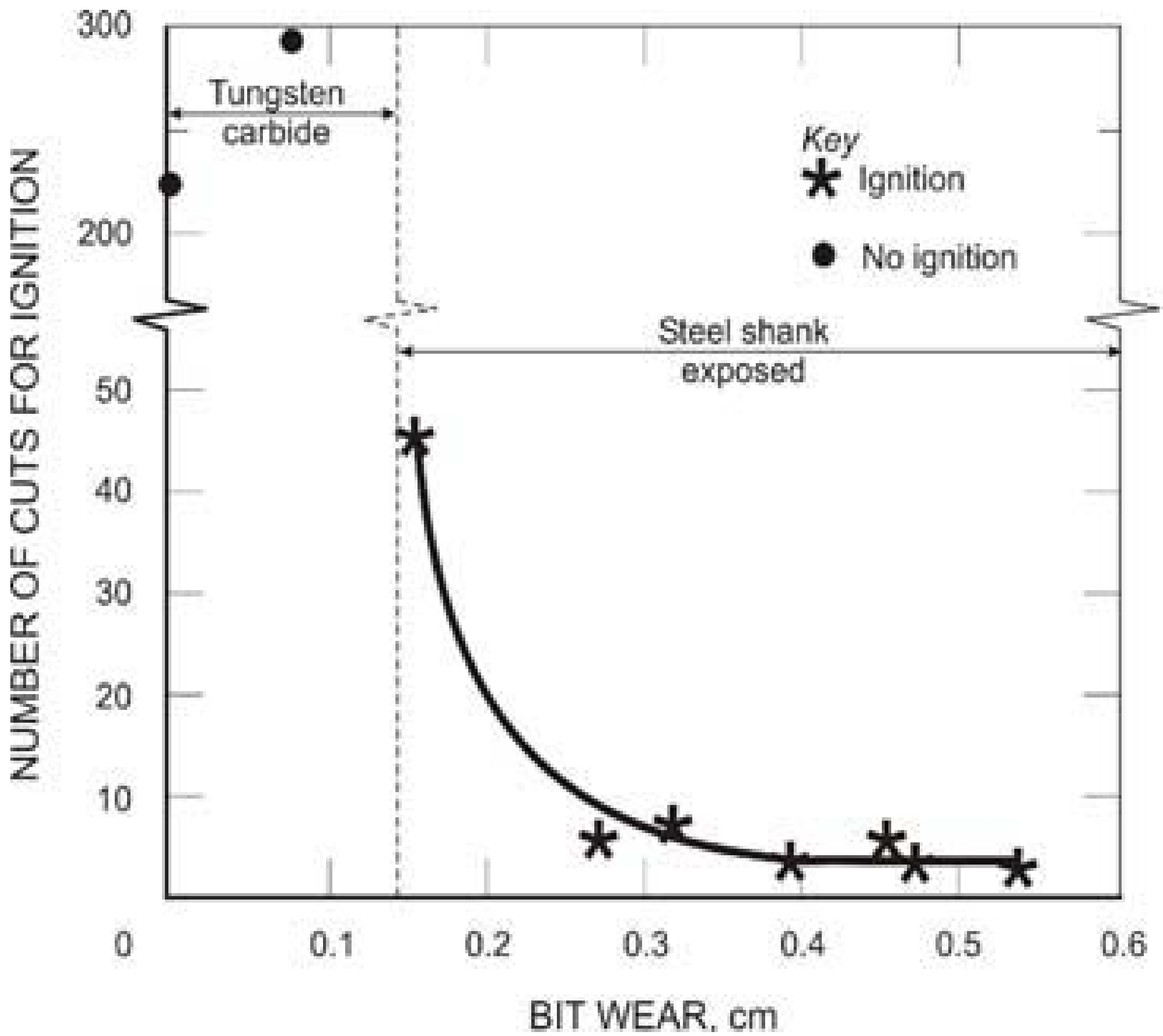


Figure 29. Relation between bit wear, in centimeters, and the number of cuts required to induce a frictional ignition, from Kissell et al. (2007).

During the underground investigation, MSHA found that at least two cutting bits on the tail drum showed signs of excessive wear, including total erosion of the carbide tip and a large wear flat developed in the steel shank. One such bit is shown in Figure 30. Bits with large wear flats worn down to the steel shank striking quartz-rich sandstone, which is characterized by a high incendive potential, represents the most likely source of the initial methane ignition. While only a few bits were worn to the steel shank, one worn bit can provide an ignition source.

Figure 30. 1 North Panel tailgate drum, showing configuration of water sprays used in the pick-point flushing system. Note that sprays are directed toward the front of the bits, one missing water spray, and two bits exhibiting extreme wear.

<u>The Water Spray System Failed to Prevent the Ignition</u>

One of the purposes of a longwall shearer water spray system is to reduce the likelihood of a frictional ignition. Water sprays can reduce the likelihood of frictional ignitions by cooling the cutting bits and/or the surrounding rock surface, and by pushing methane away from the cutting surface of the bits.

The shearer drums on the 1 North Longwall Panel were equipped with a pick-point water spray flushing system, which uses nozzles mounted in the bit blocks or in blocks immediately in front of the bits to direct water at the bit-coal interface (Figure 30). This wets the coal prior to cutting (it also functions to suppress dust that would be discharged into the mine atmosphere).

MSHA D4 approved the Ventilation Plan for the MMU 050-0 (longwall mining unit) on June 15, 2009. The plan stipulated that water must be applied to the longwall shearer, the stage loader area, and the shield canopy tips during active operations. A fourth stipulation required shield washing on a weekly basis in order to prevent accumulations of coal dust. Information relating to the stage loader area and the shields can be found in the "Other Plans" Section below. The plan required that 109 functioning Conflow 650 2801 CC Staplelock drum sprays (full cone type) on the longwall shearer. A minimum operating pressure of 90 psi was required at the spray block. At the 90 psi pressure each spray would have a flow rate of approximately 0.82 gallons per minute (gpm) or a total flow rate of 89 gpm at the shearer. The plan required each shearer drum to have

43 sprays. In addition each ranging arm had to have three sprays. two body spray (sawtooth) blocks, with two sprays on the first block and six sprays on the second block, and one rack spray on the tailgate side.

River water supplied the shearer methane and dust control water system. PCC pumped this water into two 100,000 gallon holding tanks on the surface, above the Silo Portal. PCC then routed the water through the mine, utilizing a 6 to 8-inch diameter waterline to the mule train of the longwall section. Appendix R shows the location of the waterline supplying the mule train. A 4-inch diameter flexible hose was connected to the 6-inch water line that connected to four Rosedale strainers. PCC boosted the water supply through a Sunflo P3000 pump, located on the mule train. There were two 2-inch diameter flexible hoses extended inby from the pump to the stageloader area, where the lines split to supply water to the shearer, conveyor couplings, motor cooling water, and shield water. PCC supplied the shearer via 1,200 feet of 2-inch diameter flexible hose, connected from a valve bank between the stageloader and headgate box.

There were at least four different types of sprays on the shearer, which resulted in three different spray patterns. There were three types on the drums and ranging arms, and at least nine different models of water sprays, representing three different water spray patterns and eight different flow rates in the longwall supply area. Several sprays on the shearer showed signs of excessive wear, and at least three from the tailgate side of the shearer showed signs of being mechanically altered by enlarging the outlet orifice.

MSHA investigators set up a test, with PCC's assistance, to recreate the functioning water system on the longwall shearer at the time of the explosion. Because of damage to the waterlines in the explosion zone and the need for electrical power on the longwall, investigators could not use the original water system for testing purposes. A pressure gauge was utilized at the inlet side of the filter assembly; gauges were placed across each filter assembly to provide an indication of when the filters needed to be changed, and a pressure gauge was placed at the shearer inlet. Two flow meters were used to verify water flow to the shearer.

In preparation for the water test at the shearer on December 20, 2010, PCC provided MSHA with the water spray configuration used on the longwall at the time of the explosion. The distribution of nozzle locations indicated that 112 Flow Technologies 791C sprays, with a 3/32" orifice diameter, were being used on the longwall shearer, with 43 each on the headgate and tailgate drums of the shearer, ten on the headgate and tailgate ranging arms, and three on one block, located on both the headgate and tailgate sides. A total of 27 BD-5 sprays were used on the shearer, with ten each on the second body block of both the headgate and tailgate sides, three pan sprays on the headgate and tailgate sides of the shearer, and one rack spray on the tailgate side of shearer. PCC investigators reported that the average operating pressure at the sprays was 125 psi, and that the flow rate for the 791C (3/32") sprays at this operating pressure was 1.58 gpm, with a 1.76 gpm flow rate for a BD-5 sprays at the given pressure. PCC reported that their average flow was 224.30 gpm. PCC contends that they used sprays that exceeded methane and dust control plan requirements.

When MSHA investigators restored water to the shearer to test the water sprays, they found a different configuration than described in the plan or by PCC investigators. MSHA discovered that seven sprays were missing from the tail drum of the longwall shearer. Testing on December 20, 2010 revealed that, when seven sprays were missing, the remaining sprays on the tail drum could not maintain the pressure that was required in the approved ventilation plan. In fact, the water gauge on the tailgate drum read 0 psi throughout the test. The majority of the water on the tailgate drum simply discharged out of the openings on the bottom half of the drum where water sprays had been removed. When six of the seven missing sprays were replaced, operable pressure as required by the approved plan was restored to the tail drum once the pressure coming into the shearer reached approximately 186 psi. On April 5, the removal of seven sprays similarly would have caused the water pressure to be removed from the remaining sprays.

The water sprays were most likely missing from the tail drum at the time of the explosion. MSHA determined that it is highly unlikely that the explosion forces were responsible for displacing the sprays because of the design of the sprays (which are attached by staple locks) and because of the magnitude and direction of the forces. Instead, the most likely explanation is that PCC employees had removed the water sprays sometime prior to the ignition at the shearer in order to flush the tail drum.

PCC experienced clogging problems with water sprays due to the use of poorly filtered river water. This is evident in PCC records, as shown in Figure 5. Mine personnel removed sprays in an attempt to flush out the drum, as confirmed by company records and in interviews.

More detailed information concerning the Methane/Dust Suppression plan, and the water spray configuration in particular, may be found in the section, “Other PCC Plans.”

Analysis of Sediment in Filter Baskets and Spray Nozzles

The results of sediment analyses, documented in Appendix S, indicate that the longwall shearer’s tailgate drum was being operated with missing water sprays. Measurements of the size and type of sediment found in water line filters and shearer nozzles reveal that rock chips were falling out of the roof into open nozzle ports as the drum was cutting. These rock chips were too large and angular to have come from the river water supply or even passed through filters in the water line. A cement-like paste that clogged the insides of many spray nozzles was composed of clay and coal, generated from pulverizing rock with dull bits. This paste was in place prior to the introduction of rust-stained water during testing after the accident. Thus, the tailgate drum was being operated with dull bits while cutting hard sandstone, with missing and clogged water sprays.

Other Ignition Sources

MSHA also addressed several other potential ignition sources, either ruling them out conclusively or finding that they were much less likely to be sources than frictional ignition from the longwall shearer.

Roof Falls (Frictional Ignition)

Some explosions have been attributed to roof falls. MSHA could not rule this ignition source out since roof falls inby the longwall face could have occurred immediately before the explosion in either the longwall tailgate or behind the tailgate shields. The 1997 explosion at this mine on the longwall tailgate was attributed to a roof fall. Roof falls can ignite explosive methane-air mixtures by heat and releasing energy. During roof falls, rocks rub against each other and produce heat. Explosive methane-air mixtures have been ignited by rubbing friction between shale-sandstone, sandstone-metal, and shale-metal in Bureau of Mines laboratory tests. However, this frictional heat rarely reaches temperatures that will ignite methane in an underground coal mine.

In addition, this mine had sandstone bed(s) in the roof which contain quartz crystals. Crystals in rocks may produce electric charges on parts of their surface when they are compressed in certain directions. The release of this energy during roof falls is called a piezoelectric discharge. The greater the quartz content, crystal size and bond strength, the greater the potential for incendiary sparks which can ignite methane.

However, because of the deficiencies found with the tailgate shearer drum it is most likely that the ignition was caused by the shearer cutting sandstone rather than a roof fall behind the shields.

Pan Line (Frictional Ignition)

Frictional ignitions from pan lines have been documented. However, these have occurred much less frequently than ignitions from shearers. The pan line conveyor represents a much less likely source of ignition than the longwall shearer.

MSHA believes that it is much more likely that the poorly maintained longwall shearer cutting sandstone and repeatedly generating hot streaks provided the ignition source.

Smoking Articles

Smoking articles, which would have provided a potential ignition source, were not discovered in the underground portions of the mine during the investigation.

Electrical Ignition Sources

MSHA eliminated the following electrical ignition sources (see Appendix T - original report section - for a complete discussion of these eliminated electrical ignition sources):

An Executive Summary of all electrical equipment tested at MSHA's Approval and Certification Center can be found in Appendices U-1 through U-15.

Lightning - Vaisala's National Lightning Detection Network showed no lightning strikes within a ten mile radius of the mine site between 10:09:42 a.m. and 7:07:02 p.m. (See Vaisala Report 258028 in Appendix V).

Welding and Cutting - There was no evidence of welding or cutting being performed at the time of the explosion, and no cutting equipment was found in the area of the longwall face.

Shearer Electrical Components - The electrical components on the shearer included explosion-proof enclosures (motors, main controller enclosure, shearer power cable connection enclosure, and solenoid valve enclosure), a methane monitoring system with warning light enclosure, various intrinsically safe circuits, components and sensors, and all associated cables. MSHA examined these components and performed tests and found no evidence that any of the components were the ignition source.

Shearer Remote Control Transmitter - Shearer functions were controlled by two operators with handheld radio remote transmitters (Appendix U-1), designated by the JNA control system as left- and right-hand stations. The right-hand transmitter was a Matric Limited, Model TX1, Remote Control Transmitter, MSHA Approval No. 9B-220-0, and was found at shield 100. After testing was conducted at the manufacturer's facility and at A&CC, MSHA found no evidence that the right-hand transmitter could have been the ignition source. The left-hand remote control transmitter was never found, but there was no indication that it was not functioning properly. The last record on the JNA event log prior to the explosion showed that the right-hand transmitter caused the shearer to stop.

Automatic Chain Tensioning System - A Joy Automatic Chain Tensioning System (ACTS) was installed at the tailgate area of the face to automatically control the face conveyor chain tension. The ACTS components included: an explosion-proof controller enclosure, a connection enclosure for the intrinsically safe circuits (referred to as a "marshalling box"), and various intrinsically safe transducers, sensors, display beacon, and solenoids. MSHA examined this system and performed tests of these components and found no evidence that any of the components were the ignition source.

Tail Conveyor Drive Motor - MSHA examined and performed testing of the motor and found no evidence that it was the ignition source.

Electrical Cables along the Longwall Face - Electrical cables along the longwall face were located either in the cable handling system of the panline or hung along the longwall shields. MSHA examined and performed tests of the cables and found no evidence that any of the components were the ignition source.

Lighting System Components - MSHA examined these components and performed tests of these components and found no evidence that any of the components were the ignition source. (See Appendix U-2)

Electrohydraulic Shield System - The Joy MS40 electrohydraulic system, consisting of a Master Supply Unit (MSU) and a Support Control Centre (SCC) at the headgate, controlled the movement of the shields. This system also included various other components (Appendix U-3). MSHA examined and performed tests of these components and found no evidence that any of the components were the ignition source.

Comtrol Communication System - The Comtrol longwall face communication/conveyor lock-out system consisted of Longwall Loudmouth Model LM115 phones positioned at the headgate area and typically, every eighth shield. Investigators noted that some phones were not in their original positions (i.e. mounted on shields). The phone at shield 173, the last in the system, was missing, as was the phone at shield 117. At least four phones were missing on the headgate side of the longwall. Electrical investigators that have traveled the face area did not observe any components or cables that showed signs of being an electrical ignition source. MSHA examined and performed tests of the Comtrol system and found no evidence that any of the components were the ignition source. (See Appendix U-4)

Multi-Gas Detector - A MSA Solaris multi-gas detector (Exhibit No. B-15-B), carried by Richard Lane, Longwall Section Foreman, was retrieved from mid-face for examination and testing at A&CC. Testing determined that it was in working order. Downloaded data indicated that the device was energized at the time of the explosion and continued operating for several hours thereafter. MSHA tested the detector and found no evidence that the detector was the ignition source. (See Appendix U-5)

Tracking Tags - MSHA tested all of the tracking tags that belonged to victims on the longwall face and found no evidence that any of the tags were the ignition source. (See Appendix U-6)

Cap Lamps - Many intact cap lamps and components were retrieved. 33 individual items were subjected to further examination and testing at A&CC (Appendix U-7). MSHA examined and performed tests of these cap lamps and found no evidence that any of the cap lamps were the ignition source.

Air-Purifying Helmet Components - UBB's Methane and Dust Control Plan provided that all members in the face would be offered the use of Air Stream helmets, but required examiners to use respirators on the return side of the longwall shearer for an extended period of time. On April 5, miners on the longwall panel were using these helmets. Seven components from the air purifying helmets including four batteries, a portion of a battery case, and pieces of the helmet and cable were retrieved for further examination and testing at A&CC (Appendix U-8). MSHA examined and performed tests of these components and found no evidence that any of the components were the ignition source.

Watches and Calculators - Several non-permissible electrical items, including six watches and two calculators, were recovered from the longwall face and subjected to examination at A&CC. These items were all disassembled and inspected (Appendix U-9). MSHA examined all of these items and found no evidence that any of the items were the ignition source.

Methane Monitor Sensors - Two permissible methane monitor sensors were retrieved from the longwall tailgate area and sent to A&CC for analysis and testing. MSHA examined and performed tests of these components and found no evidence that any of the components were the ignition source. (See Appendix U-10)

The Ignition on the Longwall Shearer

For a description of the Mine Electrical System at UBB see Appendix W.

The information in this section describes the events that took place immediately after the tailgate shearer drum ignited a localized methane mixture when the shearer cut into the tailgate entry. These activities indicate that there was a short period of time between this ignition and when the flames from this ignition encountered a larger body of methane resulting in a methane explosion which ultimately suspended float coal dust in the tailgate entries and transitioned into a massive coal dust explosion.

<u>The Longwall Crew Stopped the Shearer and Left the Area</u>

At about 3:00 p.m. on April 5, the tail shearer operator shut off the shearer using his remote control, and the longwall crew working near the shearer started moving away from the shearer toward the headgate. A longwall crew member, who was on the headgate side of the longwall, then opened the visible disconnect de-energizing the power to the longwall shearer and shut off the water to the longwall face. About 3:02 p.m., the explosion propagated through the northern part of the mine, killing the 29 miners, including the longwall crew, and injuring two on the TG 22 crew.

Investigation interviews with longwall crews from different shifts and underground observations indicate that the longwall crew's actions at approximately 3:00 p.m. were atypical. The condition of the longwall shearer after the accident, with the shearer turned off by remote, the visible disconnect switch open, and the water shut off at the headgate, demonstrates that the longwall crew was reacting to an event at the shearer. In addition, during this two-minute gap, the ignition made its way back to an accumulation of methane in the tailgate entries inby the longwall face, where it caused a localized methane explosion.

The Tail Shearer Operator Remotely Shut Off the Shearer

Investigators removed the JNA computer control system from the shearer and took it to Joy Mining Machinery's facility in Franklin, PA, where the electronically recorded event log was examined. Evaluation of the event log revealed that the shearer was shut off by an e-stop command from the handheld remote control of the tail shearer operator between 2:59:32 and 2:59:38 p.m. (Appendix X-JNA Event Log and Fault Codes). Analysis of additional items removed from the mine indicated that power in the mine was lost at approximately 3:02 p.m. (Appendix Y-DVR Evaluation Report), from damage inflicted upon the high voltage cables by the explosive forces.

The shearer's on-board controls were set to the position that required both operators to be at the machine for it to run. MSHA concluded that both operators were at the shearer when the tail side operator shut off the shearer between 2:59:32 and 2:59:38 p.m. with an e-stop command from the handheld remote control. Four victims, the two shearer operators, the jack setter, and the utility man, were found between shields 103 and 106, approximately 400 feet from the shearer toward the headgate.

The Longwall Crew Manually Opened the Visible Disconnect Switch

The power cable extending from the longwall starter to the shearer was provided with a manually operated visible disconnect switch installed in an explosion-proof enclosure just outby the headgate controller. After the accident, investigators found the disconnect switch in the open and grounded position. With the switch in the open and grounded position, power was not being provided to the shearer. This disconnect had to be in the closed position for the shearer to operate.

The handle that operated the disconnect switch was located on the exterior of the explosion-proof enclosure. A mechanical push-button rod prevented the handle from being operated when the disconnect was closed. In order to rotate the handle and open the disconnect switch, this push-button had to be depressed and held. Depressing the push-button also opened an electrical interlock switch inside the enclosure that caused the 4,160 Vac vacuum contactor in the longwall starter to open thereby de-energizing the shearer cable. When tested during the investigation, the mechanical and electrical components of the disconnect switch functioned properly.

The explosion covered the longwall equipment, including the visible disconnect, in a layer of dust. This residue on the push-button and handle of the shearer disconnect switch was undisturbed, indicating that the disconnect had not been operated after the explosion.

Given that the visible disconnect was found open, indicating that the shearer was de-energized, and that the visible disconnect had not been disturbed after the explosion, MSHA determined that the forces generated by the explosion did not cause the shearer disconnect switch to open. MSHA also determined that a longwall crew member, who was on the headgate side of the longwall, manually opened the shearer visible disconnect switch during the period of time between the shearer being shut off with the remote control and the coal dust explosion.

MSHA eliminated other possibilities before arriving at these determinations. A possible reason given in testimony for opening the visible disconnect switch was to set bits on the shearer. The tail drum of the shearer had just cut out of the coal block into the tailgate entry at shield 176. The tail drum was still against the roof and had not been lowered to cut out the mine floor. The head drum was against the bottom, with the cowl blade positioned on the headgate side of the drum. Neither drum was located such that bits could be set. Therefore, setting bits was ruled out as the reason for the visible disconnect switch to be open. Additionally, repair to a damaged shearer cable was ruled out as the reason for the visible disconnect switch being open as testing proved that the cable was not damaged.

The Water Was Shut Off at the Headgate

The cooling and dust suppression water for the shearer was controlled at the headgate end of the face. There was no water shutoff valve installed onboard the shearer. Two 2-inch water lines from the pump car at the mule train entered a manifold near the headgate controller. Each line had a ball valve installed on it before it entered the manifold. Both water lines' valves were found in the closed position. The valves and manifold were covered in a layer of undisturbed, explosion-related dust, indicating the valves were turned off prior to the explosion. In the closed position, these valves are consistent with the shearer and face conveyor being off. Several miners stated during interviews that during normal operations, when the face conveyor shut down, it was standard practice to close these valves to shut off the water.

The Longwall Crew Working Near the Shearer Left the Shearer Because of an Abnormal Event

The investigators concluded that the most likely reason the four victims evacuated the area of the shearer was because they saw or heard an abnormal event and could not control it. In this case, the abnormal event was most likely the initial methane ignition on the tail drum of the shearer.

MSHA eliminated other possibilities before arriving at this conclusion. Testimony indicated that one reason for these employees to leave the shearer was because of shift change. The day shift and evening shift crews normally “hot seated,” meaning that the day shift crew stayed on the face until the evening shift crew arrived on the section. At the time of the explosion, the evening shift longwall crew was boarding a mantrip at the Ellis Portal for travel into the mine. Because it was not time for the day shift crew to leave the face, investigators ruled out shift change as the reason for leaving the shearer.

Another reason personnel might have left the shearer was because of a mechanical or electrical breakdown. An analysis of event logs stored electronically on the shearer and at the longwall starter did not indicate any electrical faults in the shearer circuits. Therefore, investigators ruled out an electrical problem. Because no obvious mechanical failures were observed when the shearer was inspected, investigators also ruled out a mechanical breakdown.

To address the possibility that personnel could have left the tailgate because of encountering methane, investigators removed the methane monitor components on the longwall shearer, the methane sensor near the tailgate end of the face, and the methane monitor components in the headgate controller for testing at MSHA’s Approval and Certification Center (Appendix U-10). The two methane monitor systems functioned properly. The shearer’s JNA event log listed no methane monitor faults on the shearer for the period covered in the log, from March 30, 2010, to the time of the explosion. An analysis of the stored data on Programmable Logic Controls (PLCs) in the headgate controller (PLC Appendix U-15) and the longwall starter did not indicate that the tailgate methane monitor shut down the longwall prior to the explosion.

After the ignition occurred at the shearer, a fire likely followed small accumulations of methane and burned behind the shields. The flame from this fire eventually came into contact with the accumulation of methane in the # 7 entry of TG 1 North inby the longwall. MSHA estimated that the explosive accumulation of methane that was ignited contained approximately 300 cubic feet of methane. Research has shown that the ignition of as little as 13 cubic feet of methane is sufficient to suspend and ignite coal dust. When diluted with air to 10 percent, this 300 cubic feet of methane would form an explosive volume of 3,000 cubic feet. It is feasible that two minutes passed during this burning process. The flame generated by the ignition of this 3,000 cubic feet of methane-air mixture extended approximately 140 feet (15,000 cubic feet) to just outby the stopping in crosscut 48.

The Localized Methane Explosion Transitioned into a Coal Dust Explosion, Caused by Dangerous Coal Accumulations and Inadequate Rock Dusting

The methane explosion on the tailgate, discussed in the previous section, almost instantaneously gave rise to a massive coal dust explosion which swept through the mine.

The initial flame extended in the tailgate from just inby the longwall face, to just outby the stopping in crosscut 48. The flame and force of the localized methane explosion suspended and ignited coal dust prior to the flame from the localized methane explosion being extinguished. If float coal dust had not accumulated and the mine dust had contained sufficient quantities of incombustible content, the localized methane explosion would not have propagated any further. However, float coal dust accumulated and the incombustible content of the mine dust was insufficient and as a result, coal dust was ignited. The incombustible content of the mine dust is discussed in the subsection "Mine Dust Survey" earlier in the report. Once the coal dust was ignited, the flame generated a shock wave that placed additional mine dust into suspension.

The mine dust sampling provides evidence of the extent of the flame and indicates where coking was present. Coal dust and float coal dust provided the fuel for the propagation of the explosion. Extensive sampling and analysis by MSHA, substantiated by witness testimony and company documents, revealed that rock dusting was inadequate.

Coking in Mine Dust and Visual Observation Led Investigators to Determine the Path of the Flame

<u>Flame Travel</u>

Flame is produced during an explosion when an ignition source of sufficient temperature or energy ignites a suspended fuel within its explosive range. Immediately after ignition, a fireball typically develops and rapidly begins heating the mine atmosphere. Within seconds, a flame front begins propagating through the suspended fuel. The propagating flame continues to heat the mine atmosphere, resulting in a rapid expansion of the mine atmosphere. The expansion of the mine atmosphere creates a force, known as a shock wave, which continues to travel ahead of the flame.

The magnitude of the shock wave is typically determined by the speed of the propagating flame. The faster the flame travels, the higher the pressures from the shock wave become. Flame speeds as high as 5,000 feet per second have been measured in experimental explosions. The flame of an explosion will continue to propagate as long as there is sufficient fuel, heat, and oxygen. In addition, the fuel must remain suspended and the explosion must remain confined. If any of these five conditions is lost, then the flame of the explosion will extinguish. For example, if confinement is lost, the air speed will begin to decelerate. A coal dust explosion will generally die out if the air speed is less than 150 feet per second.

Additionally, the explosion flame and shock wave generally result in overpressures which cause the destruction of mine ventilation controls and damage to mining equipment, the suspension of mine dust from the roof, ribs, and floor, and the formation of various products of combustion such as carbon monoxide, carbon dioxide, hydrogen, etc.

MSHA determined the extent of flame travel primarily through an evaluation of the samples taken during a post-explosion mine dust survey. MSHA also evaluated additional evidence including observations of the post-explosion condition of various combustible materials, the results of testing additional samples of mine dust, and a review of the autopsy results, (Appendix Z).

MSHA divided the underground workings into 22 separate sampling areas, as shown on the mine map in Appendix L. Sampling locations, on 500-foot centers in areas outby crosscut 67 of Old North Mains and 100-foot centers in areas inby crosscut 67, were designated on a mine map for each area. Sampling on 100-foot centers has been shown to offset any dust transport that may have occurred during an explosion. MSHA determined that the force of the explosion in outby areas was minimal and that dust transport was negligible.

MSHA identified 2,207 locations for band sampling. A band sample is taken around the entire perimeter of any point location, including the roof, both ribs, and the floor. If an area was too wet or inaccessible due to hazardous conditions, MSHA did not take a sample. Of the 2,207 intended locations, MSHA took samples at 1,803 locations because actual mine conditions at 404 locations were either too wet or otherwise inaccessible for sampling. MSHA did not take samples from any previously wet locations in the event that significant drying occurred prior to the end of the underground investigation.

MSHA took band samples at 1,132 of the 1,803 locations, or 62.8 percent of all sampled locations. In areas where an entire band was not possible to collect, MSHA sampled as much of the band as was possible. For example, if the floor was too wet, MSHA still took a sample from the roof and ribs. MSHA marked each sample to indicate what portion of a complete band was taken.

Whenever MSHA took a full mine dust band sample, MSHA mixed and separated the sample into quarters, each of which was representative of the mine dust at that location. MSHA placed one quarter in a sealed plastic bag with a tag identifying the sampling location. MSHA offered each of the other three quarters of the sample to representatives from WVOMHST, UMWA, and Massey traveling with MSHA's Mine Dust Sampling team.

MSHA sent all 1,803 samples to MSHA's Mount Hope National Air and Dust Laboratory (Mount Hope), which determined the incombustible content and degree of coking. The incombustible content provides an indication of the pre-explosion conditions in the affected area of the mine, while the coking indicates the area affected by the flame of the explosion.

Mount Hope subjected each of the 1,803 mine dust samples to the Alcohol Coke Test. This test determines the quantity of coke in each sample. Coking of coal occurs as the coal is subjected to heat for a period of time. The temperature required for coking to commence varies with the rank of coal, but is on the order of 700º F. Flame temperatures during an explosion can be nearly 1800º F, however the flame may only be at each location for approximately 45 milliseconds.

The amount of coking that occurs is related directly to the exposure temperature and the duration of that temperature. When objects are exposed to flame for a sufficient duration of time, heat is transferred and produces coking. However, even within the area affected by the flame, coking of the coal does not occur at all locations.

Research on alcohol coke testing indicates that coke is found whenever coal particles are dispersed into a flame, and therefore the presence of coke is a good indication of flame travel. Coke, as measured by the Alcohol Coke Test, is found after explosions at an incombustible content of up to 80 percent.

The Alcohol Coke Test indicates the quantity of coke in each sample as either none, trace, small, large, or extra-large. Large and extra-large quantities of coke are indicative of flame. The results of the Alcohol Coke Test are shown on the mine map in Appendix Z and in Table 7 for the 1,803 mine dust samples collected. The results of the coke analysis on all mine dust samples showed that 85.5 percent of all mine dust samples taken displayed evidence of coking. The results of the coke analysis on only band samples showed that 86.5 percent displayed evidence of coking.

Table 7. Amount of Coke in Samples taken During Mine Dust Survey

	Intake Entries					Return Entries				
Sampling Area	**None**	**Trace**	**Small**	**Large**	**X-Large**	**None**	**Trace**	**Small**	**Large**	**X-Large**
1	15	0	0	0	0	15	0	0	0	0
2	11	0	0	0	0	-	-	-	-	-
3	15	0	0	0	0	-	-	-	-	-
4	8	0	0	0	0	-	-	-	-	-
5	76	22	15	3	0	15	4	15	5	0
6	96	48	4	0	0	-	-	-	-	-
7	7	43	129	115	3	-	-	-	-	-
8	0	0	4	44	8	-	-	-	-	-
9	0	1	2	116	5	-	-	-	-	-
10	0	0	0	60	53	-	-	-	-	-
11	0	0	4	73	2	0	0	4	18	0
12	0	1	20	8	0	0	3	5	0	0
13	0	0	4	61	17	3	8	6	32	20
14	0	0	3	25	43	-	-	-	-	-
15	0	1	9	16	0	0	1	2	8	0
16	0	3	17	202	5	0	0	0	2	0
17	0	0	1	68	9	0	0	0	55	52
18	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	0	0	1	34	0
20	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-
Total:	228	119	212	791	145	33	16	33	154	72

In addition, MSHA sent 29 mine dust samples to the NIOSH facility in Morgantown, West Virginia for the samples to be placed under a Scanning Electron Microscope to identify presence or lack of coke in each sample. MSHA chose these 29 samples because of their underground locations near the perimeter of the flame zone and because the Alcohol Coke Test indicated large or extra-large quantities of coke in each of the selected samples. The results of the examination proved definitively that coke was present in each of the 29 samples.

MSHA determined that the coal dust explosion began approximately at the intersection of crosscut 48 and entry No. 6 in Tailgate 1 North. Explosion forces were generated by the flame in all directions, including back across the longwall face. Evidence indicates that approximately 14 psi traveled back to the longwall tailgate from the coal dust explosion. Explosion damage indicates that the coal dust explosion initially propagated inby in entries 5 and 6 and outby in entries 5, 6, and 7. Eventually, all entries and crosscuts in Tailgate 1 North from as far inby as crosscut 77 exhibited evidence of flame. The flame traveled inby at about 1,000 feet per second (fps) while generating a pressure exceeding 18 psi. While underground, investigators were unable to take mine dust samples any farther inby in the Tailgate 1 North entries and, consequently, could not determine the extent of flame in those inby entries. However MSHA's Mine Emergency Operations Group lowered a camera into the mine at two inby locations, through borehole BH A, located in the No. 1 entry at 94 crosscut of Headgate 1 North, and also down the Bandytown fan shaft. Observations made with the camera indicated that the flame of the explosion most likely did not propagate to either of these locations. Flame propagated outby from crosscut 48 and involved all entries and crosscuts of Tailgate 1 North, outby to the Old North Mains. The flame also propagated to crosscut 67 in Old North Mains in entries 1, 2, and 3.

The explosion flame traveled outby at the same time as it was traveling inby in the tailgate entries. Flame initially traveled outby in the tailgate entries at about 600 fps, generating a pressure of nearly 6 psi. Several hundred feet before reaching the crossover entries, additional coal dust became involved and flame speeds accelerated to over 1,000 fps in all tailgate entries. As the flame continued outby in the tailgate entries, eventually it propagated to the locations where the tailgate intersects the North Glory Mains. The flame speed dropped dramatically at this intersection due to the additional entries and the increased incombustibles in the mine dust. The flame extinguished in this direction about 11 crosscuts outby the tailgate entries. As the flame propagated outby in the Tailgate 1 North entries, it turned 90º to the left and entered the crossover between Tailgate 1 North and Headgate 1 North. All entries and crosscuts of the crossover were engulfed in flame, including the entries and crosscuts that turn 90º and head towards and into the North Glory Mains entries. Flame propagation did not occur along the length of the North Glory Mains but small pockets of flame extinguished as they projected a short distance into the North Glory Mains.

From the crossover entries, the explosion flame propagated into Headgate 1 North and turned both inby and outby. The outby portion propagated towards and into the North

Glory Mains. The inby portion propagated inby as far as crosscut 32. MSHA was unable to take mine dust samples any further inby in the Headgate 1 North entries and, consequently, could not determine the extent of flame in those inby entries. As flame entered Headgate 1 North, the destructive pressures propagated inby with a flame speed of about 1,200 fps, generating over 20 psi, as indicated by damage to several monorail sections. Although flame did not enter the longwall face, pressures ranging from 7 to 14 psi did travel along the longwall from the headgate.

The flame of the coal dust explosion also traveled toward the face of the TG 22. As the coal dust explosion propagated into TG 22, explosion pressures increased to near 20 psi. Just before entering TG 22, the flame also turned 90º right and entered the crossover entries between TG 22 and HG 22. Initially, the flame resulted in large and extra-large deposits of coke. However, as the flame continued through the crossover entries, coke was not produced. MSHA believes that the flame increased in speed as it continued through these crossover entries. Increased flame speeds decreased the duration of the flame at these locations and coke formation was not possible. This increase in speed could likely be attributed to the increased fineness of the coal dust and the lack of sufficient rock dust through these entries. The flame slowed as it turned into crosscuts. Mine dust samples taken in the crosscuts of the crossover entries included large and extra-large quantities of coke, indicating flame travel.

The flame entered HG 22 at the mouth of the section and turned 90º left and right. The portion of the flame that turned left traveled into HG 22 and propagated to the faces. The flame propagated into HG 22 at speeds approaching 1,500 fps generating a pressure of approximately 25 psi. Additional coal dust caused increases in the flame speed and pressure. Calculations have shown that explosion pressures were on the order of 52 to 65 psi. Pressure piling occurred as the flame and forces continued to push against the dead end of HG 22. This resulted in a reflected overpressure traveling outby that could have reached a maximum pressure of 105 psi. The flame consumed available oxygen in HG 22 and, after reaching the faces, was unable to propagate outby as it extinguished from the lack of oxygen.

The flame that turned right traveled outby to near crosscut 115 in the North Glory Mains, into all entries and crosscuts of the Glory Hole Mains, and turned again and propagated into all entries and crosscuts of the North Jarrells Mains, and all entries and crosscuts in West Jarrells Mains. Pressures throughout these areas averaged about 20 psi with flame speeds of over 1,000 fps. The flame of the explosion extinguishged at the dead ends of West Jarrells mains due to lack of sufficient oxygen for continued propagation.

A mine map showing the direction of the primary explosion forces is contained in Appendix L.

Accumulations of Coal Dust and Float Coal Dust

As noted in the examinations section, MSHA identified extensive and obvious accumulations of coal dust and float coal dust throughout its underground investigation. The coal dust and float coal dust provided the initial fuel for the coal dust explosion. Coal dust and float coal dust along the flame path continued to fuel the explosion.

MSHA sent several teams underground to travel each air course in order to take representative measurements of the accumulations. MSHA's measurements were consistent with their initial determination that the accumulations were extensive and obvious. The accumulations were found consistently along travelways, belt conveyors, intake air courses and return air courses inby crosscut 54. Many of these accumulations were left from the initial mining process. Section roadway spillage, feeder piles, and coal along the ribs was not cleaned up as normal mining continued. In addition, their location and placement indicated that they had pre-dated the explosion, i.e., that the accumulations were not the result of explosion forces. Testimony corroborated the presence of many of these accumulations pre-explosion, especially in the belt entries.

Proximate Analysis and Explosibility of the Coal

The coal at UBB was explosive. In order to verify the explosibility of the coal, MSHA removed separate channel samples from near the headgate and the tailgate of the active longwall. MSHA sent the samples to Standard Laboratories, Inc. in Freeburg, Illinois, which subjected the samples to a Proximate Analysis. The Proximate Analysis determines the moisture, ash, volatile content, and fixed carbon of each sample. The volatile content can be used to identify the rank of the coal. The volatile content and the fixed carbon can be used to calculate the volatile ratio of the coal. The moisture and ash can be used to determine the amount of rock dust necessary to reach incombustible contents of 65 percent and 80 percent. In addition, the British thermal units (Btu) and sulfur contents of each sample were determined.

The results of Proximate Analysis testing on the as-received sample from the headgate revealed the following: moisture = 1.77%, ash = 7.98%, volatile content = 32.77%, and fixed carbon = 57.48%. The headgate sample had a Btu content of 13,890 and a sulfur content of 0.83%. The results of Proximate Analysis testing on the as-received sample from the tailgate revealed the following: moisture = 2.23%, ash = 6.82%, volatile content = 32.81%, and fixed carbon = 58.13%. The tailgate sample had a Btu content of 14,010 and a sulfur content of 0.88%. The results of the Proximate Analysis identify this coal as a high volatile bituminous coal which is highly explosive. The results of testing are contained in Appendix AA.

The volatile ratio of the coal is a value independent of any inherent or added incombustible. The volatile ratio is calculated by dividing the volatile content of the coal by the summation of the volatile content and the fixed carbon. Any coal with a volatile ratio of 0.12 or less is defined as an anthracite coal and is not explosive. It has been established that all U. S. coals having a volatile ratio in excess of 0.12 are considered to present an explosion hazard. Bituminous coal is defined as any coal with a volatile ratio greater than 0.12. Bituminous coal is subject to all the requirements of the § 75.400, including the incombustibility requirements contained in § 75.403. The volatile ratio of the headgate sample was calculated to be 0.36 and the volatile ratio of the tailgate sample was calculated to be 0.36.

Rock Dusting

The use of rock dust to limit explosions in underground coal mines was pioneered by the U.S. Bureau of Mines in the 1920's. Rock dust in coal mines is defined in 30 CFR Subpart A, § 75.2 as follows:

> Pulverized limestone, dolomite, gypsum, anhydrite, shale, adobe, or other inert material, preferably light colored, 100 percent of which will pass through a sieve having 20 meshes per linear inch and 70 percent or more of which will pass through a sieve having 200 meshes per linear inch; the particles of which when wetted and dried will not cohere to form a cake, which will not be dispersed into separate particles by a light blast of air; and which does not contain more than 5 percent combustible matter or more than a total of 4 percent free and combined silica (SiO_2), or, where the Secretary finds that such silica concentrations are not available, which does not contain more than 5 percent of free and combined silica.

This definition has been in place for decades and was the requirement for rock dust composition on April 5, 2010.

The initial research supporting the rock dust particle size effects on coal dust explosion propagation was performed in 1933 and reported in Bureau of Mines Bulletin 369. Rock dust, an inert material, is intended to prevent explosions. The mechanism by which this is accomplished is that, when dispersed in sufficient quantities, inert material will quench explosion flame, partly through absorption of heat and radiant energy, and partly by hindering diffusion of oxygen and gases into and from the burning coal particles. The effectiveness of an inert dust in inhibiting ignition or explosion of a combustible dust increases with decrease in particle size of the inert dust. As a result, a lesser percentage of fine inert dust is required than for coarse inert dust. Small-scale laboratory tests, conducted by NIOSH, showed that the larger the rock dust particle size, the more rock dust is required to inert and prevent a coal dust explosion from propagating. It has been shown in various small chamber tests that by reducing the size of the rock dust particles, the surface area of the rock dust increases and promotes greater radiant heat absorption, thereby improving the prevention of underground coal dust explosions.

At UBB, four methods were used to apply rock dust: hand dusting, a scoop-mounted slinger duster, a rail-mounted duster, and trickle dusters.

Hand dusting from 40-pound bags was used for the initial application of rock dust during advance on continuous miner sections, and was also used for some supplemental applications. Scoop-mounted slinger dusters, using bulk bags and 40-pound bags, were used for supplemental dust applications. A rail-mounted duster was used inconsistently to dust the track and belt entries in the outby areas of the mine. The dual pod, rail-mounted duster had a capacity of approximately 1.6 tons of bulk rock dust. Trickle dusters, which had capacities of 200-280 pounds of rock dust, were used at some belt transfer points. Bulk rock dust was stored in two bins near the UBB Portals.

Miners stated that areas were not well dusted, areas were dark, and the only areas that were regularly dusted were track and belt entries. An examiner stated that the crossover between HG 22 and TG 22 was never dusted. The scoop-mounted slinger duster on HG 22 was found 18 crosscuts outby the face in the return entry. Other miners described the color underground as gray to black. In addition, several witnesses said that the tailgate of the longwall needed rock dusting. There is no evidence or testimony from the interviews to indicate that any additional rock dust was applied in the longwall tailgate after the longwall started retreating. Few had been trained on what adequate rock dust quantities should be. Finally, PCC never sampled its' mine to determine compliance with the rock dust regulations.

At UBB, a rail-mounted duster was used to dust the track and belt entries. Hoses were used to convey the rock dust to the belt entries. Because the longwall and development sections were approximately 5 miles from the bulk rock dust bins at the UBB Portals, the time to get a load of rock dust and transport it into the active mining areas limited the bulk duster to approximately one trip per night. Simply moving one of the bulk rock dust bins to the Ellis Portal would have decreased the time to reload the rail-mounted duster. Installing a rock dust borehole near the active production sections switch would have further reduced the reload time for the rail-mounted duster. A single rock dust crew, consisting of a motor operator and a helper, was responsible for bulk dusting the track and belts of the entire mine. The crew of the rail-mounted duster would often perform other outby work, including setting timbers, building stoppings, or supplying a section.

The rock dust equipment frequently failed. The rail-mounted duster was over 20 years old, hoses frequently clogged and multiple breakdowns took days or weeks to complete. The hoot owl crew was often without the duster altogether or spent hours trying to unclog hoses to keep dusting during their shift. The crew also had limited time to dust assigned areas of the mine, often only completing about 10 breaks of area, about 1000 feet, in a mine covering more than 7 miles. The crew and the rail-mounted duster had to be off the track and outside before the day shift production crew arrived. The complications with equipment maintenance, the distance to travel to load and unload the duster, and the time limits on use of the track often left only three hours for the dust crew to apply dust. A notebook kept by the crew (Appendix AB) summed up problems with an entry two weeks prior to the explosion: "No ride. No help. No spotter… I'm set up to fail here."

A UBB miner testified:

> We never rock dusted. I mean, very seldom…I growed up in a Massey affiliated mine and I thought it was like that everywhere. I mean, until you can see a difference, you don't have something to compare it to…

Despite the evidence that some miners were unaware of what a properly rock-dusted mine looked like, other miners were aware and were concerned about the lack of rock dust. Included in the latter group were examiners who repeatedly reported the lack of dust on reports up to the time of the explosion. The belt examination that was phoned out of UBB immediately prior to the explosion showed that eight of ten conveyor belts that were examined required rock dusting (Appendix AC). Belt examination reports for March 15, 2010 through the time of the explosion show that belts requiring rock dusting were listed 443 times but rock dust was shown as being applied only 58 times (Appendix AD).

The belt examiners' report for March, 2010 showed consistent, hazardous conditions concerning belts that required additional rock dusting. Some belts showed as high as 90 consecutive shifts when the examiner reported additional dust was needed. From December 28, 2009 to April 5, 2010, 291 belt exams were recorded for the longwall belt. On ten occasions, the record indicated "Idle belts," leaving 281 examination records. Of these recorded examinations, 96 percent (270) had a hazard recorded. Of the 281 recorded examinations, 86 percent (244) indicated that the belt entry needed at least spot dusting.

Rock dust purchase orders, provided by PCC as Bates Stamped documents PCC-MSHA 00060740 to 00060846 and PCC-MSHA 00068810 to 00069433, show that between October 26, 2009 and March 8, 2010, no bulk dust was purchased at this mine, even though production increased at this time. In September, 2009 and October, 2009, 648 tons of rock dust was purchased. During the following four months, a total of only 520 tons was purchased. In March, 2010, there was a slight increase in the amount of dust purchased.

In the course of its investigation of the accident, MSHA sampled rock dust from three separate bags of rock dust located at UBB. The tests determined that this rock dust was not compliant with 30 CFR 50.2, which requires that 70 percent of the rock dust particles must pass through a 200-mesh sieve. A few of these rock dust samples fell significantly short of the 70 percent requirement. MSHA is investigating whether the manner of storing the rock dust affects its quality. MSHA subsequently tested other samples obtained directly from the manufacturer of the rock dust, the Limestone Dust Corporation of Bluefield, Virginia. Some of these samples were compliant with 30 CFR 50.2; others were marginally below the 70 percent requirement for a 200-mesh sieve, although not to the degree noted in the rock dust sampled from UBB.

It is MSHA's conclusion that the non-compliant nature of the rock dust did not contribute to the explosion at UBB. Based on MSHA's investigation, MSHA determined that there was almost no rock dust in the tailgate entry of the longwall. Had there been rockdust present in sufficient quantities in this area, MSHA believes that the methane explosion would not have propagated into the resulting coal dust explosion.

OTHER PCC PLANS

Mine operators, including PCC, are required to develop and follow various plans in accordance with the MINER Act and applicable standards to ensure the safety and health of the miners. Those include ventilation, roof control, and emergency response – which covers communications and tracking. Additionally, PCC met the criteria to require compliance with atmospheric monitoring system standards. Plans must address the conditions and mining methods at a specific mine to protect the health and safety of the miners.

Ventilation Plan

The Approved Plan in Effect April 5, 2010

In addition to the information provided above, the approved ventilation plan included four general statements; three of which address maintenance and examination of the bleeder system:

- The roof in the bleeder entries and at the bleeder evaluation points shall be supported in accordance with the approved roof control plan.
- Accumulations of water will be controlled primarily by natural drainage supplemented by pumping to prevent accumulations of water from affecting the bleeder ventilation system.
- The effectiveness of the bleeder system shall be determined by the methane and oxygen content, the direction of airflow, and quantity at the bleeder evaluation points located as shown typically on the drawings or as previously approved on the mine ventilation map submitted under 30 CFR § 75.372.

The fourth statement addresses the installation of mechanized mining equipment:

- During installation and removal of mechanized equipment, 9,000 cfm will be maintained at the last open crosscut of the section being set up or abandoned and at the intake end of a pillar line. Ventilation controls will consist of permanent stoppings, check curtains and brattice material, as necessary, to maintain the required ventilating current. The system of installing controls will be similar to those on face sketches.

These statements show PCC's knowledge and recognition of unique conditions and issues to be addressed at UBB.

Five regulatory compliance statements are contained in the ventilation plan:

- § 75.371(g),(m) – Volume of air required in last open crosscut – Permanent stoppings will be maintained up to, but not including, the third connecting crosscut outby the working face. In order to insure that adequate ventilation is maintained, a minimum of 13,500 cfm in the last open crosscut will be provided when the last open crosscut is three crosscuts inby the permanent stopping. A minimum of 9,000 cfm will be maintained with one or two open crosscuts.
- § 75.371(x) – A description of the bleeder system to be used, including its design (see § 75.334) – Blowing ventilation with outcrop punch-outs or ventilation holes and cut-throughs into mains on the back end of panels or rooms is proposed for the bleeder system evaluation for this mine. Typical bleeder designs are attached [in the plan]. Existing bleeder systems are shown on the § 75.372 mine ventilation map.
- § 75.371(z) – Weekly examinations – Non-Pillared, Worked Out Areas – In addition to the requirements of § 75.364(a)(1), measurements of methane, oxygen, air quantity, and air direction will be made in the last open crosscut or in the immediate return outby the last permanent stopping in each panel or mains.
- § 75.371(hh) – Ambient Level of Carbon Monoxide – The ambient level of carbon monoxide in all areas where carbon monoxide sensors are installed is 0 ppm. This ambient level is determined using a handheld, calibrated CO detector. Current settings are 5 ppm and 10 ppm, respectively, for alert and alarm levels. CO monitors will be spaced at maximum 2,000 foot spacing.
- § 75.371(uu), (vv), and (ww) – Diesel Equipment – At this time, there is no diesel equipment in service at this mine.

The plan further stipulates how belt air will be monitored as it is fed through a regulator:

1. Belt Air – Where intake air is regulated into the belt, it will have a CO monitor upwind on the intake side and another one will be installed both inby and outby in the belt air course. The regulator feeding the air from the intake into the belt air course will have the capability of being adjusted remotely from outby the regulator in the intake and also outby in the belt air course. This is considered point feed. At this time, there is no point feed in the mine. A revision will be submitted and approved before adding a point feed.

Recent Revisions to the Approved Ventilation Plan and Map

From September 11, 2009 until April 5, 2010, UBB submitted 38 revisions (referred to by UBB as addendums) to the ventilation plan, of which 18 were approved and two seal completions were acknowledged. There were 13 revisions to the ventilation plan and map that were disapproved, five revisions to the plan and map pending approval and one which was withdrawn. The December 23, 2009 revision described how belt air would be used on the longwall, with the operator stating that within 30 days, a long term plan would be submitted to show how belt air would be coursed outby, away from the longwall while more intake air courses would be opened up. This was submitted after the company was unable to implement the December 18, 2009 approval, referring to a company submission showing the belt air coursing outby, away from the longwall.

Prior to the installation of the Bandytown fan, the Headgate 1 North and Tailgate 1 North development sections were ventilated with the North fan. The ventilation of these sections was reported to be poor, and likely represented the extent of the effectiveness of the North fan. The ventilation history of this area is presented below, based on a review of the approved ventilation changes and other applicable records, beginning with the inception of the longwall section. The longwall dust control plan, approved on June 15, 2009, required "40,000 cfm volume of air intake to longwall," with minimum face velocities of 400 fpm at shield 9 and 250 fpm at shield 160. The dust control plan required 15,000 cfm for the MMU-029 (HG 22) and MMU-040 (TG 22) sections in the last open crosscut.

- Addendum B4-A56, approved August 6, 2009. This was a three-phase plan. Phase 1 concerned the activation of Bandytown fan and development of the north longwall district. The plan proposed a quantity of 300,000 cfm for Bandytown fan. Phase 2 plan concerned the start-up of the 1 North Longwall Panel. The longwall tailgate outby the face was ventilated with belt/track air. This phase also established the measurement points (MP) and evaluation check points (EP) for the longwall. The Panel 2 crossover unit was proposed to be ventilated by a return, directed to the Bandytown shaft and separated from the worked-out longwall area along Headgate 1 North. This unit became HG 22 at a later date. The Panel 1 crossover was ventilated by return air, isolated from the worked-out longwall area, along Tailgate 1 North to Bandytown fan. This return later became the main return for the development sections. The approved plan showed the longwall using belt air. The map included as part of Phase 2 included a 30,000 cfm minimum air quantity for the longwall. This would have superseded the minimum quantity in the dust control plan. Phase 3 depicted projections for developing 2 North (HG 22) and 3 North. The plan also included four typical face ventilation sketches, showing the ventilation of the longwall face and the MP and EP locations.

During an inspection conducted while the plan was being implemented, multiple ventilation citations were issued. Phase 1 had been completed with the activation of the Bandytown fan. On September 1, 2009, as the longwall ventilation system was being adjusted to meet the approved Phase 2 plan requirements, MSHA inspectors found airflow across the longwall face to be traveling in the wrong direction (tailgate to headgate). MSHA identified that other ventilation controls needed to be constructed and controls had been constructed that were not approved by the Phase 2 plan. While these ventilation revisions were in progress, miners not necessary to make these changes were in the mine producing coal on other continuous mining sections and performing other nonrelated work. Miners were withdrawn from the mine and the appropriate violations were issued.

- B4-A61, approved September 4, 2009. Doors were installed in Tailgate 1 North between crosscuts 9 and 11. This was designed to regulate intake airflow entering Tailgate 1 North entries from the belt/track air course in the Old North Mains.

- B4-A62, approved September 4, 2009. Intake regulators were installed at the overcasts over Ellis Mains near Ellis switch. These regulators were designed to cause air to travel inby in the intake and belt/track entries at Ellis Portal.

- B4-A65, approved September 18, 2009. Regulators were installed in Tailgate 1 North between crosscuts 33 and 34 in No's. 4 and 5 entry. This was designed to regulate intake airflow entering Tailgate 1 North entries from the belt/track air course in the Old North Mains.

- B6-A6, approved November 13, 2009. The plan depicted the beginning of HG 22 (Headgate 2 North). Mine record books indicated the HG 22 section started on or about November 30, 2009.

- B6-A13, approved December 18, 2009. Ground control failure damaged the stoppings in Headgate 1 North separating the return from the worked-out area. This plan depicted the HG 22 return air course, directed outby in the North Glory Mains and through Panel 1 crossover to Tailgate 1 North. At that time, the conveyor belt from the Panel 2 crossover was dumping on the longwall conveyor belt. The longwall intake expanded to two entries inby the Panel 2 crossover conveyor belt. Inby the longwall face, the No. 3 entry became common with the air that ventilated the worked-out area of the longwall. The plan established the location of air pumps and stated that water was not roofed to impede ventilation or travel. The plan also depicted a regulator to course intake belt air into the Panel 1 crossover return. This was intended to reverse the belt air direction away from the longwall face. A continuous mining section (MMU 040-0) was depicted mining rooms off the Panel 1 crossover.

- B6-A7, approved December 23, 2009. This plan was approved following a failed attempt to implement the B6-A13 plan, approved December 18, 2009, to reverse the direction of the air in the longwall belt entry. This plan depicted the longwall belt air splitting near crosscut 25, with air travelling to the longwall face and outby.

- B6-A14, approved January 5, 2010. This plan depicted the mining of pillars to install a belt drive to enable the HG 22 belt to transfer coal onto the 7 North conveyor belt.

- B6-A16, approved January 20, 2010. This plan depicted the reversal of the HG 22 intake to bring intake air around North Jarrells and West Jarrells Mains to HG 22 and direct the air to Headgate 1 North.

- B6-A15, approved January 22, 2010. This plan depicted new projections shown for the development of TG 22. The route of the HG 22 return changed to the Panel 2 crossover. The HG 22 intake route was changed to North Glory Mains. At this point, the intake air course split and went to HG 22 and TG 22, returned from HG 22 and TG 22, then joined and split again, with return air going inby at Headgate 1 North and outby in Headgate 1 North to the Panel 1 crossover, and out the isolated return to Bandytown fan. The TG 22 conveyor belt is depicted dumping coal on the Panel 2 crossover conveyor belt, which then dumped onto the HG 22 conveyor belt. Mining on TG 22 began about March 2, 2010.

- B6-A25, approved March 11, 2010. This revision was submitted in response to a closure order, issued on March 9, 2010 for not following the plan approved for the longwall. The longwall tailgate air was travelling in the wrong direction. The plan depicted ventilation controls to ensure previously approved airflow direction.

- B6-A26, approved March 22, 2010. This revision depicted a revised, typical longwall face sketch to be utilized after the longwall had passed the Panel 2 crossover. The face sketch showed the longwall belt air direction going outby and noted that the stoppings separating the travelable return from the longwall gob air would be kept intact.

Disapproved Revisions to the Ventilation Plan and Map

There were 13 revisions to the ventilation plan and map that were disapproved, five revisions to the plan and map pending approval and one which was withdrawn. On November 20, 2009, MSHA disapproved a revision to the plan that proposed to dump belt air from the longwall into the return after the Panel 1 crossover was cut through and completed. It also proposed to dump intake air into the longwall belt air course at crosscut 13. MSHA disapproved this proposal because the company was proposing a point-feed at crosscut 13, without addressing the requirements of 30 CFR §§ 75.350(c) and (d).

On December 4, 2009 a proposed revision to the map was disapproved. This revision would have modified ventilation controls, so pillars could be mined to install a new longwall belt was disapproved because of deficiencies on the submitted map, and due to the potential for return air to contaminate the belt air course.

On the same day, MSHA disapproved another revision to the map. This revision proposed to reroute the return off the HG 22 section, down the left side of North Glory Mains, crossing overcasts on Headgate 1 North and up the Tailgate 1 North isolated return (not a part of the longwall ventilation air courses); change the No. 3 entry of the Headgate 1 North to a return air course common with the worked out area inby the location of the longwall; convert the No. 3 entry of Headgate 1 North to an additional intake air course common with the existing primary escapeway outby the longwall face; and revised face sketches for both longwall gate road development and the longwall face. MSHA disapproved this proposal because of deficiencies on the map, including ventilation controls that conflict with plan revisions approved previously (September 4, 2009, October 29, 2009, and November 13, 2009), roof falls that impeded travel and eliminated the potential for compliance with 30 CFR § 75.384 for the second longwall panel were not shown, nor addressed; water accumulations within the active areas and within adjacent areas were not shown; a means for compliance with § 75.334(c) was not provided, actual air readings were not provided (production had been ongoing since September 2009); belt air from the development section was shown to be ventilating the longwall face; and belt air from the No. 1 entry of the Headgate 1 North did not meet the requirements of the newly promulgated regulation (December 2008).

In addition the submittal did not clarify how the return stopping line shown on the longwall face sketch was to be traveled or maintained. The submittal lacked adequate details addressing whether the air courses were to become common or if the return stopping line was to be reconstructed. The submittal also did not indicate whether the measuring points (MP) shown on the face sketch must be checked for proper air direction. The gate road development face sketch (3-entry) contained a statement, “number of entries may vary provided the ventilation scheme does not change,” which was inappropriate for the projections and system shown on the attached maps in the disapproval letter.

On December 9, 2009, MSHA disapproved a revision to the map that proposed to route the travelable return air course from the active HG 22 section into a common entry with the section mining rooms off of the Panel No. 1 crossover (MMU 040-0); make the No. 3 headgate entry a common intake air course with the existing primary escapeway; provide dewatering information; and project a future gateroad. MSHA disapproved this proposal because, among other deficiencies, it did not indicate that an isolated, tailgate entry would be available or re-established for the second longwall panel, and statements with the ventilation scheme provided did not comply with the existing base plan, and ignored the requirements of 30 CFR §§§ 75.334, 75.384, and 75.364.

The December 9, 2009 disapproval letter also addressed the company's request that the August 6, 2009 approval be honored with respect to ventilation with belt air. The disapproval letter reminded the company that a request was made to the company by D4, for a ventilation revision subsequent to new belt air regulations on August 6, 2009, and the current longwall plan was approved to allow additional time to develop and submit a plan. As of the December 9, 2009 disapproval letter, this request was not answered. The disapproval letter further reminded the company that an additional request was sent on November 20, 2009, which also had not been addressed, and subsequently, another written notice was provided on December 4, 2009, which also resulted in no additional information provided to justify the continued use of belt air. In all the company was provided with a verbal request on August 6, 2009, and written requests on November 20, 2009 and December 4, 2009, in addition to the request made in the December 9, 2009 disapproval. In each case the company failed to submit justification for use of belt air on the longwall face.

Methane/Dust Control Section of the Ventilation Plan

The ventilation plan contained a general dust control section for the mine that addressed the use of water to control dust along conveyor belts, transfer points and haulageways. It also addressed the use of ventilation to course dust to the return, and stated that 3M brand dust and mist respirators would be available upon request. The approved ventilation plan for each MMU within the mine had an approved methane and dust control plan that was site-specific. The ventilation plan also addressed the belt lines and specifically identified the Designated Areas (DAs), their sampling status, and the methods of dust control to be used at each location. The Designated Area (DA) methane and dust control plan, part of the approved ventilation plan for the belt lines was approved January 22, 2010, and contained details regarding the use of water to control respirable dust and methane along the belt lines at each DA specified in the approved plan. The plan specified the location and sampling status at each DA and how respirable dust would be controlled. Provisions of the approved ventilation plan for the control of methane and dust on the longwall are discussed below. Additional information on mechanized mining units utilized in continuous miner sections MMU 040-0, MMU 029-0, and MMU 062-0 is contained in Appendix AE.

MMU 050-0 (Longwall Shearer) Plan Requirements

The approved methane and dust control plan had the following ventilation requirements:

Volume of Air at Intake to Longwall	40,000 cfm
Required Velocity at Shield #9	400 LFM
Required Velocity at Shield #160	250 LFM

An addendum on a map later reduced the minimum volume of air in the intake to the longwall to 30,000 cfm.

The approved methane and dust control plan had the following water spray requirements at the shearer:

Minimum Operating Pressure at the Spray Block	90 psi
Type of Water Spray	Conflow Staplelock 650 2801CC or equivalent
Total Number of Sprays on the Shearer	109
Sprays at Headgate Drum	43
Sprays at Headgate Ranging Arm	3
Sprays at 1st Headgate Body Block	2
Sprays at 2nd Headgate Body Block	6
Sprays at Tailgate Drum	43
Sprays at Tailgate Ranging Arm	3
Sprays at 1st Tailgate Body Block	2
Sprays at 2nd Tailgate Body Block	6
Sprays at Tailgate Rack Spray	1

The approved methane and dust control plan had the following water spray requirements at the stage loader and crusher:

Minimum Operating Pressure at the Spray Block	60 psi
Type of Water Spray	Unspecified
Total Number of Sprays on the Stageloader / Crusher	14
Sprays at Headgate Motor	3
Sprays at Crusher Intake	3
Sprays at Crusher Exit	3
Sprays at Crusher	3
Sprays at Stageloader Exit	2

The approved plan contained a schematic that showed the typical longwall face ventilation, and contained the following safety precautions and can be found in Appendix AF.

Water Spray Configuration in Use as Reported by Massey Energy

On 12-3-2010 investigators from Massey Energy reported that the following configuration was in use on the longwall:

		Type of Water Spray
Operating Pressure at the Spray Block	125 psi	
Total Number of Sprays on the Shearer	139	
Sprays at Headgate Drum	43	Flow Technologies 791C Staplelock Spray 3/32" orifice Full Cone
Sprays at Headgate Ranging Arm	10	Flow Technologies 791C Staplelock Spray 3/32" orifice Full Cone
Sprays at 1st Headgate Body Block	3	Flow Technologies 791C Staplelock Spray 3/32" orifice Full Cone
Sprays at 2nd Headgate Body Block	10	BD-5 Brass Hollow Cone Spray
Headgate Pan Sprays	3	BD-5 Brass Hollow Cone Spray
Sprays at Tailgate Drum	43	Flow Technologies 791C Staplelock Spray 3/32" orifice Full Cone
Sprays at Tailgate Ranging Arm	10	Flow Technologies 791C Staplelock Spray 3/32" orifice Full Cone
Sprays at 1st Tailgate Body Block	3	Flow Technologies 791C Staplelock Spray 3/32" orifice Full Cone
Sprays at 2nd Tailgate Body Block	10	BD-5 Brass Hollow Cone Spray
Sprays at Tailgate Rack Spray	1	BD-5 Brass Hollow Cone Spray
Tailgate Pan Sprays	3	BD-5 Brass Hollow Cone Spray

This information was collected in preparation for the water test at the shearer on December 20, 2010.

Water Test – Compliance with the Ventilation Plan

Tables 8 and 9 show the results of the water spray test that was conducted on December 20, 2010. Table 8 shows the number, type and conditions of the sprays on the longwall shearer, while Table 9 shows the water pressures that were measured at certain spray locations.

Table 8. Number, Type and Conditions of the Sprays found on the UBB Longwall Shearer

		Type of Water Spray	Condition of Sprays
Total Number of Sprays on the Shearer	157		
Sprays at Headgate Drum	45	Various Flow Technologies 791C Staplelock Spray 3/32" orifice	9 clogged
Sprays at Headgate Ranging Arm	10	Various Flow Technologies 791C Staplelock Spray 3/32" orifice	6 clogged 1 missing inlet insert
Sprays at 1st Headgate Body Block	3	Various Flow Technologies 791C Staplelock Spray 3/32" orifice	
Sprays at 2nd Headgate Body Block	10	BD-5 Brass Hollow Cone Spray	8 clogged
Headgate Pan Sprays	4	BD-5 Brass Hollow Cone Spray	2 clogged
Headgate Rack Sprays	3	BD-5 Brass Hollow Cone Spray	
Sprays at Tailgate Drum	45	Various Flow Technologies 791C Staplelock Spray 3/32" orifice	15 clogged 9 missing inlet inserts 7 missing (open port on shearer)
Sprays at Tailgate Ranging Arm	10	Various Flow Technologies 791C Staplelock Spray 3/32" orifice	7 clogged 4 missing inlet insert 1 hollow cone insert
Sprays at 1st Tailgate Body Block	3	Various Flow Technologies 791C Staplelock Spray 3/32" orifice	Block is missing open 1/2" hose discharging
Sprays at 2nd Tailgate Body Block	10	BD-5 Brass Hollow Cone Spray	4 clogged
Sprays at Tailgate Rack Spray	6	BD-5 Brass Hollow Cone Spray	
Tailgate Pan Sprays	8	BD-5 Brass Hollow Cone Spray	6 clogged

Table 9. Water Pressures Measured on the UBB Longwall Shearer

Water Test Data from 12-20-2010

Pressure Gauge at Spray Position #6 on Tailgate Drum

PSI coming into shearer	PSI on Tailgate Drum
50	0
100	0
150	0
200	0
250	0

Pressure Gauge at Spray Position #14 on Tailgate Drum

PSI coming into shearer	PSI on Tailgate Drum
50	0
100	0
150	0
200	0
250	0
300	0
350	0
400	0
450	0

Pressure Gauge at Spray Position #14 on Tailgate Drum
Six of the Seven Missing Sprays replaced on Tailgate Drum

PSI coming into shearer	PSI on Tailgate Drum
100	58
200	95
300	100
400	100
450	120

Pressure Gauge at Spray Position #14 on Tailgate Drum
Six Sprays for Previous Test are Removed
Seven Clogged Sprays are Replaced

PSI coming into shearer	PSI on Tailgate Drum
100	0
200	0
300	0
400	0
450	0

Difference in Water Nozzles Used by the Operator on the Shearer

The BD-5 sprays as well as the hollow cone and jet Staplelock sprays were not approved for use on the shearer. The operator used a FT 791C Staplelock drum spray with a full cone pattern and a 3/32" orifice (although several 1/16" orifice sprays were found). The approved methane and dust control plan required a Conflow 650 2801 CC or equivalent (this is a full cone spray with a 1/16" orifice). There are differences in the inlet for these full cone sprays. The inlet pieces for the 2801 CC and 2801 DC are identical. Table 10 summarizes the differences between the spray inlets made by the manufacturers. This information was obtained from the respective manufacturers during interviews and from design drawings.

Table 10. Summary of Differences between Spray Inlets Manufactured by Flow Technologies and Conflow.

	FT	Conflow	% Difference
Middle Hole Diameter	**0.0393"**	**0.032"**	**20.5%**
Angled Side Holes Diameter	**0.0468"**	**0.078"**	**50%**
Angle of Side Holes	**67º**	**35º**	**62.7%**

The larger middle hole caused a much courser water droplet to be discharged from the Flow Technologies spray which made it less efficient for dust suppression. In addition, the 1/16" full cone Staplelock spray had a 30º spray angle at the outlet orifice, while the 3/32" full cone Staplelock spray had a 45º spray angle at the outlet orifice. This caused the 3/32" spray to have a greater overspray that contributed to turbulence around the shearer and potentially pushed dust into the walkway. The 3/32" full cone spray had a larger water droplet size which made it less likely to wet the surface being cut adequately and collect dust out of the air. A more in-depth discussion on the specifications of the water sprays can be found in Appendix AG.

Shield Tips

The ventilation plan required water sprays (does not specify a type) on the underside of the shield tips every 20 shields that were manually activated as the longwall passed. The plan did not specify the type of water sprays, shield numbers where sprays were located or minimum operating pressure, and did not provide sufficient technical information about the water sprays. MSHA investigators found that these sprays were brass hollow cone sprays and that many of these sprays were damaged or missing.

Stageloader/Crusher

MSHA investigators found both Staplelock sprays and brass hollow cone sprays in use in the stage loader. The plan did not specify a spray type at this location and only specified a minimum psi (60).

UBB Clean-up Program

UBB's clean-up program for coal dust accumulations pursuant to 30 CFR § 75.400-2 consisted of only three items:

- Load cut of coal;
- Bolt cut of coal;
- Clean and dust cut of coal;
  Rock dust within 40' of face, and;
  Equipment cleaned on weekly preventative maintenance program and as needed.

The plan does not address several significant issues that would be considered as standard inclusions in most clean-up plans, such as clean-up of section roadway spillage, spillage at the feeder, general housekeeping around the section power center, clean-up and dusting along belt conveyer systems and entries, and rib sloughage after initial mining, and trash collection and disposal.

Lung Disease from Coal

Mine ventilation and water sprays are intended both to control explosion potential and to reduce the risk of lung diseases from respirable coal dust, commonly known as Black Lung.

Black lung refers to a number of lung diseases such as coal workers' pneumoconiosis (CWP), emphysema, and chronic bronchitis, caused by inhalation of coal mine dust. The risk of developing the disease depends on the quantity—the intensity and duration—of dust inhaled. When the Mine Act was originally passed in 1969, the U.S. Congress established standards to reduce dust exposure in an effort to eliminate black lung.

The State of West Virginia, Department of Health and Human Services, Office of the Chief Medical Examiner performed autopsies on all 29 victims. The Medical Examiner indicated that most of the victims had evidence of varying degrees of black lung in the form of CWP, emphysema, and fibrosis. A number of these miners had a substantial amount or all of their experience at UBB.

NIOSH research has determined that coal miners continue to be at risk of disease when the current dust limit is followed. Nonetheless, the UBB lung autopsy findings are very troubling. The incidence of disease found in these miners clearly demonstrates that dust control practices at UBB and other mines where these miners worked did not provide adequate protection against black lung.

Roof Control Plan

The roof control plan in effect at the time of the accident was dated October 21, 2009, received by D4 on October 27, 2009, and was approved on December 23, 2009. The portion of the plan outlining the required support for Headgate 1 North and Tailgate 1 North is included in Appendix AH.

The operator failed to design for the extensive occurrence of multiple seam mining conditions, overburden depths exceeding 1,100 feet, and floor heave during development of the 1 North Panel gateroads. The operator did not include pillar design or stability analyses in the roof control plan despite the presence of extensive overlying workings in the reserve area and widespread falls of ground that occurred after mining beneath Powellton seam gateroads. If a stability analysis had been conducted, the Analysis of Multiple Seam Stability (AMSS) program would have indicated that the multiple seam interactions were expected to generate degraded ground conditions and therefore, supplemental support would be required. The operator did not consider the methane outbursts in 2003 and 2004 nor did they implement the precautions discussed with Technical Support at two different meetings in 2004, as described previously in the "Outburst History at UBB" section. These measures, as previously presented, included the construction of a geologic hazard map to predict possible outburst areas, and the related drilling of degasification holes in the identified target areas to release gas prior to mining. During discussion with the mine's senior engineer, Technical Support indicated that a zone of geological weakness appeared to extend southeast through the 2003 and 2004 outburst locations, and that it would be prudent to anticipate encountering a similar event on the next subsequent longwall panel. The mine map indicates that the panel in question was stopped short where it intersected the trend indicated by Technical Support, suggesting that mine management might have been aware of the element of predictability of outbursts in this reserve. However, there appears to have been no attempt to alter the stop position of the 1 North Panel, which mined into the northwestern extension of the projected zone. Technical Support recommended additional precautions in 2004, during a meeting with company officials and CMS&H District 4 personnel, pertaining to the need for increased ventilation on the longwall face and in the longwall bleeder. Those recommendations were not heeded, since the longwall face quantities were actually decreased on the 1 North Panel compared to the previous district where the outbursts occurred.

Pages 2-3 of the approved roof control plan state that tailgate pillars will be designed with 80-foot crosscut centers and that pillars on development and retreat sections will be designed in accordance with the latest edition of Analysis of Retreat Mining Pillar

Stability (ARMPS). The ARMPS program was not an appropriate tool to evaluate the stability of current or future gateroads, which should be evaluated using the Analysis of Longwall Pillar Stability (ALPS) program. In addition, PCC should have used AMSS due to the presence of overlying mine workings and the possibility of multiple seam stress interactions to evaluate gateroad pillar stability. More details with respect to stability analyses are included in Appendix AI.

Roof control issues in Headgate and Tailgate 1 North are listed below.

Headgate 1 North

The headgate was developed as a three-entry gateroad, beginning in November 2008, utilizing 100-foot crosscut centers, with 95-foot centers from the No. 1 to No. 2 Entry, and 105-foot centers from the No. 2 to No. 3 Entry. Prior to this, the development had begun from the North Glory Mains as a 5-entry section in July 2008. The 1 North Panel was the first to be developed beneath Powellton seam longwalls since May 2005, at the end of the previous district when Panel 20 crossed diagonally beneath a 500-foot wide longwall panel. Maximum overburden, based on comparison with structure contours for the Eagle seam provided by the company and a standard USGS topographic map, is 1,290 feet. Headgate 1 North passes beneath several gateroads in the Powellton seam, located 170 feet above. This represents a gob/solid boundary between crosscuts 60-65, with gateroads between mined-out longwall panels, interpreted to represent remnant pillars farther west. For purposes of AMSS analyses, the 4-entry gateroads in the Powellton seam are treated as a single barrier, the width of which is measured to the outside ribs of the outside pillars, a distance of 160 feet. A long barrier between adjacent room-and-pillar workings may represent a remnant pillar configuration near crosscut 45, particularly if the floor has been softened in the Powellton seam or if pillar extraction has been performed.

An AMSS analysis for Headgate 1 North, dated December 14, 2009, was conducted by D4 personnel following deterioration of the headgate. The analysis indicated that the Pillar Stability Factor for tailgate loading essentially met the NIOSH recommended value of 1.13, utilizing a gob/solid boundary beneath the Powellton seam longwall panels and assuming 990 feet of overburden. The MSHA AI Team reviewed the analysis and conducted its own analysis for purposes of comparison. Based on field visits to the Powellton seam and the Eagle seam in this area, the MSHA AI Team analysis used different values for seam height than indicated in the D4 analysis. The D4 analysis appears to address the vicinity of crosscut 60-65, beneath the gob/solid boundary represented by a longwall in the overlying Powellton seam. Based on the D4 analysis seam height of five feet, the design of Headgate 1 North appears to meet the NIOSH recommended value of 1.13. However, field experience indicates that a more realistic value of seam height is seven feet, which substantially reduces the Pillar Stability Factor to 0.82 for tailgate loading conditions and no longer meets the NIOSH recommended value. MSHA's analysis indicates that for the gateroad design to meet the NIOSH recommended Pillar Stability Factor of 1.13, the pillars would have to be increased to

125-foot crosscut and entry centers, compared to the current 100-foot crosscut and 95- to 105-foot entry centers.

Although the gateroads were subjected only to headgate loading conditions, an AMSS analysis conducted by MSHA indicates that it should have been apparent that the gateroad design was not robust enough to meet the recommended stability factors beneath the deepest overburden in combination with Powellton gateroad crossings. MSHA represented the Powellton gateroad crossings as remnant pillars 160 feet wide, surrounded by adjacent longwall gob 620 feet in width at 1,290 feet of overburden. This resulted in Pillar Stability Factors under headgate loading conditions of only 0.93 (0.52 for tailgate loading conditions). This does not meet the NIOSH recommended value of 1.13, and generates a "condition yellow" warning (A major interaction should be considered likely, unless a pattern of supplemental roof support, such as cable bolts or equivalent is installed; rib instability is also likely) for development, and a "condition red" warning (A major interaction should be considered likely, even if a pattern of supplemental roof support is installed; it may be desirable to avoid the area entirely) for tailgate loading. In the vicinity of crosscut 45, Headgate 1 North passed beneath an 80-foot barrier between two room-and-pillar sections, at 1,260 feet of overburden. The AMSS calculated Pillar Stability Factor for the headgate is only 0.93, following the interpretation that the pillars in the Powellton seam are no longer carrying load, either due to floor softening from water, or undersized pillars that have crushed out, or were retreat mined. The value of 0.93 does not meet the NIOSH recommended value of 1.13.

Inspector notes and witness testimony established that a massive water inundation occurred on the 1 North Panel on November 16, 2009 and forced the panel to be shut down for nearly two weeks while water was pumped out. Based on review of mine maps, the longwall was between Headgate 1 North crosscuts 52-61 during that period, with the face located at crosscut 55 in mid-November. This area is significant in that it occurs beneath the transition in the overlying Powellton seam from a series of longwall panels to room-and-pillar workings, separated by a 220-foot wide barrier. At best, the transition represents a gob/solid boundary and, if the room-and-pillar workings were retreat mined or if mine floor softening prevented pillar remnants from carrying any load, at worst it represents a wide barrier between two gobs. Overburden in this area is up to 1,180 feet. Thus, it is plausible that differential subsidence above the 1 North Panel occurred beneath the barrier, causing joints or fractures to open sufficiently to allow water and air communication between the Eagle and Powellton seams. Notations in the longwall production report indicate that a roof fall, 10 feet high and 16 feet wide, occurred in the headgate entry itself, extending from shield 1 outby to the stage loader, on December 4, 2009, when the face was between crosscuts 51-52 beneath the same gob/solid transition zone. This roof fall was not reported until December 5, 2009 and included inaccurate information. MSHA was unable to evaluate the roof fall because the longwall had advanced and the area was unsafe at the time MSHA was notified. The roof fall was reported to MSHA as falling out between the bolts. Witness testimony also indicated that floor heave had been encountered during development of the Headgate 1 North. Although the ARMPS Pillar Stability Factor exceeded the value recommended by NIOSH for development loading conditions, AMSS predicted a “condition yellow” warning (“A major interaction should be considered likely, unless a pattern of supplemental roof support, such as cable bolts or equivalent, is installed; rib instability is also likely”). Subsequent longwall mining validated the predicted AMSS results when significant floor heave and rib sloughing damaged ventilation controls, and ground conditions became unsuitable for use as a tailgate to the next planned longwall panel. At the time of the underground investigation, the headgate had degraded to the point that it was considered inaccessible.

Tailgate 1 North

Tailgate 1 North was developed using seven entries with 100-foot crosscut and 80-foot entry center spacing, resulting in 80 x 60-foot rectangular pillars. It should be noted that because the 1 North Panel was the first panel in the new longwall district, the tailgate would never be subjected to actual tailgate loading, and instead would be subjected to only headgate loading conditions. However, according to witness testimony and review of the 2008 Annual Ventilation Map, dated January 15, 2009, what became the Tailgate 1 North Panel was developed originally as a 7-entry submains configuration, a non-standard gateroad design. Mine management subsequently elected to use this configuration as a longwall tailgate when the longwall equipment was forced to return earlier than expected from the Castle Mine after encountering adverse geological conditions. The 7-entry submains configuration began development from the North Glory Mains in January 2008 and continued until October 2008 when the two left-hand entries were dropped. The development continued as a 5-entry submains configuration by December 2008. Stability analysis using AMSS indicates that beneath the remnant pillar configuration of overlying Powellton seam gateroads flanked by 620-foot wide longwall gobs and at depths approaching 1,200 feet, such as was encountered during the November 2009 water inundation, the 5-entry Tailgate 1 North is characterized by a Pillar Stability Factor of only 0.95, which does not meet the NIOSH recommended value of 1.13. At the longwall face position at the time of the explosion, the Pillar Stability Factor of 1.11 was slightly less than the recommended value of 1.13 for the tailgate beneath 970 feet of overburden and a remnant pillar configuration in the overlying Powellton seam. If Tailgate 1 North had been used as a submains and not been subjected to longwall abutment stresses, the Pillar Stability Factors would have exceeded the values recommended by NIOSH, even when subjected to the worst combination of overburden depth and multiple seam interaction. However, underground observations by MSHA indicated that extensive floor heave and roof degradation occurred in the 5-entry and 7-entry portions of the Tailgate 1 North, both inby and outby the longwall face. This degradation became progressively worse over time. Floor heave extended from the tailgate entry itself across the section to the No. 1 Entry, the farthest away from longwall side abutment stress.

Emergency Response Plan (ERP)

The MINER Act of 2006 requires all mine operators to develop Emergency Response Plan (ERP)s. The ERP in effect on April 5, 2010 was approved on January 25, 2010. The ERP defines how the company will respond to mine emergencies that occur at the mine.

The approved ERP addressed the following sections:

Training

The ERP required the operator to train miners within 30 days of approval on the provisions of the plan. The approved ERP provided scenarios in which miners on the section and outby areas were to be provide instruction on assembling, evacuation, and donning a SCSR.

Mine Communication and Tracking

Mine operators are required to provide a post-accident communication system between underground personnel and surface personnel, via a wireless two-way medium and an electronic tracking system, which permits surface personnel to determine the location of any persons trapped underground. Operators were required by the Mine Improvement and New Emergency Response (MINER) Act to submit plans by June 15, 2009 to address this requirement. If the fully wireless provisions cannot be adopted, the MINER Act requires that ERP's set forth an alternative means of compliance that approximates, "as closely as possible, the degree of functional utility and safety protection provided by the wireless two-way medium and tracking system." The operator submitted an ERP plan on October 9, 2009. This plan stated that a leaky feeder (radio) system was already installed in the mine to provide a wireless means of communication. It also stated that a tracking system was in the process of being installed. This plan was approved on January 25, 2009.

According to witness testimony, installation of the leaky feeder communication system began on or about October 6, 2009. The system consisted of a coaxial distributed antenna system from which radio frequencies could be transmitted and received. Within range of the coaxial cable, miners could communicate with Ultra-High Frequency (UHF) radios. The tracking system utilized a "tracking tag" transmitter worn by miners, which sent signals to a "tag reader" repeater. When a tracking tag signal was received by the tag reader, it re-transmitted this signal across the leaky feeder system, back to the surface. Miners had to be in range of the tag reader before any signals were transmitted to the surface. The operator had a computer system that recorded when a miner's tracking tag signal was received. When a miner left the tag reader's coverage area, the last known time the miner was located or traveling by the tag reader could be seen in the computers' tag reader database.

As of April 5, 2010, the communication and tracking system was partially completed. The leaky feeder system was approximately 1,250 feet from the face of the HG 22 section, and approximately 750 feet from the TG 22 section. The leaky feeder was installed in the belt entry to the stageloader, and in the track entry to the mule train of the longwall section. The last tag reader for the tracking system was installed at the Mother Drive of the longwall conveyor. This tag reader is approximately 2,700 feet from the longwall face, 3,700 feet from the face of TG 22, and 7,000 feet from the face of HG 22.

After the explosion, mine rescue personnel could not determine the number of miners underground until 1:40 a.m. on April 6, when the correct number of miners underground were reported. The ERP requires PCC to manually track miners in locations where the tracking system is inoperative, but in this case, miners were not tracked properly, a sufficient number of tag readers were not installed, and existing tag readers were not maintained. 27 tag readers were inoperative prior to the explosion and no tag readers were working inby the South Portal area. In addition, not all employees who went into the mine were entered in the computer database, the tracking system did not have an identifiable number entered into the computer that matched the miner's belt tag, and miners were going underground without taking an assigned tracking tag.

Other deficiencies identified regarding the operator's compliance with the communications and tracking requirements of the approved ERP included:

- Leaky feeder amplifiers that were blowing fuses, causing the system to be ineffective for providing adequate post-accident communications; and,
- Several tag readers in the database that were not storing data properly. The readers were displaying data from a previously selected reader; and
- The difficulty of determining the number of miners using only the tracking system's computer screen.

Testimony provided by mine employees indicates that the operator did not utilize sufficient resources on a daily basis to provide an adequate post-accident communication and tracking system. Two mine employees were assigned to install the system, while performing other duties. Appendix AJ describes in greater detail the communication and tracking system.

Mine Emergency Evacuation and Firefighting Program of Instruction (MEEFP)

The Mine Emergency Evacuation and Firefighting Program (MEEFP) is designed to instruct miners in the procedures for mine emergencies that present an imminent danger to miners from fire, explosions, and inundations, and to evacuate all miners not required for a mine emergency response (Appendix AK). 30 CFR §§ 75.1502 and 75.1504 in an operator's program require quarterly drills to be performed. Training drills dealing with emergencies including fires, water inundation, gas inundation, and explosions must be performed on a quarterly basis. The records for the five quarters preceding the explosion on April 5, 2010, show that no explosion drill training was conducted.

MSHA reviewed the operator's approved plans, records, and testimony, and identified deficiencies in the operator's MEEFP. Emergency drill records provided by PCC for the five quarters preceding the explosion revealed that PCC failed to conduct emergency evacuation training in all required topics for all required miners.

<u>Atmospheric Monitoring System (AMS)</u>

The requirements for the AMS are set forth in 30 CFR §§ 75.350, 75.351, and 75.352. The company was required to fulfill these requirements because the mine utilized belt air to ventilate the longwall working section prior to the explosion. The operator's AMS consisted of hardware and software capable of measuring atmospheric parameters, such as CO. Atmospheric measurements were transmitted from the underground mine to two surface computers. The system was primarily comprised of CO sensors along the belt conveyor system. These sensors were programmed to alarm if the CO level reached 10 ppm. An AMS operator was required to be stationed on the surface, where alarms would be registered. The AMS operator should have been trained in accordance with 30 CFR § 75.351(q), to understand the system, and it has the primary responsibility to respond to emergencies. MSHA reviewed the computer system's event log data, mine maps, and CO monitoring devices in the explosion area. Appendix AJ provides details of the system design, layout, and event data.

Damage to several CO sensors was observed along belt entries in the explosion area. The AMS cable was severed at crosscut 89 of the North Glory Mains. According to the computer system's event log, the first occurrence of an alarm on April 5 was for a communication failure that occurred at 3:08:01 p.m. (computer system time). It was determined after the explosion that the computer's clock was fast. Time drift analysis was conducted on the Pyott-Boone system resulting in unexplainable results. Details of these analyses are included in Appendix AJ.

The AMS event log showed no signs of a fire underground prior to the explosion. According to the event log, approximately 26 minutes prior to the explosion, CO sensor 1.51 at Ellis 5 Head Drive alarmed and cleared quickly. This was considered a "nuisance alarm" and occurred commonly at this mine.

All CO sensors, belt monitors, and other system components inby crosscut 81 of the North Glory Mains went into communication failure immediately after the explosion. Several sensors, from crosscut 81 outby, went into alarm, starting at the 6 North belt starter CO sensor 1.95, and progressing outby to the 4 North CO sensor 1.82. These sensors were showing varying concentrations of CO for approximately 15 minutes after the explosion, until all the CO sensors in the North section of the mine stopped communicating. The communication failure was possibly due to either the loss of backup power from the uninterruptible power supplies, or a loss of data signal.

Several deficiencies were discovered with PCC's AMS compliance requirements during the investigation. These deficiencies include:

1. CO sensor spacing was not maintained at 1,000-foot intervals on the HG 22 section, as required. The conveyor belt was approximately 3,750 feet in length. There was only one sensor provided between the HG 22 head drive sensor 1.103 and the section CO sensor 1.53.

2. The CO sensor map was not up-to-date. Sensors were not always shown on the map, and some were shown at incorrect locations. Directions of air flow were shown in the wrong direction compared to other mine maps.

3. AMS operators did not take the correct actions when alarms were received on the surface. Operators failed to have miners removed from underground on three different occasions, when two consecutive alarms occurred.

4. AMS operators did not always record actions taken to correct system malfunctions or failures.

5. Many of the CO sensors were not being calibrated every 31 days. PCC did not indicate that each sensor was being calibrated in the handwritten record book, but instead would indicate that a particular belt's CO sensors were calibrated. The AMS computer's data showed that PCC failed to calibrate some of the CO sensors along belt flights. During the last required 31-day calibration, PCC recorded that the 4 North and 5 North conveyor belts' CO sensors were calibrated. In contrast, the computer log showed that six CO sensors were not calibrated on these two conveyor belts.

6. Not all of the AMS operators at the mine were trained adequately.

7. According to the event log, many nuisance alarms were not being addressed by PCC.

8. CO sensors located at the 6 North drive and the 5 North tailpiece were not positioned correctly.

Refuge Alternatives

Three refuge alternatives were located in the northern portion of the mine (see Appendix H). These three units were Strata Portable Fresh Air Bay units that included inflatable tents. Although the mine rescue efforts after the explosion were, in part, based on the hope that survivors had managed to reach these refuge alternatives and utilize the life-support functions of the units, none of the refuge alternatives were deployed.

Personnel from A&CC, along with representatives from WVOMHST, GIIP and PCC, inspected these refuge chambers on March 31, 2011. All three units were successfully deployed and appeared to be fully functional. Details of this investigation and photos of the refuge alternatives are shown in Appendix AL.

Self Contained Self Rescuers

NIOSH Testing

The Self Contained Self Rescuers (SCSR) used at UBB were manufactured by CSE, Model Number SR-100. NIOSH researchers in Bruceton, Pennsylvania tested a number of SCSRs which MSHA recovered from various underground areas of UBB during the rescue and recovery operations and the accident investigation. The testing included visual inspections, functional tests, and disassembly. Some of the units endured obvious damage from the explosion and, accordingly, were only visually inspected. All of the remaining SCSRs passed the functional tests except for one, PE-39-a, which showed problems with its actuator bottle. Disassembly of this unit revealed a manufacturing defect near the “O” ring seal which allowed air to slip around the seal. NIOSH researchers determined that this condition did not diminish the unit’s ability to generate oxygen and that the unit would have functioned as required. Upon disassembly of the rest of the SCSRs, NIOSH researchers determined that the defect was anomalous and had only affected PE-39-a. In sum, all units performed as expected with no problems.

Disassembly of the units also involved visual examinations of the units’ chemical beds. Based on these examinations, NIOSH researchers were able to determine which units had been used (i.e., whether oxygen had been consumed) as well as the extent to which the units had been used (i.e., how much oxygen had been consumed. (Appendix AM)

SCSRs apparently used by Blanchard and another top company official

During its investigation, MSHA found six deployed SCSRs in various locations in the area affected by the explosion. MSHA later determined that Blanchard and another top company official most likely deployed and used these SCSRs during their exploration activities following the explosion. The investigation team was unable to determine the purpose or extent of their travels as both individuals exercised their rights under the Fifth Amendment and declined to be interviewed by MSHA.

ROOT CAUSE ANALYSIS

The Accident Investigation Team performed an analysis to determine the root cause and other significant factors that contributed to the accident. Eliminating these causes would have prevented the loss of 29 lives and the two significant injuries resulting from the explosion at UBB.

Root Cause: Performance Coal Company (PCC) and Massey management engaged in practices and procedures that resulted in non-compliance with the Mine Act and regulations. PCC/Massey engaged in intimidation of miners; had a policy of illegal advance notice of MSHA inspections; did not comply with their own training plan; and intentionally failed to maintain required books recording hazards known to the company. PCC and Massey's actions reflected a pervasive culture that valued production over safety creating a significant threat to the safety and health of UBB miners and contractors. Specifically:

- Miners were routinely intimidated by PCC and Massey managers. They did not report safety problems at the mine because of fear of retaliation. They were also discouraged from listing hazards in the required examination records and correcting them. MSHA cannot be in every mine every day, and it relies on miners to report hazardous conditions in the mine. PCC and Massey's actions deprived miners of the right to participate in their own safety.

- PCC and Massey established a practice of providing advance notice to those on the surface and underground when enforcement personnel were at the mine. Mine security personnel were instructed to notify the mine personnel when inspectors arrived on mine property. Mine personnel then informed persons underground that an inspector was present at the mine. This advance notice gave those underground the opportunity to alter conditions and fix hazards prior to the inspector's arrival on the section. Advance notice resulted in limited rock dusting and ventilation changes in areas where inspectors were expected to travel. At time foremen shut down the working section before the inspector arrived.

- PCC and Massey kept two sets of books. They were aware of hazards and noted them in a production or maintenance record but in many instances failed to record them as required in the official examination book. Had these hazards been recorded as required in the official book, inspectors and miners would have had the opportunity to understand and assess the hazards and ensure they were corrected.

The investigation team also recognizes that other contributory factors, detailed below, played a significant role in the accident at UBB. These factors further reflect the disregard for miners' safety and for the obligation to comply with the Mine Act and regulations. Had these resulting contributory factors not existed, the explosion would have been averted. The new mine operator will need to develop and implement a comprehensive corrective action plan to address all of these issues.

Contributory Factor: PCC and Massey did not comply with the approved training plan; many miners did not receive training in hazard recognition, prevention of accidents, roof control, ventilation and other mining plans, and the training required in new work tasks. The lack of training was corroborated by the conditions in the mine, which led to the explosion.

Contributory Factor: PCC and Massey did not perform adequate pre-shift, on-shift, and weekly examinations. Mine examiners did not identify numerous existing hazardous conditions throughout the mine. Several air courses had not been examined in the proper time frame or were not being examined at all. Examiners and section foremen did not energize their multi-gas detectors when required and the detectors often remained de-energized for extended periods of time. As a result, examiners could not and did not take adequate air quality measurements and often recorded false measurements in the examination records. In addition, examinations were not being consistently performed in the tailgate entry near the longwall face. Finally, on-shift respirable dust parameter checks were not being performed as required on the longwall section, and tests for methane were not consistently being made at 20 minute intervals on the longwall when the shearer was operating.

Contributory Factor: PCC and Massey did not correct or post hazardous conditions immediately. Numerous reported hazardous conditions remained uncorrected. For example, belt examination records regularly indicated the need for cleaning and/or rock dusting on several consecutive shifts without any corrective actions being taken.

Contributory Factor: PCC and Massey did not maintain the longwall shearer in safe operating condition. At least two worn bits were present on the face ring of the tail drum of the shearer. Both of these bits were clearly missing their carbide tips.

Contributory Factor: PCC and Massey did not comply with the approved ventilation plan. The tailgate end drum of the longwall shearer was being operated with missing and clogged water sprays. Seven sprays were missing. As a result of the missing sprays, no pressure could be measured on the shearer tailgate drum.

Contributory Factor: PCC and Massey did not maintain the volume and velocity of the air current at a sufficient volume and velocity to dilute, render harmless, and carry away flammable, explosive, noxious, and harmful gases, dusts, smoke, and fumes, in the areas where persons worked or traveled.

Contributory Factor: PCC and Massey did not comply with the approved roof control plan. The required supplemental roof support in the tailgate entry of the longwall was not installed. The failure to maintain the required tailgate support contributed to the inability to properly ventilate the explosive mixture of gas that accumulated in the tailgate.

Contributory Factor: PCC and Massey did not rock dust the mine adequately. A mine dust survey was performed in the area affected by the explosion. Of the 1353 samples collected in the flame zone, 90.5 percent were non-compliant.

Contributory Factor: PCC and Massey failed to ensure that accumulations of loose coal, coal dust, and float coal dust were cleaned up and removed from the mine.

Corrective Actions: This mine has been under a Section 103(k) order since April 5, 2010, and has been the subject of an ongoing investigation. Massey Energy no longer owns and operates the mine at UBB. The new corporate owner must take the actions necessary to prevent unsafe and unhealthful conditions in its mines. MSHA will require the operator to take appropriate actions to address the root cause and each of the contributory factors. A commitment to health and safety must extend to all management members and corporate officials and be monitored and enforced at the highest levels. Those that instill and condone a dangerous culture must be held accountable for their actions or inactions.

CONCLUSION

The tragic deaths of 29 miners and serious injuries to two others at Upper Big Branch were entirely preventable. PCC and Massey routinely ignored obvious safety hazards and let conditions develop that allowed a small methane ignition to propagate into a massive coal dust explosion. MSHA's investigation revealed that the dangerous conditions existing at UBB were the result of PCC and Massey's practices and procedures that resulted in non-compliance with the Mine Act and regulations. This included intimidating miners to discourage them from reporting hazards or stopping production to make needed corrections; routinely giving advance notice of inspections; failing to train miners adequately; and not recording hazards in required examination books.

Along with these practices, PCC and Massey failed to take other safety precautions that would have prevented the explosion from occurring. They did not conduct examinations properly, did not correct hazards, and did not maintain the longwall shearer in the correct working condition. In addition, PCC and Massey failed to comply with the approved ventilation and roof control plans, inadequately applied rock dust and did not clean up extensive amounts of loose coal, coal dust and float coal dust accumulations.

MSHA concluded that the explosion at UBB originated as a methane ignition that led to a methane explosion and then transitioned into a massive coal dust explosion. It most likely started with an initial methane ignition caused by the cutting bits on the tail drum of the longwall shearer, which likely generated hot streaks on the sandstone roof or floor. The flame from the initial ignition then ignited an accumulation of methane. It encountered this methane because of PCC's poor roof control practices, which restricted the airway through the next inby crosscut, thereby allowing methane to accumulate.

Once a localized methane explosion occurred, it encountered fuel in the form of coal dust and float coal dust beginning in the tailgate entries that were inadequately rock dusted. Examiners had allowed these and other accumulations at other locations in the mine to build up over days, weeks, and months. If float coal dust had not accumulated and the mine dust had contained sufficient quantities of incombustible content, the localized methane explosion would not have propagated any further. PCC did not apply adequate quantities of rock dust in the affected area; as a result, the coal dust and float coal dust allowed the localized methane explosion to propagate into a massive coal dust explosion that quickly spread throughout the northern section of the mine. The explosion resulted in the worst mining disaster in the United States in the last 40 years.

Kevin G. Stricklin Administrator for Coal Mine Safety and Health	12/6/11 Date

ENFORCEMENT ACTIONS

A 103(k) order was issued to ensure the safety of all persons until an investigation was completed and the area and equipment deemed safe. Twelve violations that were deemed to have contributed to the accident were issued to PCC. Of this number, nine were designated as flagrant violations. Two additional contributory citations were issued to DSC. Other violations deemed not to have contributed to the cause or severity of the accident were cited separately and are not addressed in this report.

Control Order No. 4642503 under Section 103(k) of the Mine Act

An accident occurred at this operation on 4/5/2010 at approximately 3:27 p.m. This order is being issued, under the Federal Mine Safety and Health Act of 1977 Section 103(j), to prevent destruction of any evidence which would assist in investigating the cause or causes of the accident. It prohibits all activity in the underground areas of the mine except to rescue and recover miners.

The initial order is modified to reflect that MSHA is now proceeding under the authority of Section 103(k) of the Federal Mine Safety and Health Act of 1977. This Section 103(k) Order is intended to protect the safety of all persons on-site, including those involved in rescue and recovery operations or investigation of the accident. The mine operator shall obtain prior approval from an Authorized Representative of the Secretary for all action to recover and/or restore operations in the affected area. Additionally, the mine operator is reminded of its existing obligations to prevent the destruction of evidence that would aid in investigating the cause or causes of the accident.

104(a) Citation No. 8431853, Section 103(a) of the Mine Act, S&S, Reckless Disregard

Section 103(a) of the Mine Act states that: "Authorized representatives of the Secretary… shall make frequent inspections and investigations in coal or other mines each year…" and that "In carrying out the requirements of this subsection, no advance notice of an inspection shall be provided to any person…". The mine operator has failed to comply with this section of the Mine Act. Testimony given by both management and hourly employees during the accident investigation indicates that the mine had a regular practice of notifying persons underground that an inspector was present on the surface. Underground employees would regularly cease production to correct hazards prior to the possible arrival of the inspectors. This advance notice prevented MSHA inspectors from observing the actual conditions to which miners were being exposed.

Unannounced inspections are a key part of MSHA's effort to identify unsafe and unhealthy conditions in mines. By providing advance notice of inspections, the mine operator has interfered with inspectors in their attempts to inspect the mine and has shown a reckless disregard for the health and safety of their miners.

This violation of the Mine Act contributed to the death of 29 miners in that MSHA was denied the opportunity to develop additional guidelines, discover hazards, and make inspections of the actual conditions at the mine.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

<u>104(d)(2) Order No. 8250014, 30 CFR §75.220(a)(1), S&S, High Negligence</u>

The operator failed to comply with the approved roof control plan, in the 1 North Panel tailgate entry. Page 19 of the plan stipulates that in longwall development entries of initial longwall panels, "the Tailgate Entry will have supplemental support in the form of two rows of 8' (foot) cable bolts or posts installed between primary support. This supplemental support shall be maintained 1000 feet outby the longwall face at all times." The operator failed to install the required supplemental supports in the tailgate entry adjacent to the 1 North longwall panel. The operator failed to install cable bolts and only installed one row of posts in the tailgate entry.

Required tailgate support is significant because observations indicate that crosscut 49, (the first crosscut inby the face) had already caved prior to the face reaching crosscut 48, (the crosscut outby the face) as evidenced by observations of soot, coal dust and debris on the fall rubble. Roof failure in crosscut 49 restricted airflow from traveling inby from the face. The failure to maintain the required tailgate support contributed to the inability to properly ventilate the explosive mixture of gas accumulation in the tailgate and contributed to the explosion that occurred on 4-5-2010 that resulted in the deaths of 29 miners.

The failure to maintain the required supports in the tailgate entry also prevented safe access for mine examiners from conducting required examinations in those entries.

The failure to maintain the required supports in the tailgate entry also prevented examiners from conducting required examinations in those entries.

The installation of one row of posts rather than the required two rows would have been very evident to weekly examiners, Longwall preshift and on-shift examiners and the Longwall Coordinator. Testimony revealed that examiners were instructed that one row of supports was sufficient in the tailgate entry.

The operator has engaged in aggravated conduct constituting more than ordinary negligence. This is an unwarrantable failure to comply with a mandatory standard.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc. and Massey Energy Company.

104(a) Citation No. 8227560, 30 CFR §75.321(a)(1), S&S, Moderate Negligence

The operator has failed to maintain the volume and velocity of the air current in the areas where persons work or travel to dilute, render harmless, and carry away flammable, explosive, noxious, and harmful gases, dusts, smoke, and fumes.

The air current at the Longwall tail (Tailgate 1 North, crosscut 48) was not sufficient to dilute, and render harmless, and carry away flammable, explosive, noxious and harmful gases, dusts, smoke, and fumes. An explosive mixture of gases was allowed to accumulate in the vicinity of the shearer which was located at the tailgate end of the longwall. An ignition of this mixture resulted in a mine explosion on 4/5/2010 and propagated throughout areas of the mine including the longwall, HG 22, and TG 22 sections. This explosion resulted in the deaths of 29 miners, disabling injuries to one miner, and serious injuries to another miner.

In addition to the occurrence of the explosion, the following facts establish that the air current at the tailgate end of the longwall was inadequate:

The mine has a history of methane incidents on prior longwall panels. These incidents put the operator on notice for methane hazards on the longwall face. These incidents include:

- A methane ignition / explosion that occurred on 1/4/1997 at No. 2 West Longwall.
- A methane outburst that occurred on 16 Longwall panel in July of 2003.
- Another methane outburst occurred on 17 Longwall panel on 2/18/2004.

These incidents all occurred in a fault zone and while mining with an overburden in the excess of 1,000 feet. The accident on 4/5/2010 occurred in this same fault zone.

This mine was on a 103 (i) spot inspection due to the methane liberation.

The operator failed to implement / follow the recommendations of MSHA's geologist and Ventilation technical support group following the 2004 outburst. These recommendations included:

- Increasing airflow along the longwall face (the plan at the time required a minimum of 60,000 cfm).
- Degasification wells for the subsequent longwall panels in an effort to bleed of gas prior to encroachment of the longwall face.
- Construct a hazard map that showed areas with 1,100 feet of overburden and less than 13 feet of interburden between the eagle and lover eagle seams. Additionally this map should show the projected structural zone identified in headgate 18, and overmined areas.

The operator’s failure to maintain a sufficient volume and velocity to dilute, render harmless, and carry away flammable, explosive, noxious, and harmful gases, dusts, smoke, and fumes contributed to the deaths of 29 miners.

- This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 8431838, 30 CFR §75.360, S&S, Reckless Disregard

The operator has engaged in a practice of failing to conduct adequate preshift examinations in the north area of the mine where an explosion occurred on April 5, 2010 which resulted in 29 fatalities and serious injuries to two miners. The inadequate examinations occurred from 1.1.2010 up to the date of the explosion.

The practice includes violations of the following subsections of 75.360:

(a)(1) Miner testimony obtained during the accident investigation indicates that miners entered the mine prior to the completion of the preshift examinations.
An agent of the operator, Jeremy Burghduff, failed to conduct a preshift examination prior to two miners on the pumping crew entering the work area for at least 19 shifts from 03.18.2010 through 04.05.2010. Testimony indicates that the two miners traveled with Mr. Burghduff while he conducted the preshift examination. In addition, data downloaded from Burghduff's Solaris multi-gas detector reveals that the detector had not been turned on from 03.18.2010 until after the mine explosion on 04.05.2010. With his detector turned off, Burghduff was unable to test for methane or oxygen deficiency as required.
Another agent of the operator, John Skaggs, performed an inadequate preshift examination of the longwall on 4.4.2010 for the oncoming midnight maintenance shift. According to testimony, the examination consisted of examining the stage loader area. The examiner failed to examine the entire length of the longwall face, where miners were scheduled to and did work during the oncoming shift, and did not include the required air measurements.
Testimony indicates that examiners routinely failed to examine the tailgate entry of the longwall section.

(b) Over many shifts, several different examiners failed to adequately examine the areas along the travelways from the North Portal to/and including the three working sections: headgate 22, tailgate 22 and the longwall. The examiners failed to identify very obvious hazardous conditions throughout the examined areas. For example, accumulations of loose coal, coal dust, and float coal dust are present in the entries and crosscuts throughout these areas. Additionally, entry widths exceeded the required widths of the approved roof control plan in 16 locations.

(c)(2) The operator regularly failed to accurately measure the air quantity in the intake entries at the intake end of the longwall immediately outby the face.

(g) Preshift exam records for headgate 22 (03.25.2010), tailgate 22 (03.22.2010) and the longwall (03.10.2010) were not verified by the person conducting the examinations. The operator recorded hazardous conditions in its internal production and maintenance reports while failing to record the same hazards in its preshift examination records. This practice prevented MSHA, WVMSH&T, miners, and oncoming foremen from knowing of hazardous conditions and taking preventative measures. In the alternative, the operator failed to comply with 30 C.F.R. 75.363(b).

The failure to identify, record and correct hazards in one area of the mine can result in injury or loss of life in another part of the mine, due to the confined nature of the underground mining environment. The operator's practice of failing to conduct adequate preshift examinations, as well as the operator's practice of failing to conduct adequate weekly and on-shift examinations (as cited in 8431855 and 8227550), exposed miners to ongoing hazards. This practice of failing to conduct adequate preshift examinations and to identify and correct obvious hazardous conditions contributed to the explosion on April 5, 2010 and the resulting 29 deaths, disabling injuries to one miner, and serious injuries to another miner.

The operator engaged in aggravated conduct constituting more than ordinary negligence. This violation is an unwarrantable failure to comply with a mandatory standard.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc. and Massey Energy Company.

104(d)(2) Order No. 8227550, 30 CFR §75.362, S&S, Reckless Disregard

The operator has engaged in a practice of failing to conduct adequate onshift examinations in the north area of the mine where an explosion occurred on April 5, 2010 which resulted in 29 fatalities and serious injuries to two miners. The inadequate examinations occurred from October, 2009 up to the date of the explosion.

The practice includes violations of the following subsections of 75.362:

(a)(1) The operator failed to identify obvious accumulations of loose coal, coal dust, and float coal dust that were present in various locations in the entries and crosscuts of the travelways for HG 22, TG 22, and Longwall sections and on the sections. These hazardous conditions existed over several shifts and should have been observed, recorded and corrected by examiners.

(a)(2) The operator engaged in a practice of failing to conduct adequate onshift examinations of the longwall equipment within one hour of the shift change or before production began to ensure compliance with the respirable dust control parameters.

Numerous deficiencies on the longwall equipment existed as cited in Order No. 8227558 and Citation No. 8227552.

(d) The operator had a practice of failing to test for methane at 20 minute intervals during the operation of the shearer. On the day of the explosion six (6) 20 minute tests for methane were not conducted.

The failure to identify and correct hazards in one area of the mine can result in injury or loss of life in another part of the mine, due to the confined nature of the underground mining environment. The operator's practice of failing to conduct adequate onshift examinations, as well as the operator's practice of failing to conduct adequate preshift and weekly examinations, exposed miners to ongoing hazards. This practice of failing to conduct adequate onshift examinations and to identify and correct obvious hazardous conditions contributed to the explosion on April 5, 2010 and the resulting 29 deaths, disabling injuries to one miner, and serious injuries to another miner.

The operator has engaged in aggravated conduct constituting more than ordinary negligence. This is an unwarrantable failure to comply with a mandatory standard.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 4900578, 30 CFR §75.363(a), S&S, Reckless Disregard

The operator failed to immediately correct or post with conspicuous "Danger" signs hazardous conditions observed and recorded during the on-shift examinations of the belt conveyor systems in the north area of the mine (the area affected by the explosion on 4.5.2010). From 03.01.2010 through 04.05.2010, the operator's on-shift examination records identified approximately 982 hazardous conditions. Of these hazardous conditions, approximately 937 were listed as accumulations of coal and/or lack of rock dusting.

The preshift and onshift records do not indicate that the corrective actions required to address the listed accumulations were taken. Although some corrective actions were listed, most instances where cleaning and dusting was listed as being needed do not indicate that the required corrective actions were adequately performed.

The operator’s failure to immediately correct these hazardous conditions contributed to the death of 29 miners, disabling injuries to one miner, and serious injuries to another miner. Witness statements indicated that the belts were in need of cleaning and additional rock dusting. Investigators observed accumulations of combustible materials in the form of loose and compacted coal throughout the area affected by the explosion. Laboratory Analysis of the rock dust spot survey conducted by MSHA in the affected area after the April 5, 2010 explosion indicated significant non-compliance. The explosion propagated throughout this area where records show cleaning and rock dusting was needed but was not performed.

The operator engaged in aggravated conduct constituting more than ordinary negligence. This violation is an unwarrantable failure to comply with a mandatory standard.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 8431855, 30 CFR §75.364, S&S, Reckless Disregard

The operator has engaged in a practice of failing to conduct adequate weekly examinations in the north area of the mine where an explosion occurred on April 5, 2010 which resulted in 29 fatalities. The inadequate weekly examinations occurred from January 1, 2010 up to the date of the explosion. Weekly examinations of this area conducted during this period failed to identify and correct obvious hazardous conditions, including accumulations of combustible materials, and failed to effectively evaluate the performance of the mine's ventilation system.

The practice includes violations of the following subsections of 75.364 that occurred between 01.01.2010 and 04.05.2010:

Subsection 75.364(a) has been violated as follows:
1. Between 01.01.2010 through 04.05.2010, records show that the required weekly examinations of worked-out locations exceeded the required 7 days;
2. Evaluation Point (EP)-LW 1 (air entering Headgate 1 North to assure the headgate of the Longwall is ventilated) was last examined on 03.10.2010. An entry in the record for 03.16.2010 reflects that this EP is blocked with water and records do not indicate it was examined/or could be examined since that date;
3. Data downloaded from one examiner's multi-gas detector indicates that the detector had not been turned on since 03.18.2010. Records indicate this examiner conducted numerous examinations at Bandytown fan, EP-LW 3 (where air exits Headgate 1 North), and EP-TG 1 (where air exits Tailgate 1 North) with his detector turned off;
4. There is no record of EP 65 (return of TG 22 entering Headgate 1 North) ever having been examined;
5. One of the five required air readings (#3 entry) for the EP-LW 2 (Tailgate 1 North) was never taken;
6. No air quality measurements were taken at MP A (intake side of Longwall at Headgate 1 North) and MP B (Longwall tail side of Tailgate 1 North);
7. Air Quantity measurements were not taken at Monitoring Point (MP) B since 03.20.2010.

Subsection 75.364(b) has been violated as follows:

1. The intake split from the West Jarrells Mains to the return off HG 22, and the intake split traveling through old #2 section and crossover, located outby the Longwall, was not traveled;
2. The return split in the crossover between HG 22 and TG 22 was not traveled since 03.13.2010;
3. The intake split, #7 entry of Tailgate 1 North was not traveled since its plan approval on 03.11.2010.

Subsection 75.364(c) has been violated as follows:
1. Air quantity measurements were not taken for 13 intake air splits;
2. Air quality and quantity measurements were not taken for five return air splits.

Subsection 75.364(d) has been violated as follows:
1. The Operator has failed to immediately correct very obvious hazardous conditions that are present throughout ten air courses and two bleeders in the North area of the mine that existed prior to the mine explosion on 04.05.2010. Very obvious hazards of loose coal, coal dust, and float coal dust are present in numerous locations throughout the entries and crosscuts of the air courses that are required to be examined weekly. The explosion which occurred on 04.05.2010 propagated throughout these ten air courses and two bleeders. These areas that the explosion propagated through include intake and return air courses required to be traveled by the weekly examiner. This fire and explosion hazard was obvious to the most casual observer.
2. The Operator has failed to immediately correct areas where entry widths exceeded 21 feet for a distance of more than 5 feet, in 17 locations throughout various areas traveled by the weekly examiner.
3. Since 01.01.2010, hazardous conditions were listed in the weekly examination reports with no corrective action listed. Some of these same hazards were recorded for several consecutive weeks with no corrective action shown. For example, water accumulations in the longwall bleeders were recorded for eight consecutive weeks with no correction action noted.

Subsection 75.364(f) has been violated as follows:
The entry in the weekly examination record book on 03.16.2010 reflects that EP-LW1 was blocked by water and could not be examined. Although the entire mine could not be examined, persons continued to enter the mine and produce coal until the explosion on 04.05.2010.

Subsection 75.364(h) has been violated as follows:
The Operator failed to record hazardous conditions, their locations, corrective action taken, results and locations of air quality and quantity measurements at various times and various locations.

The failure to identify and correct hazards in one area of the mine can result in injury or loss of life in another part of the mine, due to the confined nature of the underground mining environment. The operator's practice of failing to conduct adequate weekly examinations, as well as the operator's practice of failing to conduct adequate preshift and on-shift examinations (as cited in 8431838 and 8227550), exposed miners to ongoing hazards. This practice of failing to conduct adequate weekly examinations and to identify and correct obvious hazardous conditions contributed to the explosion on April 5, 2010 and the resulting 29 deaths, disabling injuries to one miner, and serious injuries to another miner.

The operator has engaged in aggravated conduct, constituting more than ordinary negligence. This is an unwarrantable failure to comply with a mandatory standard.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A. T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 8226115, 30 CFR §75.400, S&S, Reckless Disregard

Loose coal, coal dust and float coal dust, was allowed to accumulate in active workings and on rock dusted surfaces. These accumulations of combustible materials existed throughout the following active workings inby survey spad station 19430: Old North Mains, Tailgate 1 North, Headgate 1 North, North Glory Mains, the Long Wall Face, Tail Gate 22 development section, Head Gate 22 development section, Jarrells Mains and the areas known as the Longwall cross over's.

Accumulations ranged from a thin observable layer of float coal dust on belt structures, cribs and various other types of stationary equipment to as much as four feet deep in travelways. The accumulations extended up to the entire entry width and extended as much as 120 feet in length. Many of these accumulations were created during the initial development stages of the mining process. Observations of the cited accumulations are consistent with belt examination records and testimony provided by several miners.

A mine explosion occurred on April 5, 2010 originating on the tailgate of the Longwall and propagating through these areas of the mine inby survey spad 19430. These accumulations of combustible material contributed to the deaths of 29 miners and the disabling injuries of one miner and the serious injuries to another.

The cited accumulations were obvious, extensive and existed for an extended period of time. The conditions were evident to mine management due to the hundreds of weekly, preshift and onshift examinations that had been conducted by examiners and countersigned by upper management during the time the area was developed from March of 2005 to April 5, 2010. These conditions would be obvious to the most casual observer and would have been recorded by any prudent and diligent examiner.

Based on the history of 75.400 violations and this mine being previously placed on a potential pattern of violations, the operator had been placed on notice that greater attention to compliance with 75.400 was needed. The lack of appropriate action to address this ongoing problem establishes that the operator has engaged in a practice of violating 75.400. This is an unwarrantable failure to comply with a mandatory standard.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 8226116, 30 CFR §75.403, S&S, Reckless Disregard

The operator has failed to adequately apply and maintain rock dust in such quantities that the incombustible content of the combined coal dust, rock dust, and other dust are not less than 65 per centum in intake air courses or 80 per centum in return air courses. Following a mine explosion on 04.05.2010 a mine dust survey was conducted by MSHA to determine the incombustible content of the combined coal dust, rock dust, and other dust in the mine. These survey samples provided a depiction of the pre-explosion incombustible content in the affected areas of the mine.

MSHA divided the underground workings into 22 separate sampling areas beginning at survey spad 22382 along the Ellis Track entry and survey spad 7301 along the North Mains and extending inby to the deepest accessible portions of the mine affected by the explosion. Areas 18, 20, 21 and 22 inby the Longwall face were not accessible due to adverse roof conditions. Sampling locations were designated on a mine map for each area. Those locations were spaced every 500 feet in areas outby crosscut 67 of Old North Mains and approximately every 100 feet in areas inby crosscut 67. Sampling on 100-foot centers has been shown to offset any dust transport that may have occurred during an explosion. MSHA identified 2,207 locations for band sampling. If an area was too wet or inaccessible due to hazardous conditions, MSHA did not take a sample. Of the 2,207 intended sampling locations, MSHA took samples at 1,803 locations because actual mine conditions dictated that 404 locations were either too wet or otherwise inaccessible for sampling. MSHA sent all 1,803 samples for analysis to determine their incombustible content. Of the 1803 samples collected 1412 of the samples were non-compliant (78.31 percent). Of the 22 sampling areas designated by MSHA, flame propagated through 12 of these areas (area 5 at crosscut 67 and extending inby, and areas 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 and 19). Flame propagation could not be determined in areas 18, 20, 21 and 22 due to inability to collect samples. The flame propagation through these areas directly contributed to the deaths of 29 miners.

The results of the 1353 mine dust samples collected by MSHA within the area encompassed by flame propagation (determined by the extent of coking found in the dust samples collected) show that the operator failed to adequately apply and maintain rock dust on the top, floor, and ribs of this underground coal mine. Of the 1353 total samples collected from the flame propagation area, 1225 were non-compliant (90.5 percent). The failure by the operator to adequately rock dust these areas of the mine allowed a coal dust explosion to propagate, resulting in the deaths of 29 miners and injuries to others. The operator has engaged in aggravated conduct and more than ordinary negligence by failing to adequately rock dust and maintain the incombustible content in these areas of the underground coal mine to control dangerously volatile accumulations of combustible material. This is an unwarrantable failure to comply with a mandatory standard.

This order is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(a) Citation No. 8227549, 30 CFR §75.1725(a), S&S, Moderate Negligence

The operator has failed to maintain the JOY 7LS Longwall Shearer in safe operating condition.

At least two worn bits were found on the outby bit ring on the drum. Both bits were clearly missing the carbide tip. These bits had noticeably large wear flats on them.

An explosion occurred at this mine on 4/5/2010 that resulted in 29 fatalities.

The most likely ignition source was the longwall shearer bits striking rock. Studies have shown that worn bits pose a significant ignition potential. This can occur when the steel shank of the bit strikes sandstone with a high quartz content and produces a hot molten streak. Studies have also shown that a well maintained tungsten carbide tip, when used with the proper attack and tip angles to prevent the steel shank from coming into contact with the sandstone, will greatly reduce the odds of a frictional ignition. Frictional heat from the worn bits striking rock is the most likely source of the ignition for the April 5, 2010 explosion. The failure to maintain the shearer in safe operating condition contributed to the deaths of 29 miners.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 8256726, 30 CFR §48.3, S&S, Reckless Disregard

The mine operator failed to comply with the approved training plan in effect at the mine prior to April 5, 2010. The approved training plan, dated March 29, 2007, required training to be provided in several training programs, including experienced miner training, task training, and annual refresher training. The operator’s failures included:

1). Approximately 112 miners either did not receive experienced miner training or received incomplete experienced miner training.

2). Approximately 42 miners did not receive task training before performing the task as mobile equipment operators or performing other new job tasks.

3). Approximately 21 miners did not receive annual refresher training.

4). Approximately 22 miners received experienced miner training from individuals who were not MSHA-approved instructors. Nine different individuals certified these miners' training records despite not being MSHA-approved instructors.

Company audits conducted in September 2009 and October 2009 identified many of these failures, which put the operator on notice of its compliance problems. As of April 5, 2010, the operator had failed to correct or address most of these failures.

Due to the operator's failure to comply with the mine's approved training plan, many miners did not receive training in hazard recognition, prevention of accidents, and the mine's roof control and ventilation plans (including the mine's methane and dust control plan for the longwall water spray system). The operator also failed to provide task training to many of its examiners, its rock dusting crew, and several miners who operated and maintained the longwall shearer. The underground conditions at the mine, including the extensive accumulations of loose coal, coal dust, and float coal dust, the lack of adequate rock dusting, and the poor condition of the longwall shearer, were present in part because of the operator's failure to provide adequate training on identifying and correcting these hazardous conditions. These conditions contributed to the deaths of 29 miners on April 5, 2010.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(2) Order No. 8227558, 30 CFR §75.370(a)(1), S&S, Reckless Disregard

The mine operator failed to follow the approved ventilation plan in effect at the mine on April 5, 2010.

The operator failed to comply with the methane and dust control plan portion of the approved ventilation plan approved on June 15, 2009 for the 050-0 MMU. The approved methane and dust control portion of the ventilation plan requires that the JOY 7LS Longwall shearer be equipped with 109 water sprays, with 43 water sprays on each drum. The plan further specified that these sprays operate at a minimum of 90 psi at each spray block.

Evidence obtained during the investigation of an explosion accident revealed that the shearer was being operated with missing and clogged water sprays. Seven sprays on the tailgate drum were missing. As a result of the missing sprays, the pressure at the remaining sprays was significantly reduced below the 90 psi requirement. One function of the water sprays is to prevent a potential ignition source from frictional heat generated by the shearer bits striking rock. Such frictional heat from bits striking rock is the most likely source of the ignition for the April 5, 2010 explosion. The failure to comply with this plan requirement contributed to the deaths of 29 miners.

Operating the shearer with the missing sprays would have been obvious to casual observation. Testimony and company records indicate that operating the shearer with missing sprays was a practice at the mine. The operator has engaged in aggravated conduct constituting more than ordinary negligence. This is an unwarrantable failure to comply with a mandatory standard.

Standard 75.370(a) (1) was cited 33 times in two years at mine 4608436 (33 to the operator, 0 to a contractor).

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(a) Citation No. 4900615, 30 CFR, §75.363(a), S&S, Moderate Negligence

An employee of David Stanley Consultants LLC has failed to immediately correct or post with conspicuous "Danger" signs hazardous conditions observed and recorded during the examinations of the belt conveyor systems in the North area of the mine (the area of the mine affected by an explosion on 04.05.2010). From 03.05.2010 through 04.05.2010, David Stanley Consultants (YBV) employee William Campbell conducted 83 examinations along the conveyor belts affected by explosion. The record reflects that these conveyor belts needed rock dusting and/or cleaning. These hazardous conditions were almost never shown to be fully corrected or posted with conspicuous danger signs.

David Stanley Consultants LCC's failure to immediately correct these hazardous conditions contributed to the death of 29 miners, disabling injuries to one miner, and serious injuries to another miner. Witness statements indicated that the belts were in need of cleaning and additional rock dusting. Investigators observed accumulations of combustible materials in the form of loose coal and compacted coal throughout the areas affected by the explosion. Laboratory Analysis of the rock dust spot survey conducted by MSHA in the affected areas after the April 5, 2010 explosion indicate significant non-compliance. The explosion propagated throughout areas where records show cleaning and rock dusting was needed but was not performed.

This citation is being issued to the following entities as a unitary operator: Performance Coal Company, Massey Coal Services, Inc., A.T. Massey Coal Company, Inc., and Massey Energy Company.

104(d)(1) Citation No. 8431839, 30 CFR, §75.360, S&S, High Negligence

An employee of David Stanley Consultants LLC has failed to conduct adequate preshift examinations in the North area of the mine where an explosion occurred on April 5, 2010 which resulted in 29 fatalities and serious injuries to two miners. This employee of David Stanley Consultants performed inadequate preshift examinations for several months prior to the explosion.

The inadequate examinations include violations of the following subsections of 75.360:

(b) Over many shifts, the employee of David Stanley Consultants failed to adequately examine the areas along the travelways from the Ellis Portal to the three working sections: headgate 22, tailgate 22, and the longwall. The examiner failed to identify very obvious hazardous conditions throughout the examined areas. For example, accumulation of loose coal, coal dust, and float coal dust were present in the entries and crosscuts throughout these areas. Additionally, entry widths exceeded the required widths of the approved roof control plan in at least 16 locations.

(g) The examiner conducted preshift examinations on the tailgate 22 section, headgate 22 section, intake rooms off the North Mains and Glory Hole Mains, and travelways/track entries. For these locations, the examiner repeatedly failed to record the results of the required air quality checks.

The failure to identify, record and correct hazards in one area of the mine can result in injury or loss of life in another part of the mine, due to the confined nature of the underground mining environment. The contractor's failure to conduct adequate preshift examinations exposed miners to ongoing hazards. This failure to conduct adequate preshift examinations and to identify and correct obvious hazardous conditions contributed to the explosion on April 5, 2010 and the resulting 29 deaths, disabling injuries to one miner, and serious injuries to another miner.

The contractor engaged in aggravated conduct constituting more than ordinary negligence. This violation is an unwarrantable failure to comply with a mandatory standard.

APPENDIX A

LIST OF DECEASED AND INJURED MINERS

Appendix A

Deceased Miners

Name	Age	Position
Carl C. Acord	52	Roof Bolter Operator
Jason M. Atkins	25	Roof Bolter Operator
Christopher L. Bell, Sr.	33	Longwall Utility
Gregory S. Brock	47	Electrician
Kenneth A. Chapman	53	Roof Bolter Operator
Robert E. Clark	41	Continuous Miner Operator
Charles T. Davis	51	Longwall Foreman
Cory T. Davis	20	Underground Apprentice
Michael L. Elswick	56	Beltman/Fireboss
William I. Griffith	54	Continuous Miner Operator
Steven J. Harrah	40	Assistant Mine Foreman
Edward D. Jones	50	Assistant Mine Foreman
Richard K. Lane	45	Longwall Foreman
William R. Lynch	59	Shuttle Car Operator
Joe Marcum	57	Continuous Miner Operator
Ronald L. Maynor	31	Scoop Operator
Nicolas D. McCroskey	26	Electrician
James E. Mooney	51	Shuttle Car Operator
Adam K. Morgan	21	Underground Apprentice
Rex L. Mullins	50	Headgate Operator
Joshua S. Napper	26	Underground Apprentice
Howard D. Payne	53	Roof Bolter Operator
Dillard E. Persinger	32	Shield Operator
Joel R. Price	55	Shearer Operator
Gary W. Quarles, Jr.	33	Shearer Operator
Deward A. Scott	58	Shuttle Car Operator
Grover D. Skeens	57	Maintenance Foreman
Benny R. Willingham	61	Roof Bolter Operator
Ricky L. Workman	31	Shuttle Car Operator

Injured Miners

Timothy Blake	56	Roof Bolter Operator
James K. Woods	54	Electrician

WEST JARRELLS MAINS
NORTH JARRELLS MAINS
BH 20
BH 2A
BH 2B
BH 2C
BH 15B
COMMUNICATIONS BOREHOLE
GLORY HOLE
BH 1B
BH 1C
HEADGATE # 22
BH 1A
BH 10A
BH 5B
No. 2 COMPRESSED AIR LINE SHAFT
POWER BOREHOLE
BANDYTOWN FAN SHAFT
PANEL No. 2 CROSSOVER
TAILGATE #22
BH 8A
NORTH GLORY MAINS
100 BH
BH HG21-2
HEADGATE 1 NORTH
BH 40B
BH HG21-1
1 NORTH LONGWALL
#1 BOREHOLE VERTICAL TURBINE PUMP
#2 BOREHOLE VERTICAL TURBINE PUMP
No. 1 COMPRESSED AIR LINE SHAFT
BH A
BH B
TAILGATE 1 NORTH
PANEL No. 1 CROSSOVER
PARALLEL OLD NORTH MAINS
OLD NORTH MAINS
ELLIS PORTAL MAINS
ELLIS PORTAL
BELT ENTERS ELLIS EAGLE MINE
OVERLAND BELT
NORTH MAINS
PARALLEL NORTH MAINS
LBB MAINS
LBB SUB MAINS
2ND RIGHT SUB MAINS
HEADGATE 11
HEADGATE 12
HEADGATE 14
HEADGATE 15
HEADGATE 16
HEADGATE 17
HEADGATE 18
HEADGATE 19
HEADGATE 20
SEALED AREA
15 PANEL
14 PANEL
13 PANEL
12 PANEL
11 PANEL
BARRIER SECTION (NO. 16 PANEL)
UBB PORTAL
PORTAL SECTION
11 PANEL
10 PANEL
9 PANEL
8 PANEL
7 PANEL
SILO PORTAL
OVERLAND BELT SYSTEM
NORTH FLATS MAINS
NORTH PORTAL MAINS
SOUTH PORTAL MAINS
4 PANEL
5 PANEL
3 PANEL
2 PANEL
1 PANEL
6 PANEL
LEFT NO. 1 PANEL
EAST MAINS
SEALED AREA
N
0'
500'
1000'
1500'
2000'
STOPPING
STOPPING WITH HOLE
STOPPING WITH MANDOOR
STOPPING WITH MANDOOR AND HOLE
BELT CHECK
CURTAIN
FLYPAD
EQUIPMENT DOOR
EQUIPMENT DOOR WITH HOLE
REGULATOR
OVERCAST
OVERCAST WITH HOLE
OVERCAST WITH MANDOOR
OVERCAST WITH MANDOOR AND HOLE
TRACK
CONVEYOR BELT
BELT HEAD
INTAKE AIR COURSE
BELT AIR COURSE
RETURN AIR COURSE
BELT AIR CONTAMINATED WITH RETURN AIR
ROOF FALL
FAN
CROSSCUT NUMBER
SEAL
LEGEND
Scale 1"=500'
APPENDIX – B
Mine Map
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

APPENDIX C

LIST OF MASSEY'S CORPORATE STRUCTURE AND EMPLOYEES

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 10-K

(Mark One)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2009

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission File No. 001-07775

MASSEY ENERGY COMPANY

(Exact name of registrant as specified in its charter)

Delaware	**95-0740960**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification Number)**
4 North 4th Street, Richmond, Virginia	**23219**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (804) 788-1800

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
Common Stock, $0.625 par value	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act:
None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☒ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ . No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes ☒ No ☐

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer or a smaller reporting company. See the definitions of "large accelerated filer," "accelerated filer," "non-accelerated filer" and "smaller reporting company" in Rule 12b-2 of the Exchange Act (Check One):

Large accelerated filer ☒
Accelerated filer ☐
Non-accelerated filer ☐
Smaller reporting company ☐
(Do not check if a smaller reporting company)

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ . No ☒

Item 10. Directors, Executive Officers and Corporate Governance

Executive Officers of the Registrant

Don L. Blankenship, Age 59

Mr. Blankenship has been a director since 1996. He has been Chairman and Chief Executive Officer since November 2000 and also held the position of President from November 2000 until November 2008. He has been Chairman and Chief Executive Officer of A.T. Massey Coal Company, Inc., our wholly owned and sole, direct operating subsidiary, since 1992 and served as its President from 1992 until November 2008. Mr. Blankenship was formerly President and Chief Operating Officer from 1990 to 1991 and President of our subsidiary, Massey Coal Services, Inc., from 1989 to 1991. He joined our subsidiary, Rawl Sales & Processing Co., in 1982. He is a director of the National Mining Association and the United States Chamber of Commerce.

Baxter F. Phillips, Jr., Age 63

Mr. Phillips has been a director since 2007. He has been President since November 2008. Mr. Phillips previously served as Executive Vice President and Chief Administrative Officer from November 2004 to November 2008, as Senior Vice President and Chief Financial Officer from September 2003 to November 2004 and as Vice President and Treasurer from 2000 to August 2003. Mr. Phillips joined us in 1981 and has also served in the roles of Corporate Treasurer, Manager of Export Sales and Corporate Human Resources Manager, among others.

J. Christopher Adkins, Age 46

Mr. Adkins has been Senior Vice President and Chief Operating Officer since July 2003. Mr. Adkins joined our subsidiary, Rawl Sales & Processing Co., in 1985 to work in underground mining. Since that time, he has served as section foreman, plant supervisor, President and Vice President of several subsidiaries, President of our Eagle Energy subsidiary, Director of Production of Massey Coal Services, Inc. and Vice President of Underground Production.

Mark A. Clemens, Age 43

Mr. Clemens has been Senior Vice President, Group Operations since July 2007. From January 2003 to July 2007, Mr. Clemens was President of Massey Coal Services, Inc. Mr. Clemens was formerly President of Independence Coal Company, Inc., one of our operating subsidiaries, from 2000 through December 2002 and our Corporate Controller from 1997 to 1999. Mr. Clemens has held a number of other accounting positions and has been with us since 1989.

Michael K. Snelling, Age 53

Mr. Snelling has been Vice President, Surface Operations of our subsidiary, Massey Coal Services, Inc. since June 2005. Mr. Snelling was formerly Director of Surface Mining of Massey Coal Services, Inc. from July 2003 until May 2005. Mr. Snelling joined us in 2000 and has served us in a variety of capacities, including President of our subsidiary, Nicholas Energy Co. Prior to joining us, Mr. Snelling held various positions in the coal industry including engineer, production supervisor, plant supervisor, general foreman, manager of contract mining, superintendent, mine manager and vice president of operations.

Michael D. Bauersachs, Age 45

Mr. Bauersachs has been Vice President, Planning since May 2005. Mr. Bauersachs joined us in 1998, and served as Director of Acquisitions from 1998 until 2005. Prior to joining us, Mr. Bauersachs held various positions with Zeigler Coal Holding Company and Arch Mineral Corporation.

Jeffrey M. Gillenwater, Age 45

Mr. Gillenwater has been Vice President, Human Resources since January 2009. In October 1999, Mr. Gillenwater became Director of Human Resources at our Massey Coal Services, Inc. subsidiary, and held the position of Director of External Affairs & Administration from October 2002 until January 2009. Prior to October 2002 he held the position of Human Resources Manager at several of our subsidiaries.

Richard R. Grinnan, Age 41

Mr. Grinnan has been Vice President and Corporate Secretary since May 2006. He served as Senior Corporate Counsel from July 2004 until May 2006. Prior to joining us, Mr. Grinnan was a corporate and securities attorney at the law firm of McGuireWoods LLP in Richmond, Virginia from August 2000 until July 2004.

M. Shane Harvey, Age 40

Mr. Harvey has been Vice President and General Counsel since January 2008. He served as Vice President and Assistant General Counsel from November 2006 until January 2008 and as Corporate Counsel and Senior Corporate Counsel from April 2000 until November 2006. Prior to joining us, Mr. Harvey was an attorney at the law firm of Jackson Kelly PLLC in Charleston, West Virginia from May 1994 until April 2000.

Jeffrey M. Jarosinski, Age 50

Mr. Jarosinski was appointed Vice President, Treasurer and Chief Compliance Officer in February 2009. Prior to that he served as Vice President, Finance since 1998 and Chief Compliance Officer since December 2002. From 1998 through December 2002, Mr. Jarosinski was Chief Financial Officer. Mr. Jarosinski was formerly Vice President, Taxation from 1997 to 1998 and Assistant Vice President, Taxation from 1993 to 1997. Mr. Jarosinski joined us in 1988.

John M. Poma, Age 45

Mr. Poma has been Vice President and Chief Administrative Officer since January 2009. Mr. Poma previously served as Vice President, Human Resources from April 2003 to January 2009. Mr. Poma served as Corporate Counsel from 1996 until 2000 and as Senior Corporate Counsel from 2000 through March 2003. Prior to joining us in 1996, Mr. Poma was an employment attorney with the law firms of Midkiff & Hiner in Richmond, Virginia and Jenkins, Fenstermaker, Krieger, Kayes & Farrell in Huntington, West Virginia.

Steve E. Sears, Age 61

Mr. Sears has been Vice President, Sales and Marketing, and President of our subsidiary Massey Coal Sales Company, Inc. since December 2008. Mr. Sears served as President of Massey Industrial and Utility Sales, a division of Massey Coal Sales Company, Inc., from December 2006 to December 2008. Mr. Sears has held various positions within the sales department. He joined us in 1981.

Eric B. Tolbert, Age 42

Mr. Tolbert has been Vice President and Chief Financial Officer since November 2004. Mr. Tolbert served as Corporate Controller from 1999 to 2004. He joined us in 1992 as a financial analyst and subsequently served as Director of Financial Reporting. Prior to joining us, Mr. Tolbert worked for the public accounting firm Arthur Andersen from 1990 to 1992.

David W. Owings, Age 36

Mr. Owings has been Corporate Controller and principal accounting officer since November 2004. Mr. Owings previously served as Manager of Financial Reporting since joining us in 2001. Prior to joining us, Mr. Owings worked at Ernst & Young LLP, the Company's independent registered public accounting firm, serving as a manager from January 2001 through September 2001 and as a senior auditor from October 1998 through January 2001 in the Assurance and Advisory Business Services group.

The following information is incorporated by reference from our definitive proxy statement pursuant to Regulation 14A, which will be filed not later than 120 days after the close of Massey's fiscal year ended December 31, 2009:

- Information regarding the directors required by this item is found under the heading *Election of Directors* .
- Information regarding our Audit Committee required by this item is found under the heading *Committees of the Board* .

- Information regarding Section 16(a) Beneficial Ownership Reporting Compliance required by this item is found under the heading *Section 16(a) Beneficial Ownership Reporting Compliance* .

- Information regarding our Code of Ethics required by this item is found under the heading *Code of Ethics* .

Because Common Stock is listed on the NYSE, our chief executive officer is required to make, and he has made, an annual certification to the NYSE stating that he was not aware of any violation by us of the corporate governance listing standards of the NYSE. Our chief executive officer made his annual certification to that effect to the NYSE as of May 21, 2009. In addition, we have filed, as exhibits to this annual report on Form 10-K, the certifications of our principal executive officer and principal financial officer required under Section 302 of the Sarbanes Oxley Act of 2002 to be filed with the SEC regarding the quality of our public disclosure.

APPENDIX D

LIST OF PERSONNEL WHO EXERCISED THEIR FIFTH AMENDMENT RIGHTS

Appendix D

List of Personnel who Exercised their Fifth Amendment Rights

Adkins, Chris
Asbury, Rob
Blanchard, Chris
Blankenship, Don
Chamberlin, Elizabeth
Clay, Greg*
Ferguson, Jamie
Frampton, Gary
Foster, Rick
Hager, Everett
Lilly, Eric
May, Gary
McCombs, Paul
Moore, Terry
Nicolau, Rick**
Persinger, Wayne
Roles, Jack
Ross, Bill
Whitehead, Jason

*Participated in one interview prior to asserting his Fifth Amendment rights when requested to come in for second interview.

**Initially asserted his Fifth Amendment rights then agreed to a voluntary interview at a later date.

APPENDIX E

MINE RESCUE PERSONNEL AND TEAMS RESPONDING

Appendix E

Mine Rescue Personnel and Teams Responding

The following teams participated in the UBB rescue and recovery. This list does not include members of the State or Federal teams or members of Task Force One. While not individually identified, their valuable contribution is appreciated.

Brooks Run Mining Company
Brooks Run North

Chris Ray	Leslie Clutter	Bobby Clutter
Pat Chapman	Kevin Bennett	Brad Cable
Teddy Sharp	Curt Clevinger	Pete Tanner
Jeff Bennett	Steve Dawson	

Rock Springs
Rock Springs - Gold

Dave Cook	Mike McGinnis	Mark Lovins
Thomas Marcum	Greg Spaulding	Zendil Nichols
Dennis Horn	Johnny Brown	

Rock Springs
Rock Springs - Blue

Greg Stepp	Neil Stepp	Eric Varney
Paul Messer	Stan Wonnell	Mark Jerasonek
Elmer Perry	Jarrod Cisco	

Kingston Resources
Kingston - White

Daniel Bragg	Gary Brooks	David Birchfield
George Smith	Ryan Haga	Jarrod Birchfield
Matt Price	Greg Fernett	

Kingston Resources
Kingston - Red

Phillip Saunders	Larry Helmick	Oscar Hughes, Jr.
John Crump	Shawn Tinchell	Jason Stone
Ernie Watkins	Nick Huddleston	

Cobra Natural Resources
Cobra

Doug Blankenship	Chuck Childress	Todd Collins
Paul McCloud	Brad Birchfield	Otto Bryant
Terry Lambert	Roosevelt Payne	Burns Diamond
James Murray		

Brooks Run Mining Company
Brooks Run South

Ken Perdue	Travis Grimmett	Darnell Baker
Joe Wyatt	Garreth Hubbard	Ronald Vance
James Greer	David Booth	Rages Matney

Wolf Run Mining Company
Wolf Run - Blue

Al Schoonover	Everette Kalbough	Marty Conrad
Kermitt Melvin	George Brooks	Brian Wachob
Craig Zirkle		

Wolf Run Mining Company
Wolf Run - White

Joe Runyon	Travis Anderson	Chris Chisolm
Mike DeLauder	Brandon Triplett	Shon Sublett
Brad Shoulders	Jeff Kelley	Scott Boylen

ICG Knott County, LLC
Hazard - Flint Ridge - Blue

Ron Hughes	George Gilbert	Lathan McIntosh
Charles Smith	John Collins	Tony Pennington
Jimmy Adams	Randy Feltner	Scott Thompson
Joe Tussey	Tony Osborne	

ICG Knott County, LLC
Knott County, LLC - White

Clark Meade	David McGuire	Marty Mitchell
William Sloan	Daniel Boggs	John Swiney
Rick Sturgill	Brandon Tackett	Steven Johnson

ICG Beckley, LLC
Beckley - Black

George Gibson	Eddie Persinger	Mike Robinson
Mike Gosnell	Jamie McClaugherty	Rodney Smith

ICG Beckley, LLC
Beckley - Gold

Raymond Coleman	James Griswold	Kevin Burnette
Ron Barr	Roy Smith	Zach Bowman
Jeff Varney	John Lucas	Gary Patterson
Richie Henderson		

Federal #2

John Sabo	Tim Fleeman	Justin Scott
Tyler Peddicord	Harry McGinnis	John Toothman
Bert Matheney	Richard Matheney	Mark Gouzd
Gary McHenry		

Southern Appalachia

David Blankenship	Kermit Rex Osborne	Kevin Wriston
Steve B. Southern	Matt Green	Greg Lukacs
Joe Runyon	Travis Miller	Jim Richey
Chris Green		

Magnum

Michael Balser	Justin Billups	Terreal Blankenship
Randy Boggs	Breton Crouse	Greg Fillinger
Robert Samuel Goodyear	Daniel R. Hudson	Travis Lett
Aaron Price	Shawn Smith	Thad Williams
Frank Foster	Harvey Ferrell	Terry Hudson

Cumberland Resources Corporation
Black Mountain Resources

Kentucky - Blue

Ronnie Biggerstaff	Don Walker	Jack Quillen
Randy Watts	Kevin Harris	Raymond Sturgill
Eddie Spangler	Donnie Thomas	Tim Turner

Kentucky - White

Jason Brown
Reno Johnson
Tom Asbury
Roger Gilliam
David Patterson
Tim Kiser
Tony Lloyd

Cumberland Resources Corporation
Cumberland Resources

Virginia - Maroon

Andy Anunson
Robbie Middleton
Billy Sluss
Larry Hall
Johnny Dishner
Kevin Baldwin
David Arnold
James Ramey

Virginia - Black

Travis Mullins
Casey Mooneyham
Chad Lane
Tommy Asbury
Jesse Moore
Shane Gibson
Vernon Brian Keith
Adam Phillips

Southern Pocahontas 1 and 2

Dewayne Blankenship
Don Cook
Eric Lowery
Raymond Simpson
Eddie Toler
Miles Blankenship
Johnny Goodman
Jonathan Mounts
Jamie Sloan
Randy Wright
Donnie Coleman
Pat Graham
Sampy Owens
Jordan Smith

Mountaineer 1 and 2

J. Dale Adkins
Logan Griffin
George Lawson
John Parsons
Burge Speilman
Michael Travis
Dave Boggs
William Holcomb
Jason McKinney
Bryan Petrosky
Tony Shields
Cary Fitzwater
Mike Hutchinson
Robbie Ortiz
Nathan Sharp
Christopher Stewart

Massey Southern WV 1 and 2

Rob Asbury
Mike Alexander
Jason Castle
Casey Campbell
Mark Bolen
Jamie Ferguson
Chris Adkins

Jim Aurednik
James Thomas
Scotty Kinder
Charles Kingery
Clinton Craddock
John Click

Shane McPherson
Larry Ferguson
Tommy Dove
Duane Thaxton
Jeremy McClung
Elizabeth Chamberlin

Sidney Coal Company, Inc.
Massey East Kentucky

Charlie Conn
Matt Owens
Jimmy Stanley
Mike Plumley

John Ball
Scotty Ernest
John Reed

Paul Adkins
Steve Miller
Tim Adkins

Knox Creek Coal Corporation
Massey Knox Creek

Mark Jackson
Chris Wilson
Matt Gates

Dave Elswick
Lanny Hart

Brad Hawkins
Daniel Orr

<u>Other Activities</u>

Mike Vaught
John Gallick
Perry Whitely
Joe Pugh

Ed Rudder
Allen Dupree
Chris Presley
Jeff Ellis

Randy McMillion
Brian Keaton
Mark Schuerger
Don King

APPENDIX F

UBB BOREHOLES

APPENDIX F

UBB BOREHOLES

Appendix F

UBB Boreholes

Borehole Name	Date Borehole Started	Date Borehole Stopped	Location	Crosscut	Depth
1A	4/06/10	4/07/10	HG 22	35	1,099
1B	4/06/10	4/08/10	HG 22	Missed	1094
1B (Redrilled)	4/22/10	4/28/10	HG 22	35	1100
1C	4/7/10		HG 22	Abandoned	
1C	4/17/10	4/20/2010	HG 22	Abandoned	95
2A	4/7/2010		West Jarrells Mains	161	1,151
2B	4/11/10	4/23/10	West Jarrells Mains	161	1,255
2C	4/11/10	4/21/2010	West Jarrells Mains	Abandoned	100
2D	5/21/2010	5/26/10	North Jarrells Mains	155	900
5B	4/08/10	4/10/2010	HG 22	Abandoned	1,005
10A	4/08/10	4/09/10	HG 22	Missed	1,130
15B	4/16/2010	4/22/10	North Jarrells Mains	142	1,259
8A	4/29/2010	5/07/10	TG 22	5	1,251
HG 21-1		6/06/10	Headgate 1 North	34	~1,160
HG 21-2	4/28/2010	5/04/10	Headgate 1 North	78	1,290

APPENDIX G

ACCIDENT INVESTIGATION PROTOCOLS

Performance Coal Company
Upper Big Branch Mine-South
Accident Investigation

U.S. Department of Labor
Mine Safety and Health Administration
1301 Airport Road
Beaver, West Virginia 25813-9426

State of West Virginia
Office of Miners' Health Safety and Training
1615 Washington Street, East
Charleston, West Virginia 25311-2126

Upper Big Branch Mine – South – Accident Investigation Protocols

The underground portion of the investigation being conducted at Upper Big Branch Mine – South of the April 5, 2010 explosion accident will be conducted pursuant to the following investigation protocols. The parties involved in the underground portion of the investigation include: The Department of Labor, Mine Safety and Health Administration (MSHA); the State of West Virginia, Office of Miners' Health, Safety and Training (OMHS&T); the State of West Virginia Governor's Independent Investigation Panel (GIIP); Performance Coal Company, including Massey Energy and any of its related entities (the Company); and duly recognized representatives of the miners of the Upper Big Branch Mine, including the United Mine Workers of America (UMWA).

General Protocols

1. The underground investigation will consist of the following teams:

   a. Five Mapping Teams;
   b. Ten Mine Dust Survey Teams;
   c. Three Electrical Teams;
   d. Three Photography Teams;
   e. One Flames and Forces Team;
   f. One Geologic Mapping Team;
   g. One Evidence Gathering Team.

   MSHA and OMHS&T may add additional teams as necessary.

2. Each investigation team will consist of at least one MSHA representative and at least one OMHS&T representative. One Company representative, one GIIP representative, and one miner's representative may accompany each team. Additional members may accompany the team at the discretion of the MSHA and OMHS&T representative(s).

3. The members of each team will remain together at all times while inside the mine.

4. Prior to traveling underground each day, specific assignments will be given to each team by MSHA's Accident Investigation Team, in consultation with the OMHS&T team.

5. The members of each team may take notes during the investigation.

Mapping Protocols

6. One map only shall be produced by each Mapping Team for each area of the mine. All team members shall sign and date the map when completed. It is anticipated that copies will be made at the conclusion of each shift. They will be distributed to each investigation team.

7. The originals will be retained by MSHA.

Mine Dust Survey Protocols

8. For purposes of the mine dust survey, the underground workings in or near the area affected by the explosion have been partitioned into 22 separate sections. Each of the Mine Dust Survey Teams will be assigned one or more of these sections of the mine to take MSHA compliant mine dust samples.

9. All 22 section locations are marked on a single map that is included in the packages provided to each Mine Dust Survey Team. The provided package also contains one or more individual section maps that are applicable to each individual Mine Dust Survey Team. The section maps clearly indicate the sample locations where that particular team is responsible for taking samples.

10. Only MSHA representatives will take samples. MSHA anticipates that on many occasions, it will obtain excess materials in its samples; in such cases, it will share this excess with the parties so that they may perform their own tests should they so desire.

11. Samples are to be taken at each location near to the center of the pillar. In the event that water, debris, or other obstruction prevents an acceptable sample from being taken at the center of the pillar, it is acceptable to relocate the sample to within 20 feet of the original location on either side of the centerline of the pillar. This provides for a length of 40 feet along each pillar in which an acceptable sample can be obtained. The MSHA and OMHS&T representative(s) will decide where to precisely take each sample.

12. Sample tags shall be filled out at each sample location. The tag must indicate the sample location and the type of sample taken.

13. If no acceptable sample can be obtained within the 40 feet length, a sample tag shall still be completed that includes the location identification. Also, the reason for no sample shall be designated on the tag.

14. If any Mine Dust Survey Team completes the sampling requirements for their assigned section or sections, then they can provide assistance to any other Team that has not yet completed their sampling.

15. Sampling bags and tags will be provided to each Team.

16. Evidence is not to be disturbed during the sampling process.

17. Samples are to be taken out of the mine at the end of the shift. All samples are to be transferred to the custody of MSHA's investigators on the Evidence Gathering Team. The Evidence Gathering Team will store all samples in a secure location.

Electrical Protocols

18. The primary purpose of the Electrical Teams will be to analyze circuits and equipment in proximity to the point of origin in order to identify potential ignition sources.

19. Machine mounted methane monitors from all working sections will be tested in place and/or taken into custody by MSHA for further testing.

20. Electrical equipment and circuits not in proximity to the point of origin will be examined by MSHA and OMHS&T electrical specialists to collect evidence and to assess compliance with the requirements of 30 CFR and state law.

Photography Protocols

21. No photographs other than the official team photographs will be taken by any party. Only MSHA or OMHS&T representatives will take photographs for each team.

22. The MSHA and OMHS&T persons on each Photography Team are responsible for determining which photographs to take. GIIP, Company, and Miner's Representatives may request additional photographs. MSHA and OMHS&T will make good faith efforts to take these requested photographs.

23. A Photography Team will specifically photograph evidence to be removed from the mine for investigative purposes. The MSHA representative(s) on this Photography Team will also act as the MSHA representative(s) on the Evidence Collection and Testing Team.

24. When requested, a Photography Team will travel with the Flames and Forces Team and will take photographs of any item designated by the MSHA or OMHS&T representatives on the Flames and Forces Team.

25. A Photography Team will be responsible for taking photographs of damage to ventilation controls, equipment, and other items of interest in the extended area affected by explosion forces, as determined by the Accident Investigation Team.

26. From the time that any Photography Team enters the mine, methane will be continuously monitored at their location. In the event that the methane concentration reaches 1% or greater, all camera equipment will be moved to a location with less than 1% methane and all photography work will cease until the methane concentration is reduced to less than 1%.

27. All photographs will be retained by MSHA. While underground, GIIP, Company, and Miner's Representatives Photography Team members may spend a reasonable time reviewing photographs taken on the digital screen after they are taken. MSHA anticipates providing GIIP, the Company, and Miner's Representatives copies of each photograph on a disk (or via similar method) at the conclusion of

each shift. Should this not be feasible on particular occasions, MSHA will provide copies within 24 or 48 hours after they have been taken.

Flames and Forces Protocols

28. The primary purpose of the Flames and Forces Team is to:
    a. Determine the extent of flame;
    b. Determine the magnitude and direction of the primary forces;
    c. Determine the location of the origin of the explosion;
    d. Determine the fuel consumed in the explosion; and
    e. Assist in identifying the source of ignition.

Geological Mapping Protocols

29. Locations for photographs will be annotated on the map, and a Photography Team will accompany the Geologic Mapping Team upon completion of the geologic mapping to collect photographs in annotated areas. Photograph collection will be at the direction of the MSHA and OMHS&T geologic mapping team member.

30. Geologic mapping will be performed by the MSHA and/or OMHS&T representative. One map only shall be produced by the Geological Mapping Team for each area of the mine. All team members shall sign and date the map when completed. It is anticipated that copies will be made at the conclusion of each shift. They will be distributed to each investigation team.

31. Individual members on the Geological Mapping Team are responsible for their own notes regarding observations and interpretations of geologic or stress features, which may be kept separate from the map.

Evidence Gathering Protocols

32. Evidence will be identified by MSHA and OMHS&T investigators and tagged with reflective markers, if necessary.

33. Only the Evidence Gathering Team will gather evidence. Other teams may identify and flag evidence for referral to the Evidence Gathering Team.

34. After a Photography Team photographs the designated evidence, the Evidence Gathering Team will place the evidence in containers to be removed from the mine.

35. All evidence tagged, photographed, and removed from the mine property will require Chain of Custody sheets to be completed.

36. Upon removal from the underground areas of the mine, evidence will be placed in a secure location on the surface area of the mine for transport to storage or testing facilities.

37. MSHA and OMHS&T shall maintain custody and control over the items they have received or taken at all times unless release of the items is necessary for the purpose of allowing testing by an outside laboratory. In such an event, MSHA and OMHS&T shall agree on the best means to ensure that adequate custody is maintained. Except as set out below, MSHA and OMHS&T shall also protect and preserve the items in their custody in the same condition as when the items were received from the Company.

38. While at any MSHA or OMHS&T facility, each and every item shall be kept secure and access shall be limited to only those persons necessary to conduct tests and examinations of the items.

39. All parties will be notified within 48 hours (or another reasonable time frame if not possible) of any tests to be conducted on evidence, the locations and dates where evidence testing is to occur, and any other relevant information, and given an opportunity to attend the testing. The parties will be provided with testing protocols relating to the particular evidence at issue prior to the testing whenever possible, and will be given an opportunity to provide input into the testing procedures to be followed. This provision shall not apply to testing on rock dust samples.

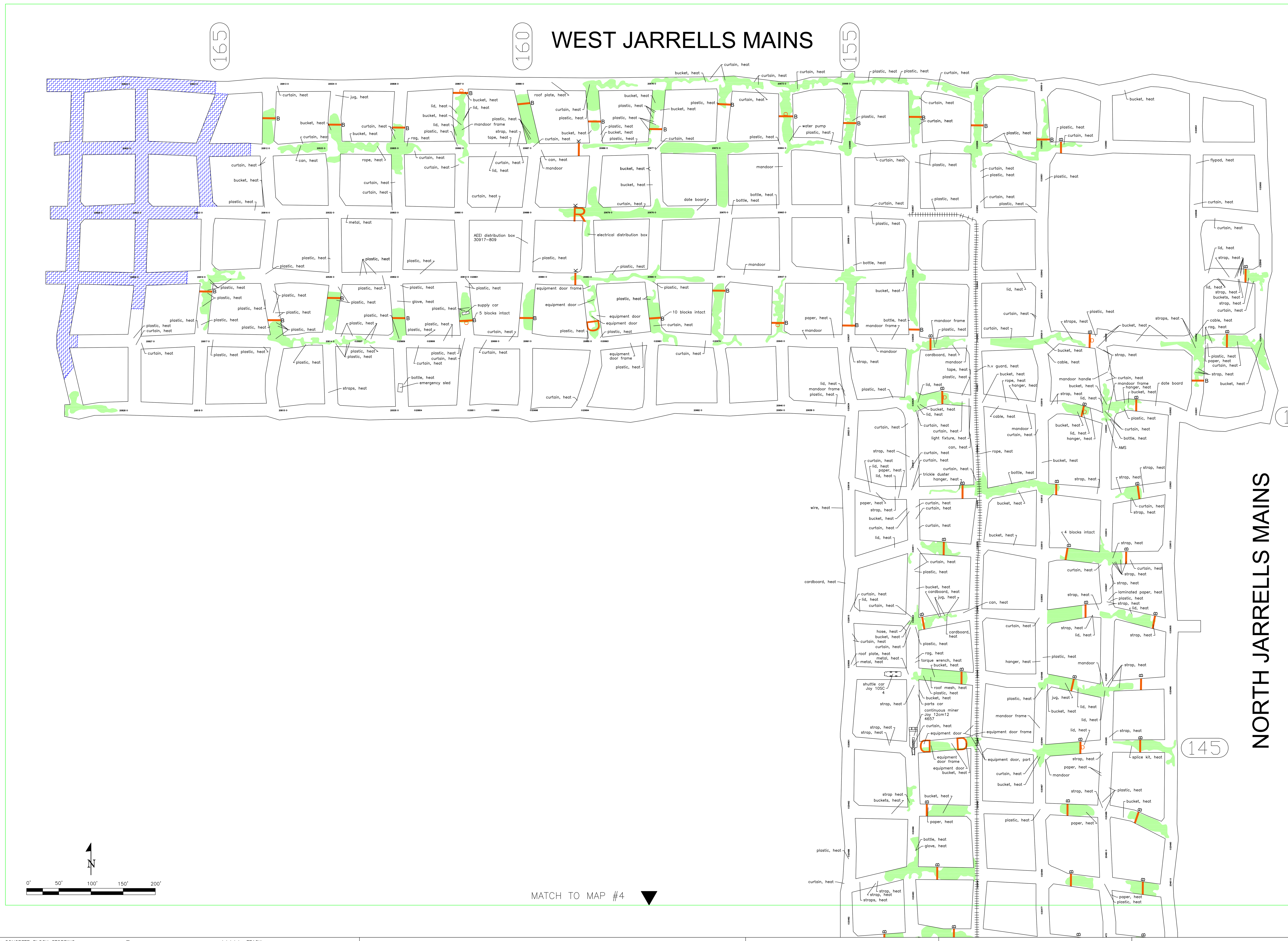
40. Should MSHA or the OMHS&T so request, the Company will maintain control and custody over any item returned to it pursuant to the same conditions listed above for a period of time to be specified by MSHA or the OMHS&T.

41. Team members shall consult with each other prior to the removal of physical evidence. MSHA or OMHS&T shall map the area prior to the removal of physical evidence.

APPENDIX H

POST-ACCIDENT MAPPING TEAM MAP

CAN BE FOUND IN THE BACK OF THE BINDER



B	CONCRETE BLOCK STOPPING
B	DAMAGED CONCRETE BLOCK STOPPING
K	KENNEDY METAL STOPPING
K	DAMAGED KENNEDY METAL STOPPING
B	CONCRETE BLOCK STOPPING WITH MANDOOR
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING
D	EQUIPMENT DOOR
D	DAMAGED EQUIPMENT DOOR
R	REGULATOR
R	DAMAGED REGULATOR
	OVERCAST
	DAMAGED OVERCAST
	CONVEYOR BELT
	CONVEYOR BELT WITH COAL/ROCK
	TRACK
	WATER
	DEBRIS FIELD
	ROOF FALL/BAD ROOF
12345 O	SPAD NUMBER

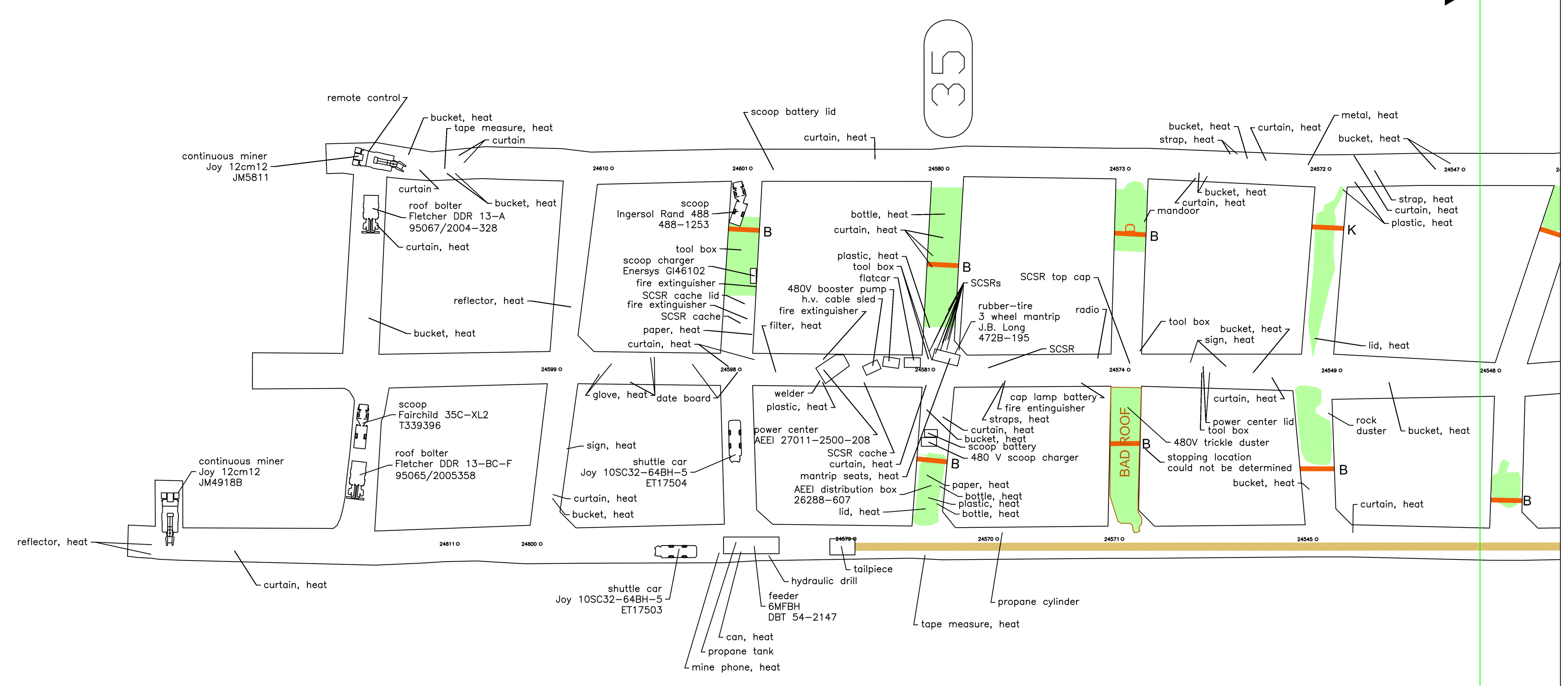
LEGEND
Scale 1"=50'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.

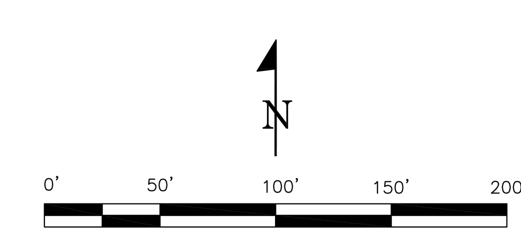
2 3 4 5 6 7 8 9 10 11 12 13

APPENDIX H-1
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



MATCH TO MAP #3

HEADGATE # 22



B CONCRETE BLOCK STOPPING
B DAMAGED CONCRETE BLOCK STOPPING
K KENNEDY METAL STOPPING
K DAMAGED KENNEDY METAL STOPPING
B CONCRETE BLOCK STOPPING WITH MANDOOR
B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B PARTIALLY INTACT CONCRETE BLOCK STOPPING

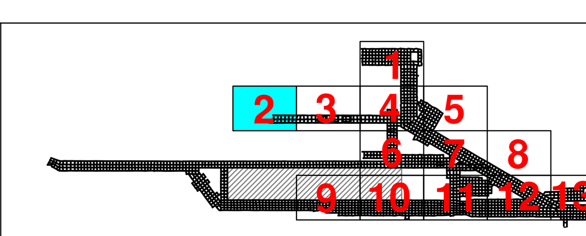
D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

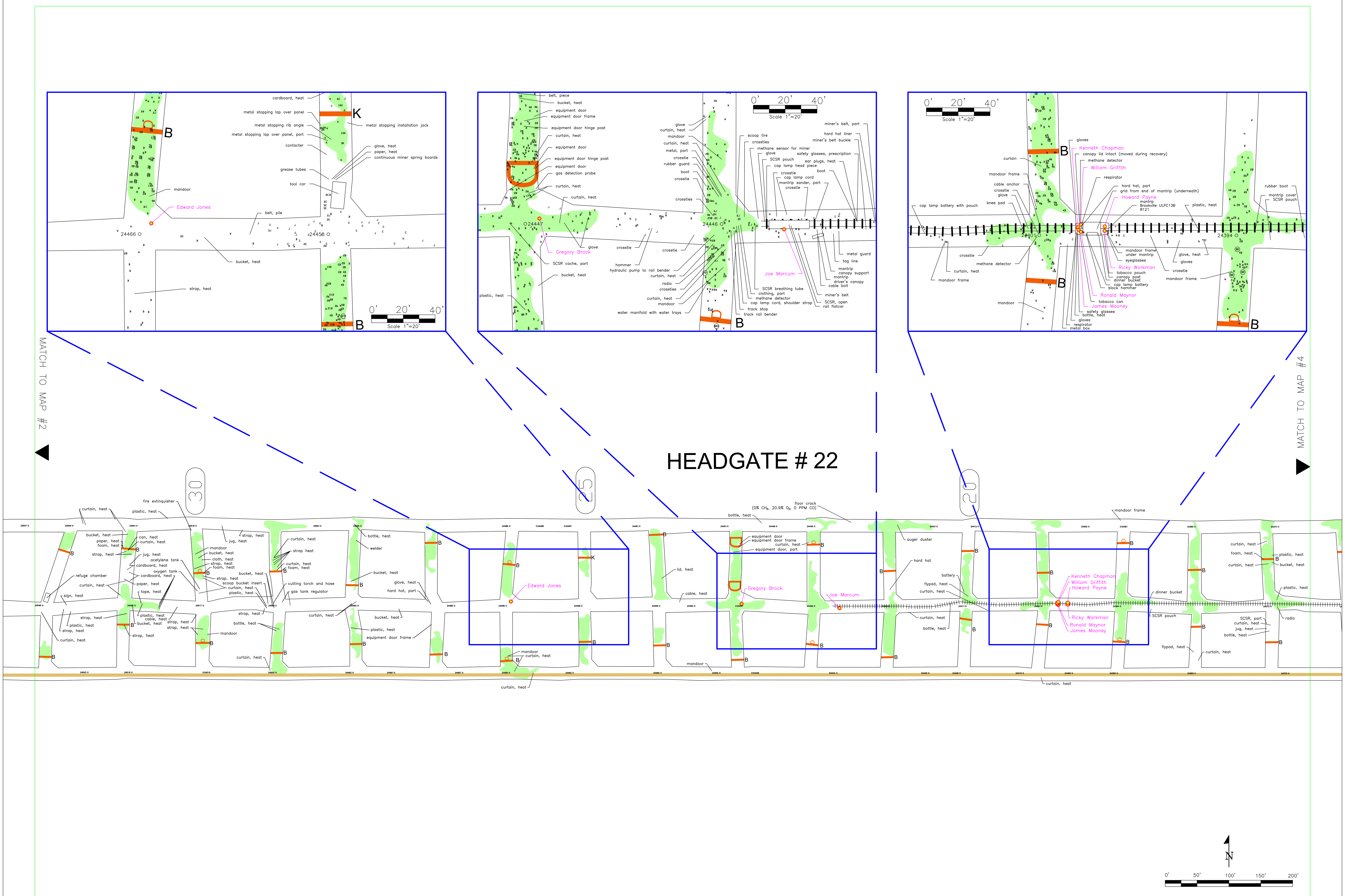
LEGEND
Scale 1"=50'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.



APPENDIX H-2
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B	CONCRETE BLOCK STOPPING
B	DAMAGED CONCRETE BLOCK STOPPING
K	KENNEDY METAL STOPPING
K	DAMAGED KENNEDY METAL STOPPING
B	CONCRETE BLOCK STOPPING WITH MANDOOR
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING
D	EQUIPMENT DOOR
D	DAMAGED EQUIPMENT DOOR
R	REGULATOR
R	DAMAGED REGULATOR
	OVERCAST
	DAMAGED OVERCAST
	CONVEYOR BELT
	CONVEYOR BELT WITH COAL/ROCK
	TRACK
	WATER
	DEBRIS FIELD
	ROOF FALL/BAD ROOF
12345 O	SPAD NUMBER

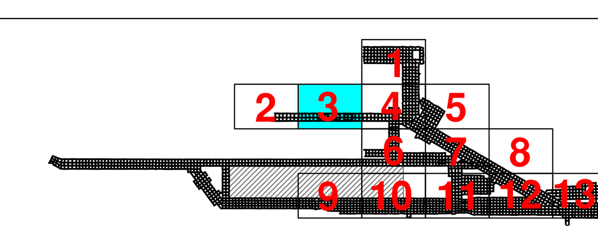
LEGEND
Scale 1"=50'

B	CONCRETE BLOCK
b	PARTIAL CONCRETE BLOCK
W	WEDGE
H	HEADER BOARD
C	CRIB BLOCK
R	WHOLE SCSR
r	PIECE OF SCSR
25B	MULTIPLE ITEMS (EX. 25 CONCRETE BLOCKS)
□	CRIB INTACT
	CONVEYOR BELT AND RAILS
	WATER LINE
CO	CO SENSOR
TR	TOP BELT ROLLER
TS	TOP BELT STRUCTURE
BR	BOTTOM BELT ROLLER
BH	BOTTOM BELT ROLLER HANGER
FP	FOAM PACK
FE	FIRE EXTINGUISHER
J	STEEL POST OR JACK (INTACT)
PS	PROP SETTER (INTACT)
J	STEEL POST OR JACK
PS	PROP SETTER

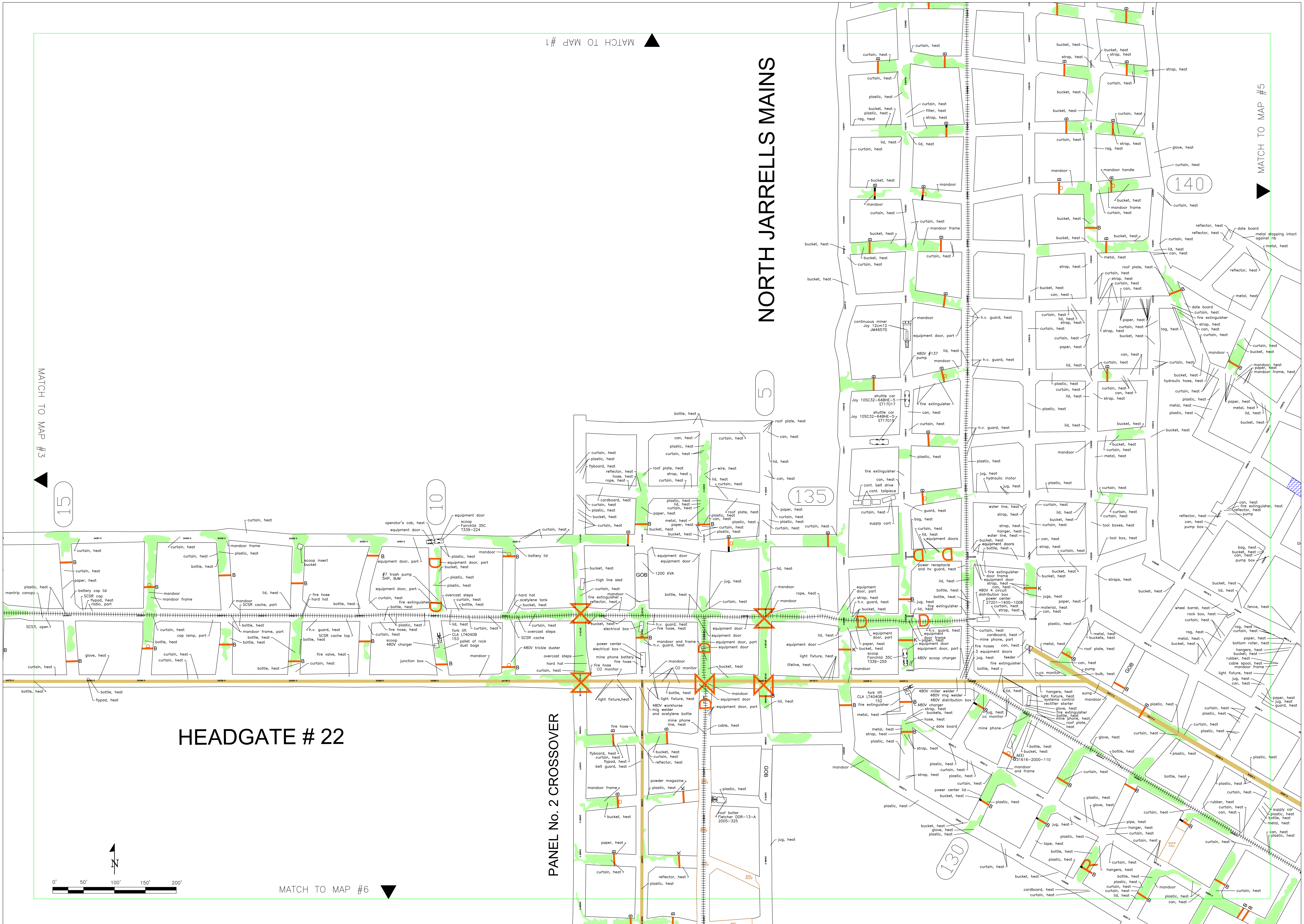
INSET LEGEND
Scale 1"=20'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS. ADDITIONAL ITEMS DISPLAYED IN 1"=20' AREAS.



APPENDIX H-3
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

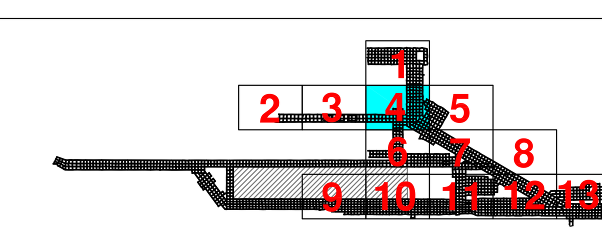


LEGEND
Scale 1"=50'

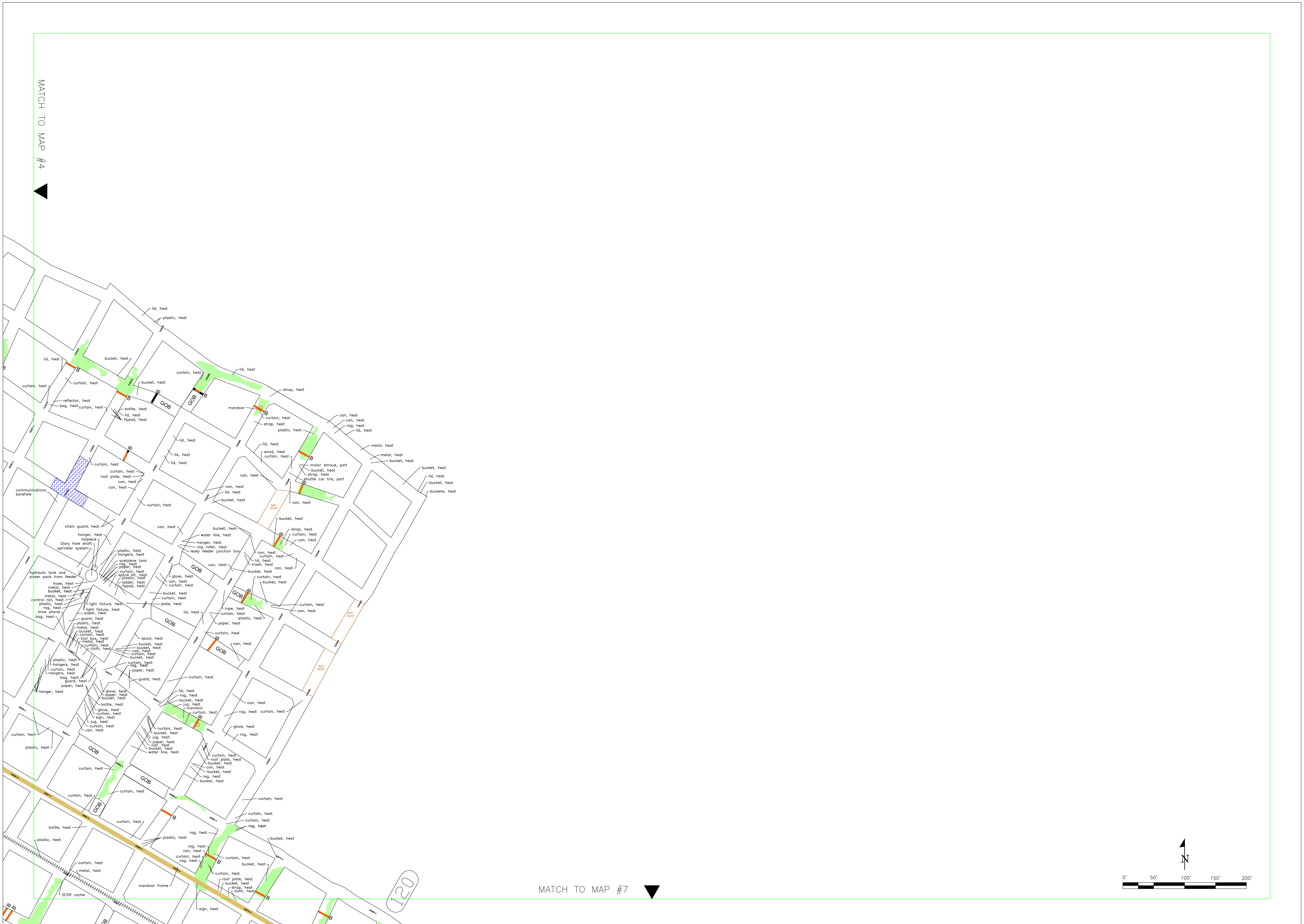
- B — CONCRETE BLOCK STOPPING
- B — DAMAGED CONCRETE BLOCK STOPPING
- K — KENNEDY METAL STOPPING
- K — DAMAGED KENNEDY METAL STOPPING
- B — CONCRETE BLOCK STOPPING WITH MANDOOR
- B — DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
- B — PARTIALLY INTACT CONCRETE BLOCK STOPPING
- D — EQUIPMENT DOOR
- D — DAMAGED EQUIPMENT DOOR
- R — REGULATOR
- R — DAMAGED REGULATOR
- OVERCAST
- DAMAGED OVERCAST
- CONVEYOR BELT
- CONVEYOR BELT WITH COAL/ROCK
- TRACK
- WATER
- DEBRIS FIELD
- ROOF FALL/BAD ROOF
- 12345 O SPAD NUMBER

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.



APPENDIX H–4
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46–08436



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B	DAMAGED CONCRETE BLOCK STOPPING
K	KENNEDY METAL STOPPING
K	DAMAGED KENNEDY METAL STOPPING
B	CONCRETE BLOCK STOPPING WITH MANDOOR
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING
D	EQUIPMENT DOOR
D	DAMAGED EQUIPMENT DOOR
R	REGULATOR
R	DAMAGED REGULATOR
	OVERCAST
	DAMAGED OVERCAST
	CONVEYOR BELT
	CONVEYOR BELT WITH COAL/ROCK
	TRACK
	WATER
	DEBRIS FIELD
	ROOF FALL/BAD ROOF
12345 O	SPAD NUMBER

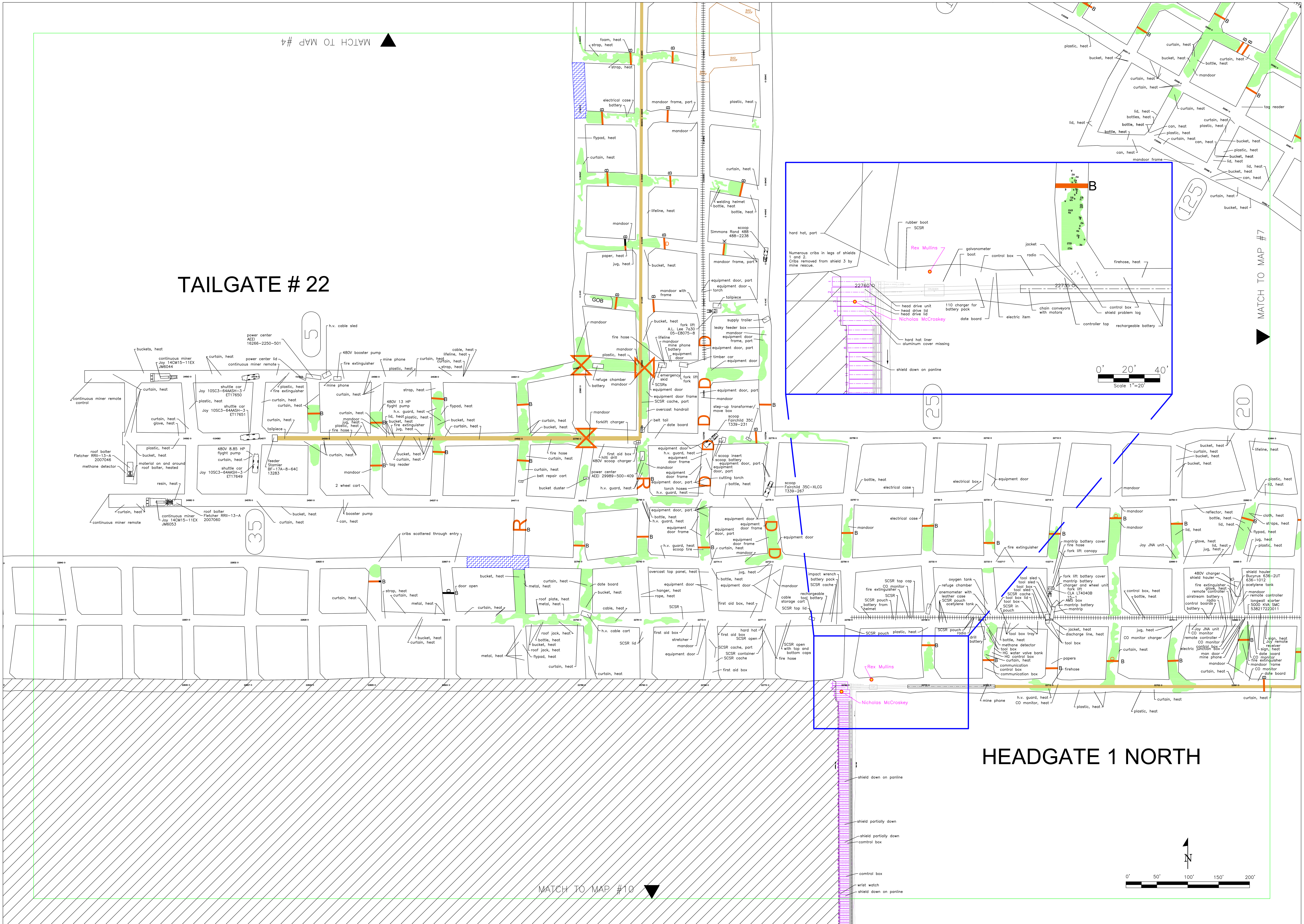
LEGEND
Scale 1"=50'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.

1 2 3 4 5 6 7 8 9 10 11 12 13

APPENDIX H-5
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B	CONCRETE BLOCK STOPPING
B	DAMAGED CONCRETE BLOCK STOPPING
K	KENNEDY METAL STOPPING
K	DAMAGED KENNEDY METAL STOPPING
B	CONCRETE BLOCK STOPPING WITH MANDOOR
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING
D	EQUIPMENT DOOR
D	DAMAGED EQUIPMENT DOOR
R	REGULATOR
R	DAMAGED REGULATOR
	OVERCAST
	DAMAGED OVERCAST
	CONVEYOR BELT
	CONVEYOR BELT WITH COAL/ROCK
	TRACK
	WATER
	DEBRIS FIELD
	ROOF FALL/BAD ROOF
12345 O	SPAD NUMBER

LEGEND
Scale 1"=50'

B	CONCRETE BLOCK
b	PARTIAL CONCRETE BLOCK
W	WEDGE
H	HEADER BOARD
C	CRIB BLOCK
R	WHOLE SCSR
r	PIECE OF SCSR
25B	MULTIPLE ITEMS (EX. 25 CONCRETE BLOCKS)
	CRIB INTACT
	CONVEYOR BELT AND RAILS
	WATER LINE
CO	CO SENSOR
TR	TOP BELT ROLLER
TS	TOP BELT STRUCTURE
BR	BOTTOM BELT ROLLER
BH	BOTTOM BELT ROLLER HANGER
FP	FOAM PACK
FE	FIRE EXTINGUISHER
J	STEEL POST OR JACK (INTACT)
PS	PROP SETTER (INTACT)
J	STEEL POST OR JACK
PS	PROP SETTER

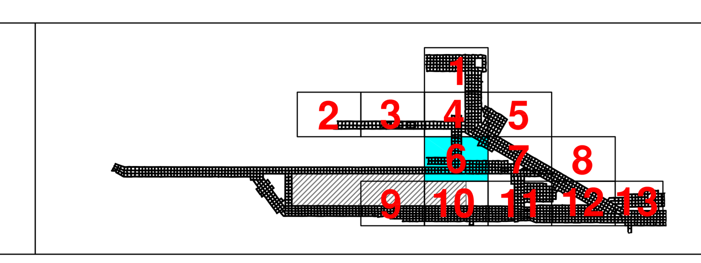
INSET LEGEND
Scale 1"=20'

MAPPING NOTES

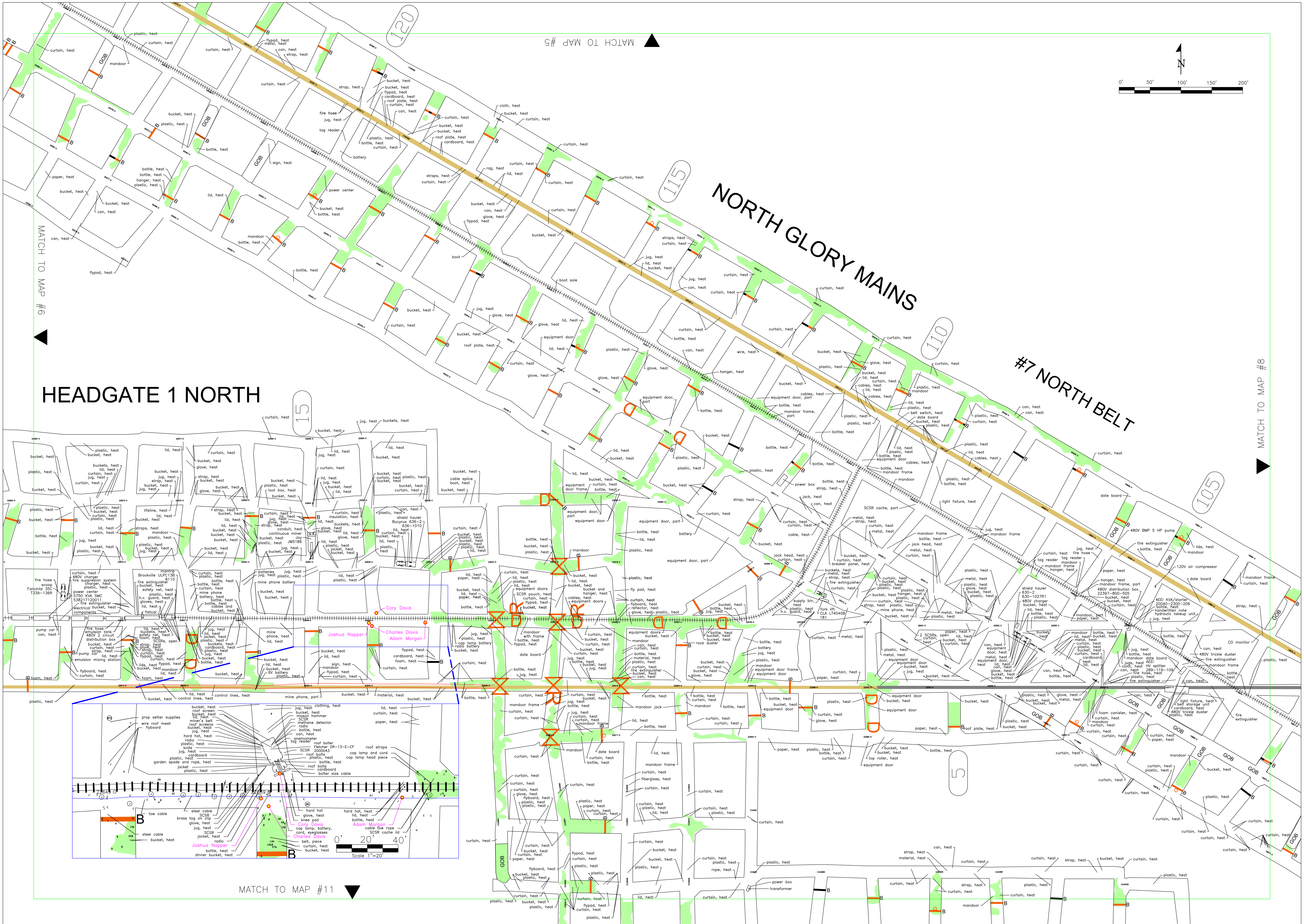
MAPPING OF SELECTED AND HEATED ITEMS. ADDITIONAL ITEMS DISPLAYED IN 1"=20' AREAS.

MAPPING LIMITED TO OUTBY CROSSCUT 34 OF HEADGATE 1 NORTH.

MAPPING NOT PERFORMED IN AREAS OF BAD ROOF.



APPENDIX H-6
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



CONCRETE BLOCK STOPPING
DAMAGED CONCRETE BLOCK STOPPING
KENNEDY METAL STOPPING
DAMAGED KENNEDY METAL STOPPING
CONCRETE BLOCK STOPPING WITH MANDOOR
DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
PARTIALLY INTACT CONCRETE BLOCK STOPPING

D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

LEGEND
Scale 1"=50'

B CONCRETE BLOCK
b PARTIAL CONCRETE BLOCK
W WEDGE
H HEADER BOARD
C CRIB BLOCK
R WHOLE SCSR
r PIECE OF SCSR

25B MULTIPLE ITEMS (EX. 25 CONCRETE BLOCKS)
CRIB INTACT
CONVEYOR BELT AND RAILS
WATER LINE

CO SENSOR
TR TOP BELT ROLLER
TS TOP BELT STRUCTURE
BR BOTTOM BELT ROLLER
BH BOTTOM BELT ROLLER HANGER
FP FOAM PACK
FE FIRE EXTINGUISHER

J STEEL POST OR JACK (INTACT)
PS PROP SETTER (INTACT)
J STEEL POST OR JACK
PS PROP SETTER

INSET LEGEND
Scale 1"=20'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS. ADDITIONAL ITEMS DISPLAYED IN 1"=20' AREAS.

APPENDIX H-7
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

B	CONCRETE BLOCK STOPPING	
B	DAMAGED CONCRETE BLOCK STOPPING	
K	KENNEDY METAL STOPPING	
K	DAMAGED KENNEDY METAL STOPPING	
B	CONCRETE BLOCK STOPPING WITH MANDOOR	
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR	
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING	
D	EQUIPMENT DOOR	
D	DAMAGED EQUIPMENT DOOR	
R	REGULATOR	
R	DAMAGED REGULATOR	
	OVERCAST	
	DAMAGED OVERCAST	
	CONVEYOR BELT	
	CONVEYOR BELT WITH COAL/ROCK	
	TRACK	
	WATER	
	DEBRIS FIELD	
	ROOF FALL/BAD ROOF	
12345 O	SPAD NUMBER	

LEGEND
Scale 1"=50'

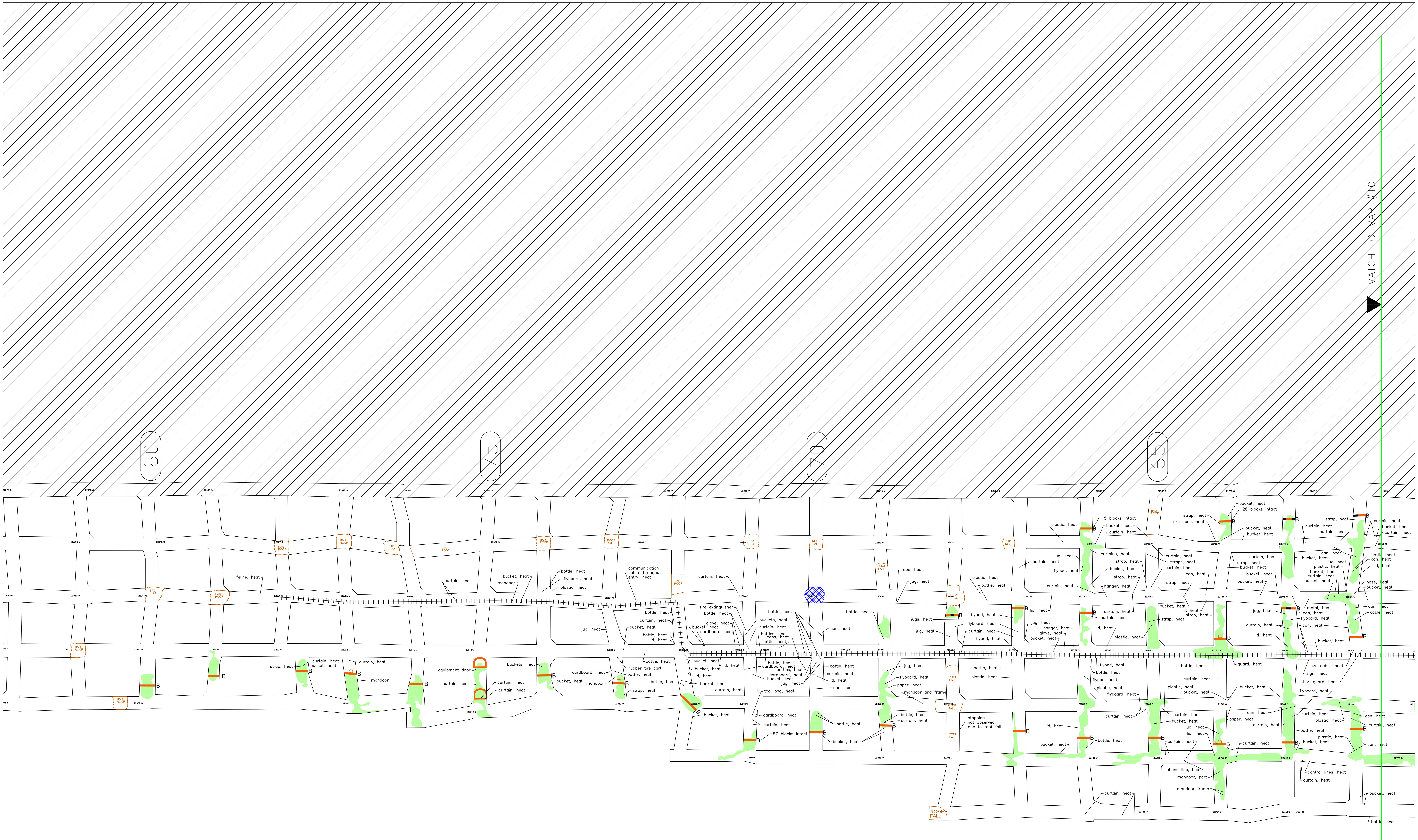
B	CONCRETE BLOCK
b	PARTIAL CONCRETE BLOCK
W	WEDGE
H	HEADER BOARD
C	CRIB BLOCK
R	WHOLE SCSR
r	PIECE OF SCSR
25B	MULTIPLE ITEMS (EX. 25 CONCRETE BLOCKS)
□	CRIB INTACT
	CONVEYOR BELT AND RAILS
	WATER LINE
CO	CO SENSOR
TR	TOP BELT ROLLER
TS	TOP BELT STRUCTURE
BR	BOTTOM BELT ROLLER
BRH	BOTTOM BELT ROLLER HANGER
FP	FOAM PACK
FE	FIRE EXTINGUISHER
J	STEEL POST OR JACK (INTACT)
PS	PROP SETTER (INTACT)
J	STEEL POST OR JACK
PS	PROP SETTER

INSET LEGEND
Scale 1"=20'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.
ADDITIONAL ITEMS DISPLAYED IN 1"=20' AREAS.

APPENDIX H-8
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



TAILGATE 1 NORTH

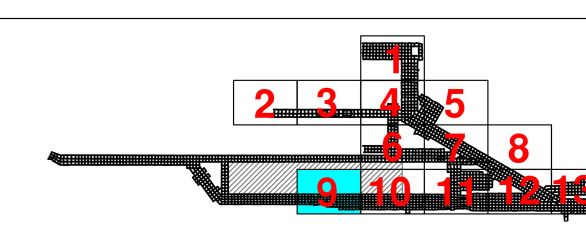
B	CONCRETE BLOCK STOPPING
B	DAMAGED CONCRETE BLOCK STOPPING
K	KENNEDY METAL STOPPING
K	DAMAGED KENNEDY METAL STOPPING
B	CONCRETE BLOCK STOPPING WITH MANDOOR
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING
D	EQUIPMENT DOOR
D	DAMAGED EQUIPMENT DOOR
R	REGULATOR
R	DAMAGED REGULATOR
	OVERCAST
	DAMAGED OVERCAST
	CONVEYOR BELT
	CONVEYOR BELT WITH COAL/ROCK
	TRACK
	WATER
	DEBRIS FIELD
	ROOF FALL/BAD ROOF
12345 O	SPAD NUMBER

LEGEND
Scale 1"=50'

MAPPING NOTES

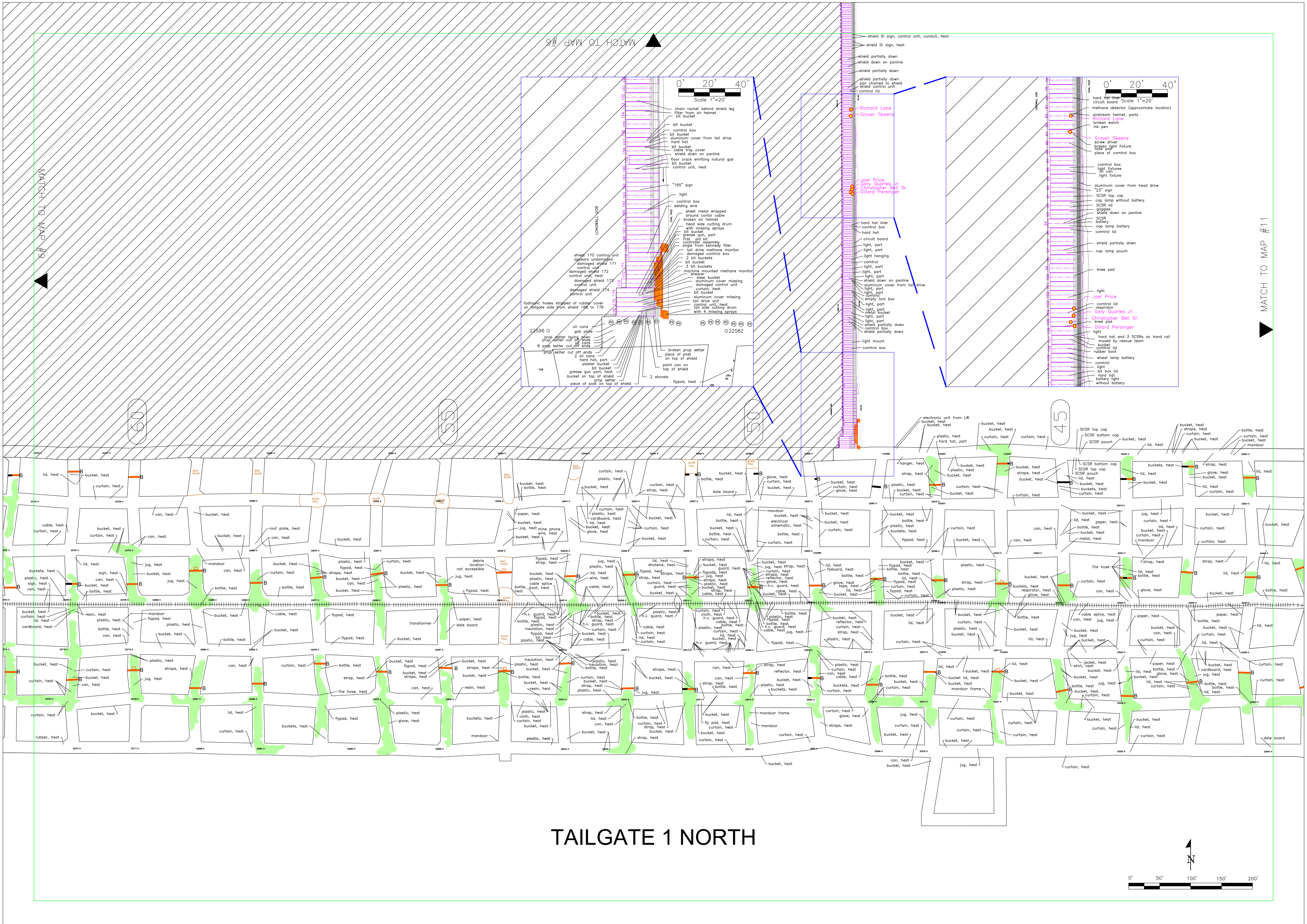
MAPPING OF SELECTED AND HEATED ITEMS.

MAPPING LIMITED TO OUTBY BAD ROOF AND ROOF FALLS ON TAILGATE 1 NORTH.



APPENDIX H-9
Mapping of the Mine

Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B	CONCRETE BLOCK STOPPING	
B	DAMAGED CONCRETE BLOCK STOPPING	
K	KENNEDY METAL STOPPING	
K	DAMAGED KENNEDY METAL STOPPING	
B	CONCRETE BLOCK STOPPING WITH MANDOOR	
B	DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR	
B	PARTIALLY INTACT CONCRETE BLOCK STOPPING	
D	EQUIPMENT DOOR	
D	DAMAGED EQUIPMENT DOOR	
R	REGULATOR	
R	DAMAGED REGULATOR	
	OVERCAST	
	DAMAGED OVERCAST	
	CONVEYOR BELT	
	CONVEYOR BELT WITH COAL/ROCK	
	TRACK	
	WATER	
	DEBRIS FIELD	
	ROOF FALL/BAD ROOF	
12345 O	SPAD NUMBER	

LEGEND
Scale 1"=50'

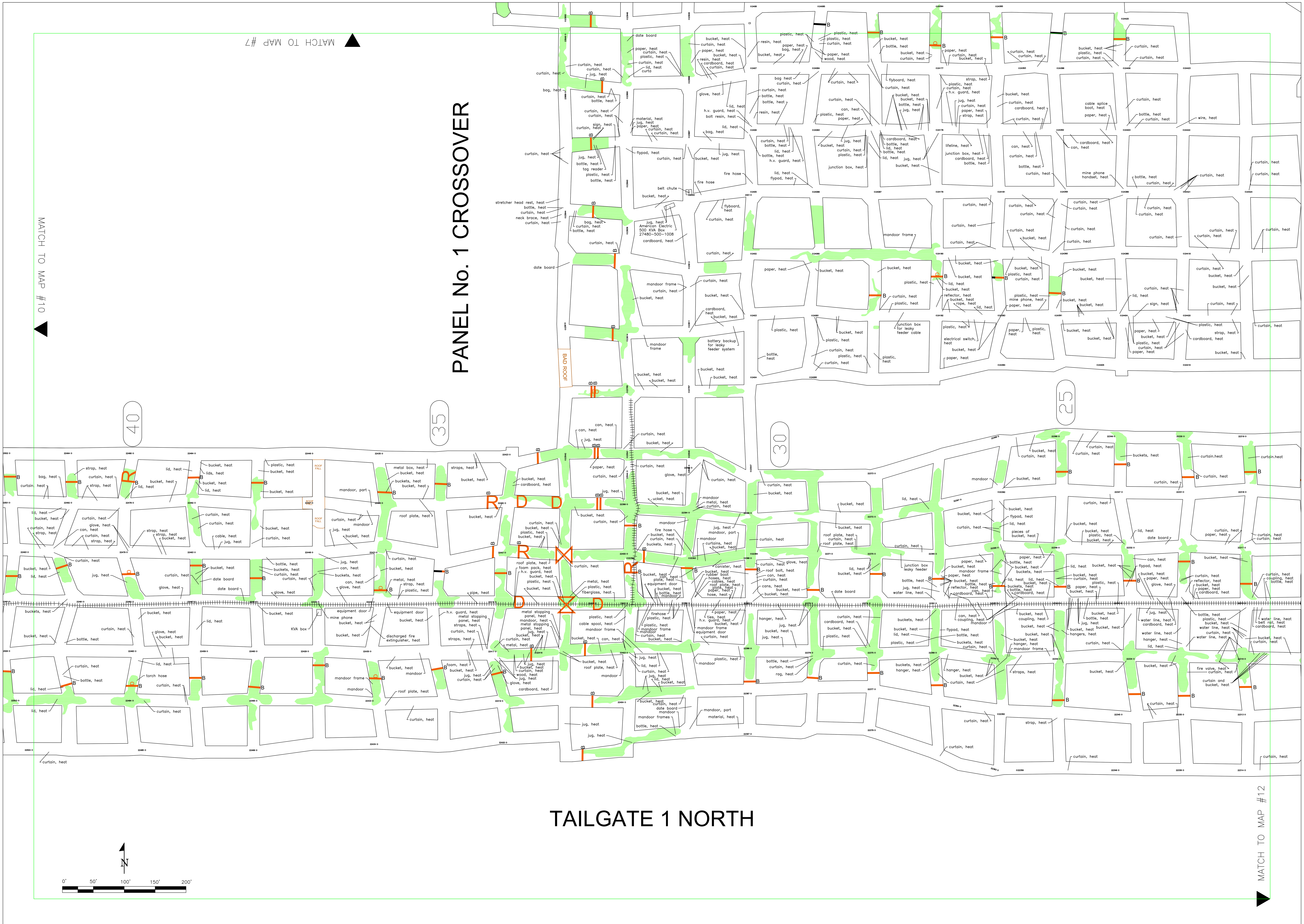
B	CONCRETE BLOCK
b	PARTIAL CONCRETE BLOCK
W	WEDGE
H	HEADER BOARD
C	CRIB BLOCK
R	WHOLE SCSR
r	PIECE OF SCSR
25B	MULTIPLE ITEMS (EX. 25 CONCRETE BLOCKS)
	CRIB INTACT
	CONVEYOR BELT AND RAILS
	WATER LINE
CO	CO SENSOR
TR	TOP BELT ROLLER
TS	TOP BELT STRUCTURE
BR	BOTTOM BELT ROLLER
BH	BOTTOM BELT ROLLER HANGER
FP	FOAM PACK
FE	FIRE EXTINGUISHER
J	STEEL POST OR JACK (INTACT)
PS	PROP SETTER (INTACT)
J	STEEL POST OR JACK
PS	PROP SETTER

INSET LEGEND
Scale 1"=20'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.
ADDITIONAL ITEMS DISPLAYED IN 1"=20' AREAS.

APPENDIX H-10
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B CONCRETE BLOCK STOPPING
B DAMAGED CONCRETE BLOCK STOPPING
K KENNEDY METAL STOPPING
K DAMAGED KENNEDY METAL STOPPING
B CONCRETE BLOCK STOPPING WITH MANDOOR
B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B PARTIALLY INTACT CONCRETE BLOCK STOPPING

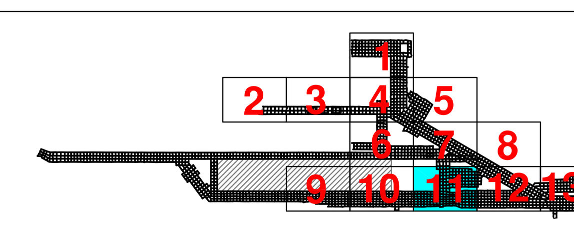
D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

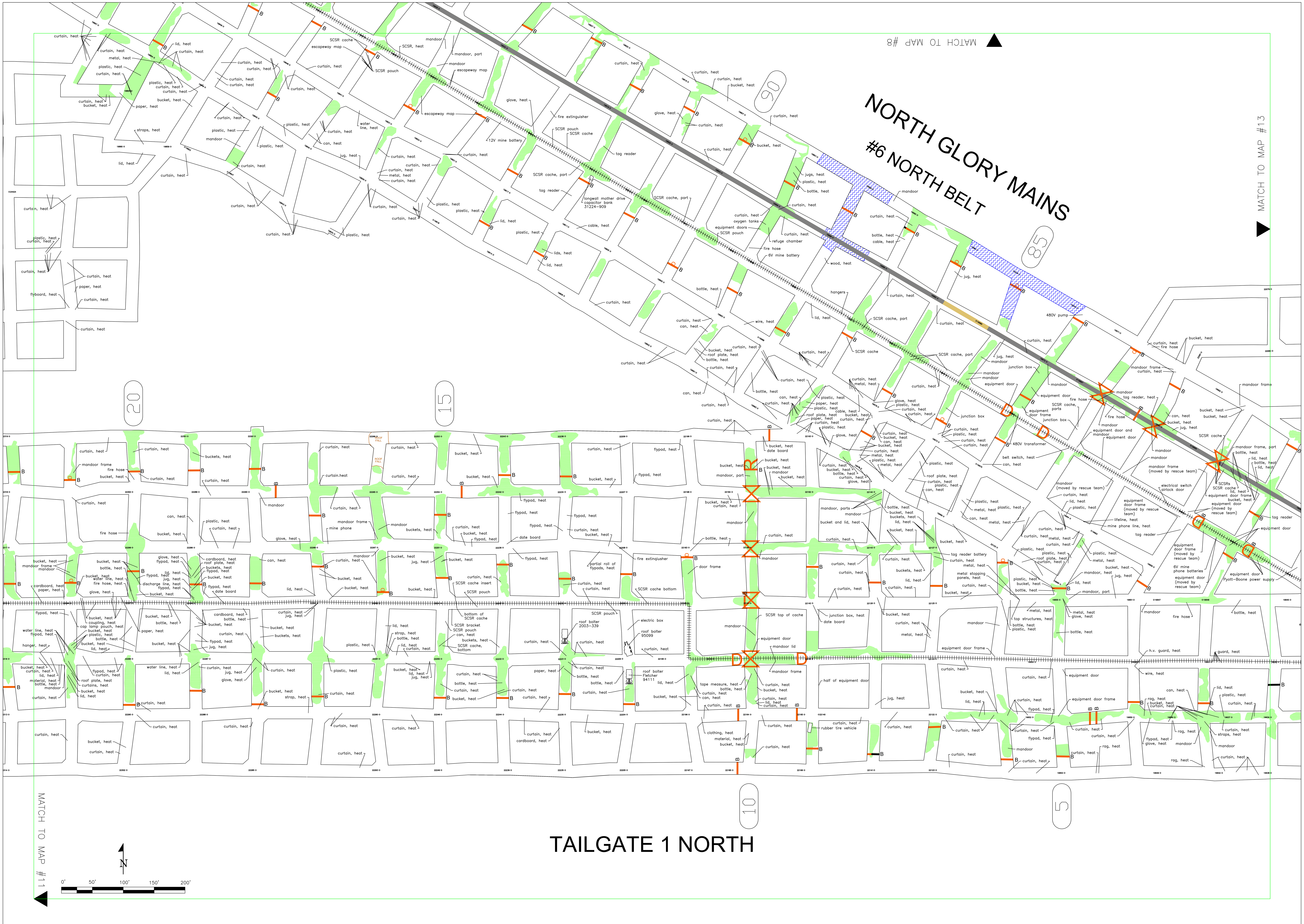
LEGEND
Scale 1"=50'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.



APPENDIX H-11
Mapping of the Mine
Upper Big Branch Mine - South
Performance Coal Company
MSHA ID No. 46-08436



LEGEND

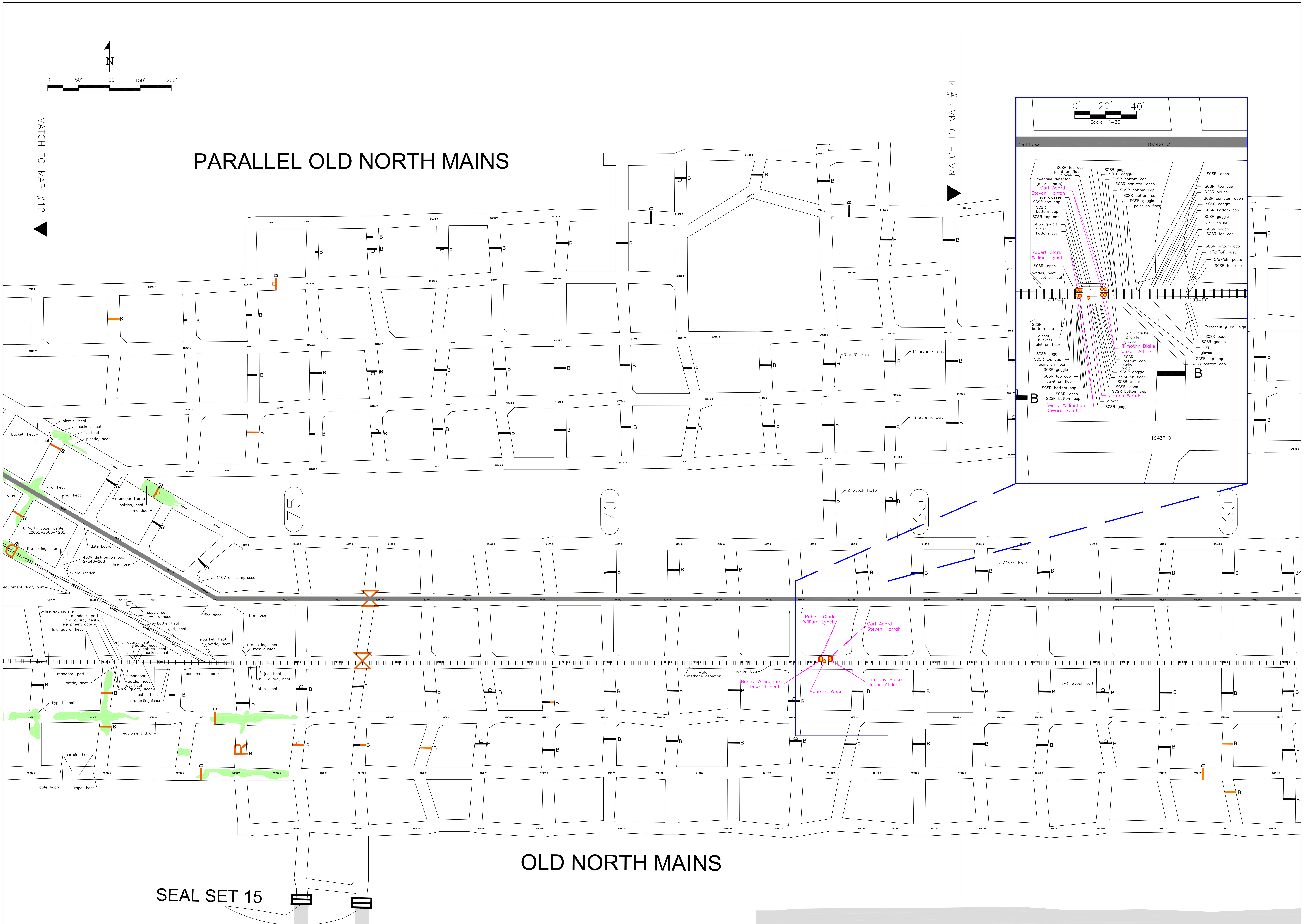
- B CONCRETE BLOCK STOPPING
- B DAMAGED CONCRETE BLOCK STOPPING
- K KENNEDY METAL STOPPING
- K DAMAGED KENNEDY METAL STOPPING
- B CONCRETE BLOCK STOPPING WITH MANDOOR
- B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
- B PARTIALLY INTACT CONCRETE BLOCK STOPPING
- D EQUIPMENT DOOR
- D DAMAGED EQUIPMENT DOOR
- R REGULATOR
- R DAMAGED REGULATOR
- OVERCAST
- DAMAGED OVERCAST
- CONVEYOR BELT
- CONVEYOR BELT WITH COAL/ROCK
- TRACK
- WATER
- DEBRIS FIELD
- ROOF FALL/BAD ROOF
- 12345 O SPAD NUMBER

LEGEND
Scale 1"=50'

MAPPING NOTES

MAPPING OF SELECTED AND HEATED ITEMS.

APPENDIX H-12
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B CONCRETE BLOCK STOPPING
B DAMAGED CONCRETE BLOCK STOPPING
K KENNEDY METAL STOPPING
K DAMAGED KENNEDY METAL STOPPING
B CONCRETE BLOCK STOPPING WITH MANDOOR
B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B PARTIALLY INTACT CONCRETE BLOCK STOPPING

D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

LEGEND
Scale 1"=50'

B CONCRETE BLOCK
b PARTIAL CONCRETE BLOCK
W WEDGE
H HEADER BOARD
C CRIB BLOCK
R WHOLE SCSR
r PIECE OF SCSR

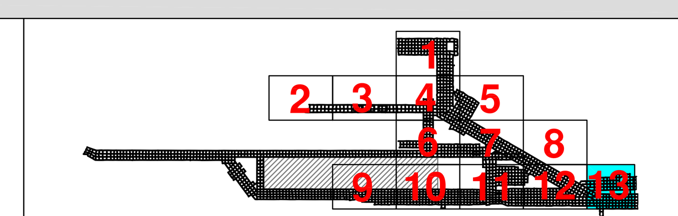
25B MULTIPLE ITEMS (EX. 25 CONCRETE BLOCKS)
CRIB INTACT
CONVEYOR BELT AND RAILS
WATER LINE

(CO) CO SENSOR
(TR) TOP BELT ROLLER
(TS) TOP BELT STRUCTURE
(BR) BOTTOM BELT ROLLER
(BRH) BOTTOM BELT ROLLER HANGER
(FP) FOAM PACK
(FE) FIRE EXTINGUISHER

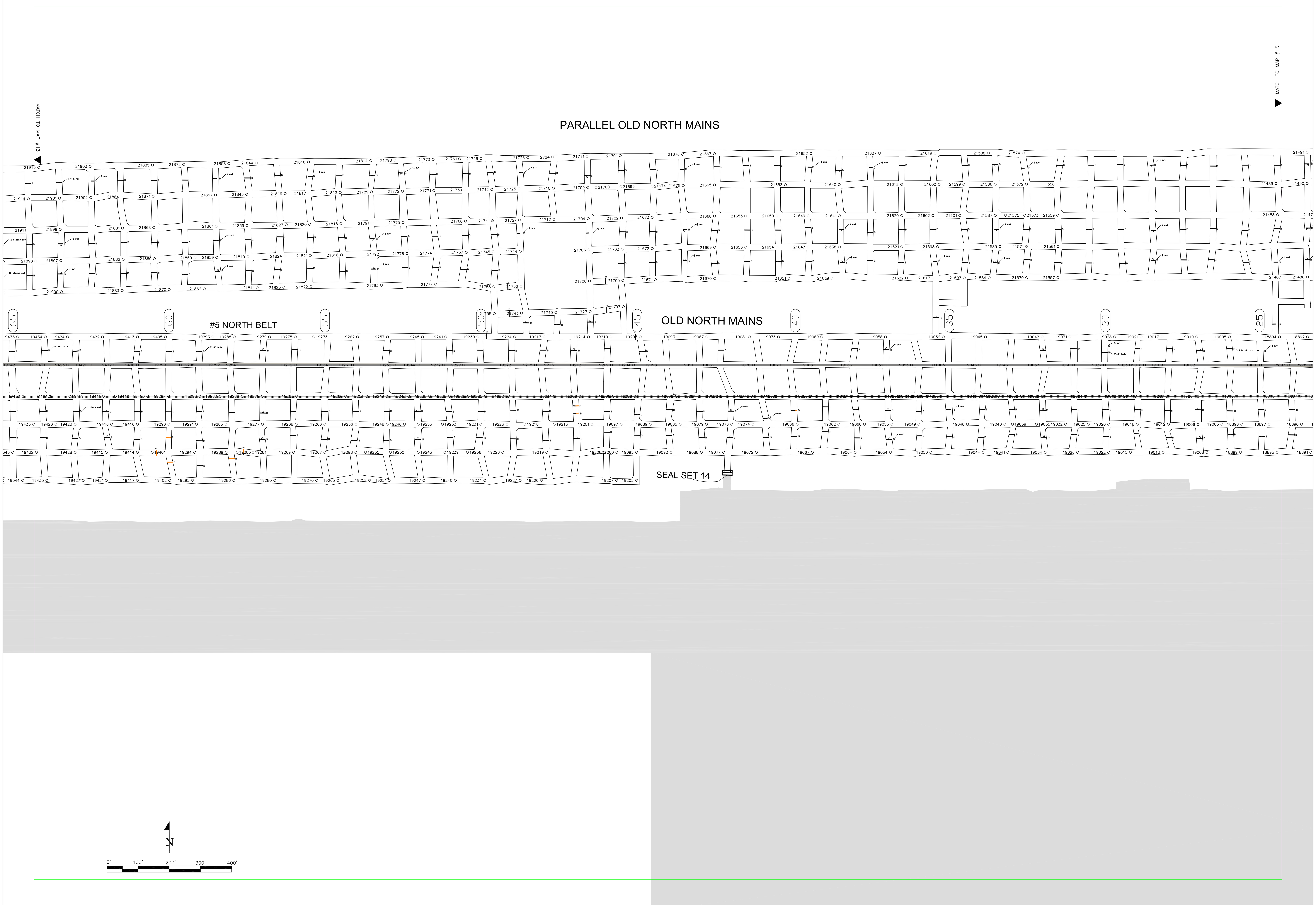
(J) STEEL POST OR JACK (INTACT)
(PS) PROP SETTER (INTACT)
J STEEL POST OR JACK
PS PROP SETTER

INSET LEGEND
Scale 1"=20'

MAPPING NOTES
MAPPING OF SELECTED AND HEATED ITEMS. ADDITIONAL ITEMS DISPLAYED IN 1"=20' AREAS.
MAPPING OF OBJECTS LIMITED TO INBY CROSSCUT 75 AND THE MANTRIP LOCATION NEAR SPAD 19440
MAPPING OF COAL AND ROCK ON THE CONVEYOR BELT LIMITED TO AREAS INBY SPAD 19639
LOCATION OF MANTRIP AND VICTIMS NEAR SPAD 19440 IS APPROXIMATE.



APPENDIX H-13
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B CONCRETE BLOCK STOPPING
B DAMAGED CONCRETE BLOCK STOPPING
K KENNEDY METAL STOPPING
K DAMAGED KENNEDY METAL STOPPING
B CONCRETE BLOCK STOPPING WITH MANDOOR
B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B PARTIALLY INTACT CONCRETE BLOCK STOPPING

D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

LEGEND
Scale 1"=100'

MAPPING NOTES

CONDITION OF VENTILATION CONTROLS AS MAPPED.

14 15 16 17 18

APPENDIX H-14
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

B CONCRETE BLOCK STOPPING
B DAMAGED CONCRETE BLOCK STOPPING
K KENNEDY METAL STOPPING
K DAMAGED KENNEDY METAL STOPPING
B CONCRETE BLOCK STOPPING WITH MANDOOR
B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B PARTIALLY INTACT CONCRETE BLOCK STOPPING

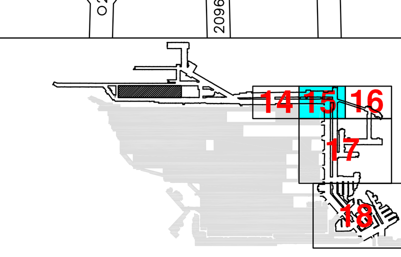
D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

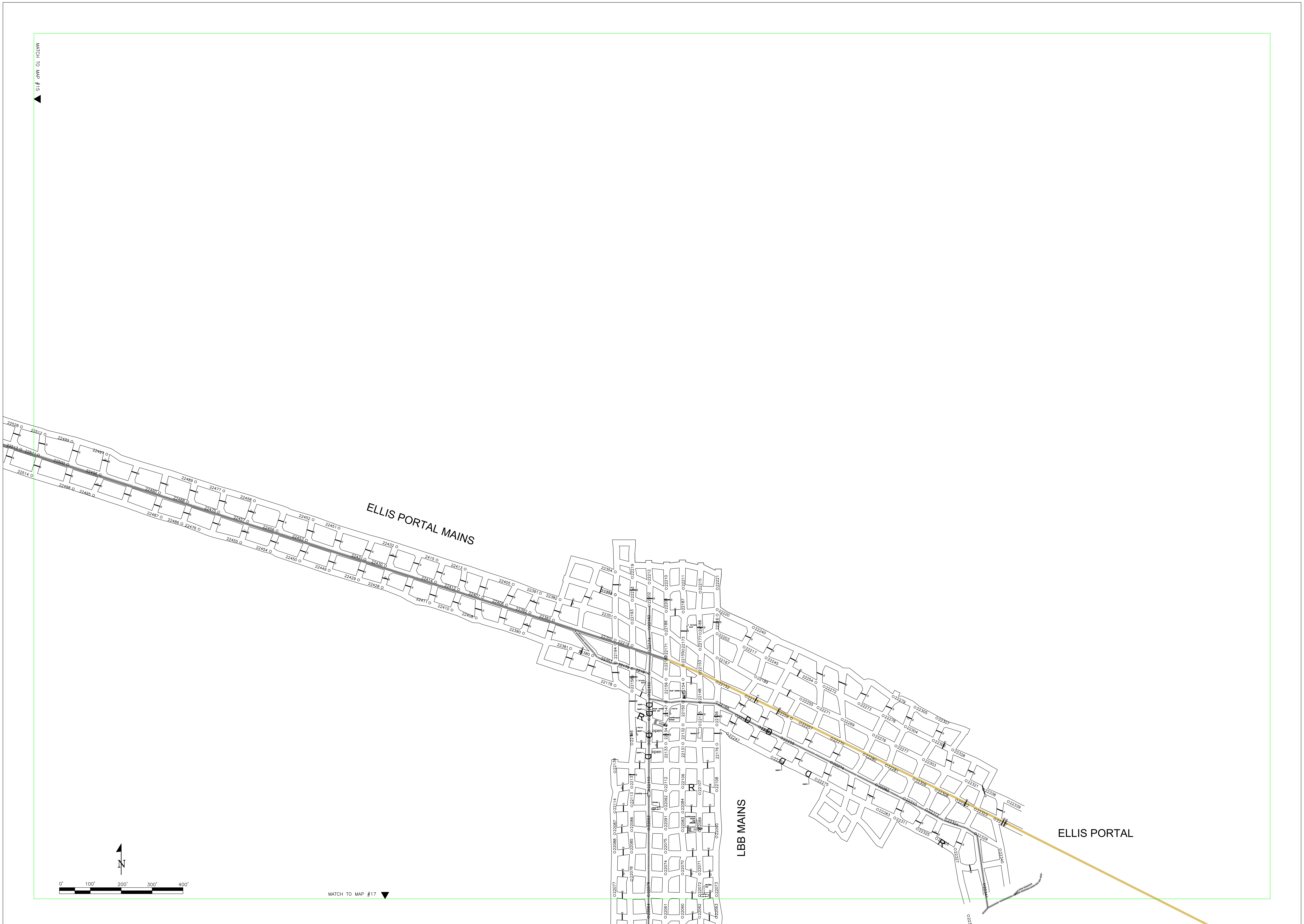
LEGEND
Scale 1"=100'

MAPPING NOTES

CONDITION OF VENTILATION CONTROLS AS MAPPED.



APPENDIX H-15
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



B CONCRETE BLOCK STOPPING
B DAMAGED CONCRETE BLOCK STOPPING
K KENNEDY METAL STOPPING
K DAMAGED KENNEDY METAL STOPPING
B CONCRETE BLOCK STOPPING WITH MANDOOR
B DAMAGED CONCRETE BLOCK STOPPING WITH MANDOOR
B PARTIALLY INTACT CONCRETE BLOCK STOPPING

D EQUIPMENT DOOR
D DAMAGED EQUIPMENT DOOR
R REGULATOR
R DAMAGED REGULATOR
OVERCAST
DAMAGED OVERCAST
CONVEYOR BELT
CONVEYOR BELT WITH COAL/ROCK

TRACK
WATER
DEBRIS FIELD
ROOF FALL/BAD ROOF
12345 O SPAD NUMBER

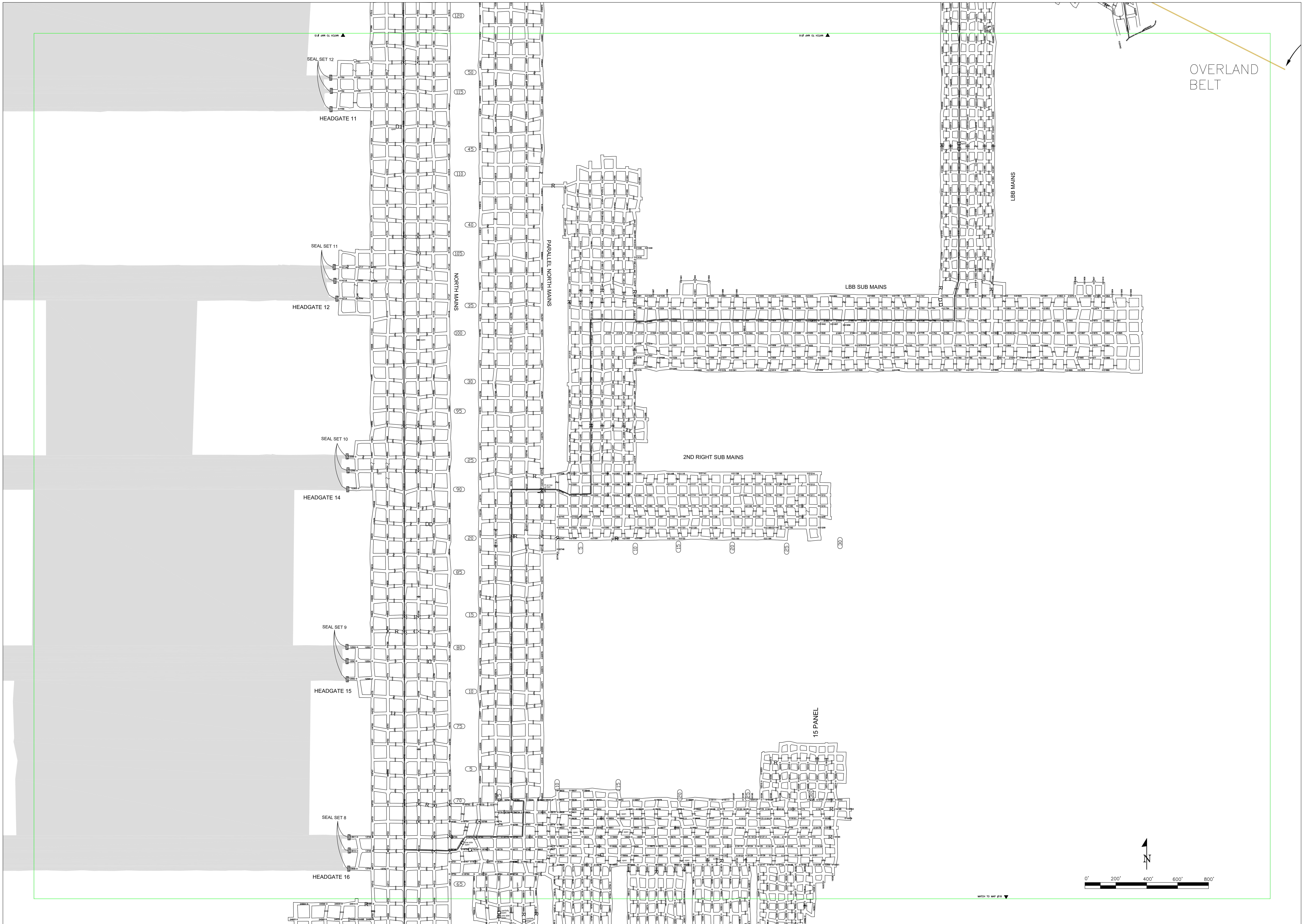
LEGEND
Scale 1"=100'

MAPPING NOTES

CONDITION OF VENTILATION CONTROLS AS MAPPED.

14 15 16
17
18

APPENDIX H-16
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



STOPPING
STOPPING WITH HOLE
STOPPING WITH MANDOOR
STOPPING WITH MANDOOR AND HOLE
BELT CHECK
CURTAIN
FLYPAD

D EQUIPMENT DOOR
EQUIPMENT DOOR WITH HOLE
R REGULATOR
OVERCAST
OVERCAST WITH HOLE
OVERCAST WITH MANDOOR
OVERCAST WITH MANDOOR AND HOLE
TRACK
CONVEYOR BELT
12345 O SPAD NUMBER

LEGEND
Scale 1"=200'

MAPPING NOTES

APPENDIX H-17
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

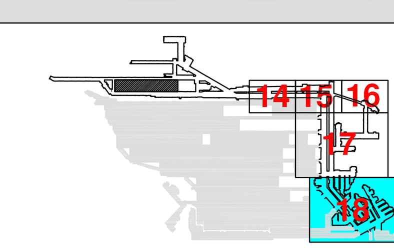
STOPPING
STOPPING WITH HOLE
STOPPING WITH MANDOOR
STOPPING WITH MANDOOR AND HOLE
BELT CHECK
CURTAIN
FLYPAD

D EQUIPMENT DOOR
D EQUIPMENT DOOR WITH HOLE
R REGULATOR
OVERCAST
OVERCAST WITH HOLE
OVERCAST WITH MANDOOR

OVERCAST WITH MANDOOR AND HOLE
TRACK
CONVEYOR BELT
12345 O SPAD NUMBER

LEGEND
Scale 1"=200'

MAPPING NOTES



APPENDIX H–18
Mapping of the Mine
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46–08436

APPENDIX I

PIL NO. 110-V-8 PROCEDURES FOR COPYING PHOTOGRAPHS

EFFECTIVE DATE: 07/13/2010 EXPIRATION DATE: 03/31/2012

PROCEDURE INSTRUCTION LETTER NO. I10-V-08

FROM: KEVIN G. STRICKLIN *Charles Thomas for*
Administrator for
Coal Mine Safety and Health

NEAL H. MERRIFIELD *Neal H Merrifield*
Acting Administrator for
Metal and Nonmetal Mine Safety and Health

THOMAS KESSLER *Thomas Kessler*
Acting Director for Educational Policy and Development

LINDA F. ZEILER *John Faini for*
Acting Director of Technical Support

SUBJECT: Use of Digital Cameras and the Storage and Preservation of Digital Images

Scope

This Procedure Instruction Letter (PIL) is intended for Mine Safety and Health Administration (MSHA) personnel who conduct inspections or investigations and maintain inspection or investigation documentation. This PIL replaces PIL No. 109-V-2, issued June 5, 2009.

Purpose

This PIL provides guidance and instructions to MSHA personnel who use digital cameras during their inspections or investigations and maintain digital images, including photographs and videos, taken during inspections or investigations as part of their documentation.

Procedure Instructions

Authorizing the Use of Digital Cameras -- In addition to other forms of documentation, digital images of violations and accident scenes are of great assistance in documenting violations or other conditions during an inspection or investigation.

Digital images and/or videos can significantly contribute to resolving differences of opinion between mine operators and MSHA personnel. The digital images and/or videos should accurately and effectively depict conditions or objects present during the investigation or inspection and subsequent abatement. This information can be invaluable during informal discussions and safety and health conferences. Such images may also expedite judicial proceedings by providing a pictorial illustration of a violation and its abatement/termination or an accident scene.

Accordingly, the use of digital cameras is encouraged, and cameras should be used whenever practical subject to the following restrictions:

1. Underground coal mines and gassy underground metal and nonmetal mines where permissible equipment is required. *Only cameras approved by MSHA's Approval and Certification Center (A&CC), when available, shall be used. Until then, the possession or use of cameras inby the last open crosscut, or within 150 feet of pillar workings or longwall face, or the use of cameras in return entries, or bleeder entries is prohibited unless approved by the District Manager.*

2. Gilsonite mines. *The possession or use of cameras is prohibited.*

3. Explosives storage magazines, loaded explosives vehicles, and explosives loading areas. *The possession or use of cameras is prohibited within 25 feet.*

Note - This prohibition does not include facilities, magazines, or vehicles storing Ammonium Nitrate Fuel Oil (ANFO).

4. Flammable material storage or use areas and areas of coal handling facilities which are Class I or Class II Hazardous Locations (explosive dusts or gasses) as outlined in the National Electrical Code. *The use of cameras is prohibited.*

Taking Digital Photographs and Images -- Digital photographs must clearly and accurately depict the nature of the violation or condition. Where appropriate, photographs of abatement or termination measures should also be taken. Before photographs are taken, ensure that the camera is set to the correct date and time. If the camera has audio capability, it should be turned off so that voices are not recorded, unless all persons are explicitly notified that their statements are being recorded.

To be most effective, a violation or condition should be captured with both an "up close" shot and a distance shot to provide perspective and points of view. The photograph should depict a miner's potential for exposure to the hazard or violation of the standard. As a rule of thumb, no more than two or three good photographs are necessary to illustrate a violation and its resolution. Too many photographs can become an administrative burden.

When taking a video recording, begin at a distance and "zoom in" to provide greater detail of particular features. When panning an area, move the camera slowly enough to permit viewers to observe relevant details and attempt to minimize camera movement. Additional, digital memory cards may be needed to assure sufficient storage capacity if both videos and photographs are taken.

If others in the inspection/investigation party are taking photographs, the identity of the individual and his/her affiliation should be recorded in the inspection/investigation notes.

At no time should MSHA personnel put themselves or others at risk or ask miners to re-enact practices in order to obtain photographs. MSHA personnel should not photograph conditions that pose an imminent danger before taking actions necessary to prevent miners from being exposed to the hazard.

Preserving Digital Photographs and Images – All photographs taken during an inspection or investigation must be retained. Images from digital photographs should be saved to a CD or DVD in the same file format (normally JPEG with moderate compression) and at the same resolution as they were originally captured by the camera. Once the digital images are effectively and reliably stored on a CD or DVD, the images may be deleted from the camera's digital memory card. Original digital images should not be modified or edited. Even when photographs are produced, the digital images should be stored on a CD or DVD and the CD or DVD must be maintained in the mine inspection/investigation file or as part of the inspection report.

Inspectors may be called to testify to the chain of custody when the pictures are introduced during a hearing. Therefore, for each digital image, the inspection/investigation notes or the Photo Mounting Worksheet (MSHA Form 4000-125) should document: (a) the person who took the photograph when more than one inspector/investigator was involved in the inspection/investigation; (b) the date and time the photograph was taken; (c) the location of the condition or object; (d) a brief description of image(s) captured; and (e) the person who transferred the digital image to the CD or DVD. All enforcement actions, inspector notes, and digital images associated with an inspection or an investigation should be provided to the Office of the Solicitor or a Conference and Litigation Representative (CLR) once a matter has been referred to the Federal Mine Safety and Health Review Commission or any other judicial body.

Background

MSHA policies concerning the use of cameras traditionally have been developed by individual MSHA District Offices or incorporated into PILs that generally address the collection and preservation of information during an inspection or an investigation. However, as the cost of cameras has decreased and digital photography permits images to be more easily and effectively captured and stored, MSHA recognizes the importance of guidance and instruction specific to the use of digital cameras and to the storage/preservation of digital images.

Authority
Sections 103(a) and 110(h) of the Federal Mine Safety and Health Act of 1977, as amended, 30 U.S.C. § 876.

Filing Instructions
This instruction letter should be filed behind the tab marked "Procedure Instruction Letters" in the binder for Program Policy Handbooks and Procedure Instruction Letters.

Issuing Office and Contact Persons
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E-mail address: lichtenfels.marvin@dol.gov

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Deputy Director
Thomas Kessler, (202) 693-9585
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Directorate of Technical Support
Chief, Electrical Safety Division, ACC
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Distribution
Program Policy Manual Holders
Coal Mine Safety and Health Personnel
Metal and Nonmetal Mine Safety and Health Personnel
Educational Policy and Development Personnel
Technical Support Personnel
Special Assessment Personnel
Underground and Surface Mine Operators
Independent Contractors

APPENDIX J

MINE DUST RESULTS

UPPER BIG BRANCH EXPLOSION INVESTIGATION

MSHA Analysis of Mine Rock Dust Samples - July 2010

Sampling Area: *5N Parallel Mains* **Sampled By:** *Team 1 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873039	6A20X	I	66.2	Trace	n/a
873040	6A21	I	70.6	Trace	n/a
873041	6A22	I	65.4	Trace	n/a
873042	6A23	I	61.2	Trace	n/a
873043	6A24	I	61.0	Trace	n/a
873044	6B20	I	66.1	Trace	n/a
873045	6B20X	I	58.7	Trace	n/a
873046	6B21	I	61.0	Trace	n/a
873047	6B22	I	59.4	Trace	n/a
873048	6B23	I	65.9	None	n/a
873049	6B24	I	62.6	Trace	n/a
873050	6B25	I	62.2	Trace	n/a
873051	6B26	I	60.0	Trace	n/a
873052	6C17	I	53.9	Trace	n/a
873053	6C18	I	71.9	Trace	n/a
873054	6C19	I	60.3	Trace	n/a
873055	6C20X	I	67.4	Trace	n/a
873056	6C21	I	51.9	Trace	n/a
873057	6C22	I	54.4	Trace	n/a
873058	6C23	I	56.9	Trace	n/a
873059	6C24	I	57.0	Trace	n/a
873060	6C25	I	57.0	Trace	n/a
873061	6C26	I	63.3	Trace	n/a
873062	6C27	I	62.1	Trace	n/a
873063	6D17	I	64.1	Trace	n/a
873064	6D18	I	64.5	None	n/a
873065	6D19	I	71.5	None	n/a
873066	6D20	I	63.3	None	n/a
873067	6D20X	I	71.6	None	n/a
873068	6D21	I	63.8	Trace	n/a
873069	6D22	I	67.8	Trace	n/a
873070	6D23	I	65.6	Trace	n/a
873071	6D24	I	60.1	None	n/a
873072	6D25	I	53.4	None	n/a
873073	6D26	I	60.4	None	n/a
873074	6D27	I	53.5	None	n/a
873075	6E17	I	78.1	None	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873076	6E22	I	68.8	Trace	n/a
873077	6E23	I	59.7	Trace	n/a

Sampling Area: ***5 North Section*** **Sampled By:** ***Team 2 - July 13, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873078	5A21X	R	76.5	Trace	n/a
873079	5A22	R	59.6	Small	n/a
873080	5B20	R	66.5	Small	n/a
873081	5B21	R	64.5	Small	n/a
873082	5B21X	R	58.6	Small	n/a
873083	5B22	R	52.4	Large	n/a
873084	5B23	R	49.4	Large	n/a
873085	5C20	R	63.1	Small	n/a
873086	5C21	R	59.8	Small	n/a
873087	5C21X	I	71.0	Small	n/a
873088	5C22	R	63.7	Small	n/a
873089	5C23	R	52.6	Large	n/a
873090	5D20	I	72.8	Small	n/a
873091	5D21	I	74.0	Small	n/a
873092	5D22	I	64.8	Small	n/a
873093	5D23	I	60.3	Small	n/a
873094	5E20	I	80.1	Small	n/a
873095	5E21	I	76.9	Trace	n/a
873096	5E21X	I	68.2	Small	n/a
873097	5E22	I	78.3	Trace	n/a
873098	5E23	I	76.5	Trace	n/a
873099	5F21X	I	68.2	Small	n/a
873100	5F22	I	86.8	Trace	n/a
873101	5F23	I	80.8	Trace	n/a
873102	5G21	I	75.7	Trace	n/a
873103	5G22	I	72.2	Trace	n/a
873104	5G23	I	70.4	Small	n/a

Sampling Area: ***HG 1 North*** **Sampled By:** ***Team 3 - July 13, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873105	13A1	I	70.3	Large	n/a
873106	13A2	I	51.6	Large	n/a
873107	13a3	I	51.7	Large	n/a
873108	13A4	I	55.4	Large	n/a
873109	13A5	I	51.5	Large	n/a
873110	13A6	I	45.0	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873111	13A7	I	51.1	Large	n/a
873112	13A8	R	46.8	X-Large	n/a
873113	13B2	I	49.5	Large	n/a
873114	13B3	I	50.5	X-Large	n/a
873115	13b4	I	47.2	X-Large	n/a
873116	13B5	I	50.2	Large	n/a
873117	13B6	I	42.4	Large	n/a
873118	13B7	I	44.4	Large	n/a
873119	13B8	I	56.5	Large	n/a
873120	13B9	I	50.8	X-Large	n/a
873121	13C3	I	47.7	Large	n/a
873122	13C4	I	59.4	Large	n/a
873123	13C4X	I	48.7	Small	n/a
873124	13C5	I	48.5	Large	n/a
873125	13C5X	I	41.9	Large	n/a
873126	13C6	I	55.4	Large	n/a
873127	13C7	I	60.6	Large	n/a
873128	13C8	I	68.9	Large	n/a
873129	13C9	I	59.2	Large	n/a
873130	13D7	I	41.1	Large	n/a
873131	13D8	R	51.9	X-Large	n/a
873132	13D9	I	63.9	X-Large	n/a
873133	13E7	I	37.0	Large	n/a
873134	13E8	R	36.6	Large	n/a
873135	13E9	R	55.9	Large	n/a

Sampling Area: *Section 17 TG 1 North* Sampled By: *Team 4 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873136	17A23	R	51.3	X-Large	n/a
873137	17A24	R	51.1	X-Large	n/a
873138	17A25	R	52.6	X-Large	n/a
873139	17A26	R	54.8	X-Large	n/a
873140	17A27	R	55.6	X-Large	n/a
873141	17B23	R	50.5	Large	n/a
873142	17B24	R	38.6	X-Large	n/a
873143	17B25	R	50.0	X-Large	n/a
873144	17B26	R	50.5	X-Large	n/a
873145	17B27	R	51.8	X-Large	n/a
873146	17C23	R	57.6	X-Large	n/a
873147	17C24	R	67.7	X-Large	n/a
873148	17C25	R	66.8	Large	n/a
873149	17C26	R	59.7	X-Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873150	17C27	R	67.2	Large	n/a
873151	17D22	R	56.5	X-Large	n/a
873152	17D23	R	61.6	Large	n/a
873153	17D24	R	49.5	Large	n/a
873154	17D25	R	58.9	X-Large	n/a
873155	17D26	R	58.6	X-Large	n/a
873156	17D27	R	62.0	X-Large	n/a
873157	17E22	R	48.9	X-Large	n/a
873158	17E23	R	53.3	X-Large	n/a
873159	17E24	R	53.9	Large	n/a
873160	17E25	R	58.6	X-Large	n/a
873161	17E26	R	55.7	X-Large	n/a
873162	17E27	R	50.6	Large	n/a
873163	17F24	R	50.8	X-Large	n/a
873164	17F25	R	37.9	Large	n/a
873165	17F26	R	50.3	X-Large	n/a
873166	17F27	R	44.1	Large	n/a

Sampling Area: 7 *North*   Sampled By: *Team 5 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873167	7A50	I	46.8	Large	n/a
873168	7A50X	I	44.8	Large	n/a
873169	7B50X	I	50.9	Large	n/a
873170	7B51	I	48.9	Large	n/a
873171	7B52	I	50.3	Large	n/a
873172	7B53	I	56.3	Large	n/a
873173	7B54	I	70.5	Large	n/a
873174	7B55	I	66.5	Large	n/a
873175	7C51	I	57.8	Large	n/a
873176	7C52	I	66.2	Large	n/a
873177	7C53	I	65.7	Large	n/a
873178	7C54	I	68.8	Large	n/a
873179	7C55	I	58.8	Large	n/a
873180	7D50X	I	67.0	Large	n/a
873181	7D51	I	62.9	Small	n/a
873182	7D52	I	70.5	Small	n/a
873183	7D53	I	59.6	Large	n/a
873184	7E50	I	73.3	Large	n/a
873185	7E50X	I	75.2	Large	n/a
873186	7E51	I	72.3	Small	n/a
873187	7E52	I	60.7	Small	n/a
873188	7F50	I	90.7	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873189	7F51	I	86.2	Large	n/a

Sampling Area: *6 North* **Sampled By:** *Team 6 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873190	7B5X	I	54.8	Small	n/a
873191	7B6	I	60.6	Small	n/a
873192	7C5	I	60.7	Trace	n/a
873193	7C5X	I	66.5	Trace	n/a
873194	7C6	I	64.6	Trace	n/a
873195	7D3	I	83.8	Trace	n/a
873196	7D4	I	68.6	Trace	n/a
873197	7D5	I	65.2	Trace	n/a
873198	7D5X	I	67.1	Trace	n/a
873199	7D6	I	70.5	Trace	n/a
873200	7E1	I	91.1	None	n/a
873201	7E2	I	87.9	Trace	n/a
873202	7E3	I	74.0	Trace	n/a
873203	7E4	I	72.8	Trace	n/a
873204	7E5	I	71.6	Trace	n/a
873205	7E6	I	70.2	Trace	n/a
873206	7F1	I	66.5	None	n/a
873207	7F2	I	70.1	None	n/a
873208	7F3	I	69.8	Trace	n/a
873209	7F4	I	67.1	Trace	n/a

Sampling Area: *8 North Mains* **Sampled By:** *Team 7 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873210	9A1	I	65.8	Large	n/a
873211	9A2	I	48.0	Large	n/a
873212	9A2X	I	51.4	X-Large	n/a
873213	9A3	I	49.1	Large	n/a
873214	9A4	I	48.9	Large	n/a
873215	9B1	I	50.0	Large	n/a
873216	9B2	I	55.5	Large	n/a
873217	9B2X	I	48.1	Large	n/a
873218	9B3	I	53.1	Large	n/a
873219	9B4	I	60.7	Large	n/a
873220	9C1	I	58.3	Large	n/a
873221	9C2	I	56.1	Large	n/a
873222	9C2X	I	45.4	Large	n/a
873223	9C3	I	50.5	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873224	9C4	I	49.2	Large	n/a
873225	9D1	I	60.2	Large	n/a
873226	9D2	I	46.5	Large	n/a
873227	9D2X	I	43.8	Large	n/a
873228	9D3	I	49.0	Large	n/a
873229	9D4	I	45.1	Large	n/a
873230	9E1	I	49.7	Large	n/a
873231	9E2	I	72.0	Small	n/a
873232	9E2X	I	51.7	Small	n/a
873233	9E4	I	44.9	Large	n/a
873234	9E5	I	42.7	Large	n/a
873235	9F4	I	45.3	Large	n/a
873236	9F5	I	48.5	Large	n/a

Sampling Area: *Sect. 10 8N Mains*   Sampled By: *Team 8 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873237	10A1	I	53.1	X-Large	n/a
873238	10A1X	I	48.3	X-Large	n/a
873239	10A2	I	49.5	X-Large	n/a
873240	10A3	I	44.4	Large	n/a
873241	10B1	I	49.2	X-Large	n/a
873242	10B1X	I	48.0	Large	n/a
873243	10B2	I	52.9	X-Large	n/a
873244	10B3	I	45.9	Large	n/a
873245	10C1	I	52.8	X-Large	n/a
873246	10C10	I	48.4	X-Large	n/a
873247	10C10X	I	45.3	X-Large	n/a
873248	10C11	I	43.1	X-Large	n/a
873249	10C1X	I	43.9	Large	n/a
873250	10D1	I	45.7	X-Large	n/a
873251	10D10	I	42.9	X-Large	n/a
873252	10D10X	I	43.8	X-Large	n/a
873253	10D11	I	59.9	X-Large	n/a
873254	10D1X	I	47.9	X-Large	n/a
873255	10E1	I	40.5	X-Large	n/a
873256	10E10	I	40.4	X-Large	n/a
873257	10E10X	I	45.3	X-Large	n/a
873258	10E11	I	48.3	X-Large	n/a
873259	10E1X	I	39.8	X-Large	n/a
873260	10E2	I	39.9	Large	n/a
873261	10E3	I	42.9	Large	n/a
873262	10E4	I	40.3	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873263	10E5	I	40.9	X-Large	n/a
873264	10E6	I	38.2	Large	n/a
873265	10E7	I	40.2	X-Large	n/a
873266	10E8	I	40.1	X-Large	n/a
873267	10E9	I	42.1	X-Large	n/a
873268	10F1	I	41.6	Large	n/a
873269	10F10	I	47.8	X-Large	n/a
873270	10F11	I	46.3	X-Large	n/a
873271	10F2	I	42.5	Large	n/a
873272	10F3	I	40.5	Large	n/a
873273	10F4	I	43.2	Large	n/a
873274	10F5	I	40.0	Large	n/a
873275	10F6	I	40.6	Large	n/a
873276	10F7	I	44.7	X-Large	n/a
873277	10F8	I	46.2	X-Large	n/a
873278	10F9	I	48.2	X-Large	n/a

Sampling Area: *Cut Out Between HG 1N and TG 1N*
Sampled By: *Team 9 - July 13, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873279	14A10	I	48.6	Large	n/a
873280	14A2	I	45.6	X-Large	n/a
873281	14A3	I	41.2	X-Large	n/a
873282	14A4	I	43.2	X-Large	n/a
873283	14A5	I	48.6	X-Large	n/a
873284	14A6	I	44.4	X-Large	n/a
873285	14A6X	I	46.7	X-Large	n/a
873286	14A7	I	49.4	X-Large	n/a
873287	14A8	I	48.4	X-Large	n/a
873288	14A9	I	46.5	X-Large	n/a
873289	14B1	I	49.1	X-Large	n/a
873290	14B10	I	47.6	Large	n/a
873291	14B2	I	49.0	X-Large	n/a
873292	14B3	I	47.6	X-Large	n/a
873293	14B4	I	49.8	X-Large	n/a
873294	14B5	I	87.9	X-Large	n/a
873295	14B6	I	48.9	X-Large	n/a
873296	14B6X	I	51.4	X-Large	n/a
873297	14B7	I	48.9	Large	n/a
873298	14B8	I	46.7	Large	n/a
873299	14B9	I	44.6	Large	n/a
873300	14C10	I	45.6	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873301	14C9	I	49.8	Large	n/a
873302	14D10	I	47.5	Large	n/a
873303	14D9	I	47.1	Large	n/a
873304	14E10	I	44.8	Large	n/a
873305	14E9	I	47.9	Large	n/a
873306	14F10	I	63.5	Large	n/a
873307	14F9	I	50.0	Large	n/a
873308	14G10	I	53.6	Small	n/a
873309	14G9	I	47.4	Small	n/a

Sampling Area: ***Section 16 TG*** **Sampled By:** ***Team 10 - July 13, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873310	16A1	I	56.0	Trace	n/a
873311	16A2	I	55.2	Large	n/a
873312	16A3	I	52.9	Large	n/a
873313	16A4	I	54.5	Small	n/a
873314	16A5	I	52.3	Large	n/a
873315	16A6	I	47.2	Large	n/a
873316	16A7	I	50.1	Large	n/a
873317	16A7X	I	48.9	Large	n/a
873318	16B1	I	61.9	Trace	n/a
873319	16B2	I	57.6	Large	n/a
873320	16B3	I	57.0	Large	n/a
873321	16B4	I	63.6	Large	n/a
873322	16B5	I	64.1	Small	n/a
873323	16B6	I	62.4	Small	n/a
873324	16B7	I	62.2	Large	n/a
873325	16B7X	I	57.1	Large	n/a
873326	16C1	I	81.3	Trace	n/a
873327	16C2	I	74.5	Large	n/a
873328	16C3	I	66.9	Large	n/a
873329	16C4	I	70.6	Small	n/a
873330	16C5	I	73.5	Small	n/a
873331	16C6	I	68.4	Large	n/a
873332	16C7	I	69.8	Small	n/a
873333	16C7X	I	58.5	Large	n/a
873334	16D1	I	78.4	Small	n/a
873335	16D3	I	81.9	Small	n/a
873336	16D4	I	67.0	Small	n/a
873337	16D5	I	63.1	Small	n/a
873338	16D6	I	65.3	Small	n/a
873339	16D7	I	67.2	Small	n/a

Sampling Area: ***5N Parallel Mains*** **Sampled By:** ***Team 1 - July 14, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873340	6A12	I	73.5	None	n/a
873341	6A12X	I	66.7	None	n/a
873342	6A13	I	79.3	Trace	n/a
873343	6A14	I	67.4	Trace	n/a
873344	6A14X	I	76.0	Trace	n/a
873345	6A15	I	61.4	Small	n/a
873346	6A16	I	64.5	Small	n/a
873347	6A17	I	60.3	Trace	n/a
873348	6A18	I	56.9	Trace	n/a
873349	6A19	I	61.2	Small	n/a
873350	6A20	I	64.5	Trace	n/a
873351	6B12	I	66.0	None	n/a
873352	6B12X	I	53.3	None	n/a
873353	6B13	I	85.0	Trace	n/a
873354	6B14	I	76.7	Trace	n/a
873355	6B14X	I	83.4	None	n/a
873356	6B15	I	66.7	Trace	n/a
873357	6B16	I	59.2	Small	n/a
873358	6B17	I	64.8	Trace	n/a
873359	6B18	I	65.4	Trace	n/a
873360	6C12	I	73.4	None	n/a
873361	6C12X	I	78.2	None	n/a
873362	6C13	I	84.3	Trace	n/a
873363	6C14	I	77.4	Trace	n/a
873364	6C14X	I	76.3	Trace	n/a
873365	6C15	I	76.9	Trace	n/a
873366	6C16	I	58.2	Trace	n/a
873367	6D12	I	55.4	None	n/a
873368	6D12X	I	59.2	None	n/a
873369	6D13	I	81.0	None	n/a
873370	6D14	I	79.5	None	n/a
873371	6D14X	I	81.3	None	n/a
873372	6E12	I	52.9	None	n/a
873373	6E13	I	75.7	None	n/a
873374	6E14	I	75.7	None	n/a
873375	6E16	I	78.9	Trace	n/a
873376	6E18	I	63.2	None	n/a
873377	6F15	I	80.1	None	n/a
873378	6F16	I	68.2	Trace	n/a
873379	6F17	I	63.5	Trace	n/a

Sampling Area: ***5 North Section*** **Sampled By:** ***Team 2 - July 14, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873380	5B17	R	63.4	Small	n/a
873381	5B18	R	55.7	Large	n/a
873382	5B19	R	65.1	Large	n/a
873383	5C17	R	64.0	Small	n/a
873384	5C18	R	61.9	Small	n/a
873385	5C19	R	65.6	Small	n/a
873386	5D15	I	71.0	Small	n/a
873387	5D16	I	66.0	Large	n/a
873388	5D17	I	66.3	Large	n/a
873389	5D18	I	69.8	Small	n/a
873390	5D19	I	65.6	Large	n/a
873391	5E15	I	83.2	Trace	n/a
873392	5E16	I	78.0	Small	n/a
873393	5E17	I	87.3	Trace	n/a
873394	5E18	I	76.6	Small	n/a
873395	5E19	I	72.8	Small	n/a
873396	5F15	I	77.4	Trace	n/a
873397	5F16	I	87.5	Trace	n/a
873398	5F17	I	85.7	Trace	n/a
873399	5F18	I	82.0	Trace	n/a
873400	5F19	I	87.0	Trace	n/a
873401	5F20	I	89.0	Trace	n/a
873402	5F21	I	84.1	Trace	n/a
873403	5G15	I	68.4	Trace	n/a
873404	5G16	I	66.2	Trace	n/a
873405	5G17	I	60.0	Trace	n/a
873406	5G18	I	73.6	Trace	n/a
873407	5G19	I	73.0	Trace	n/a
873408	5G20	I	69.6	Small	n/a

Sampling Area: ***HG 1 North*** **Sampled By:** ***Team 3 - July 14, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873409	13B10	I	51.7	Large	n/a
873410	13B11	I	56.6	Large	n/a
873411	13B12	I	64.5	Large	n/a
873412	13B13	I	64.2	X-Large	n/a
873413	13B14	I	61.8	X-Large	n/a
873414	13B14X	I	73.1	X-Large	n/a
873415	13B15	I	66.1	Large	n/a
873416	13B9X	I	63.2	X-Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873417	13C10	I	65.8	Large	n/a
873418	13C11	I	64.5	Large	n/a
873419	13C12	I	70.9	X-Large	n/a
873420	13C13	I	76.8	Large	n/a
873421	13C14	I	64.8	X-Large	n/a
873422	13C14X	I	58.2	X-Large	n/a
873423	13C15	I	65.1	Large	n/a
873424	13C9X	I	54.7	X-Large	n/a
873425	13D10	I	66.5	X-Large	n/a
873426	13D11	I	67.1	Large	n/a
873427	13D12	I	65.9	Large	n/a
873428	13D13	I	64.4	Large	n/a
873429	13D14	I	58.8	Large	n/a
873430	13D14X	R	44.9	X-Large	n/a
873431	13D15	I	52.6	X-Large	n/a
873432	13E10	R	50.7	X-Large	n/a
873433	13E11	R	45.3	X-Large	n/a
873434	13E12	R	54.2	X-Large	n/a
873435	13E13	R	44.7	X-Large	n/a
873436	13E14	R	54.3	X-Large	n/a
873437	13E14X	R	51.0	X-Large	n/a
873438	13E15	R	42.6	X-Large	n/a
873439	13E9X	R	44.8	X-Large	n/a
873440	13F10	R	43.5	X-Large	n/a
873441	13F11	R	46.0	X-Large	n/a
873442	13F12	R	48.9	X-Large	n/a
873443	13F13	R	44.0	X-Large	n/a
873444	13F14	R	39.9	X-Large	n/a
873445	13F15	R	41.2	X-Large	n/a

Sampling Area: ***17 TG 1 North*** **Sampled By:** ***Team 4 - July 14, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873446	17A18	R	52.7	X-Large	n/a
873447	17A19	R	50.8	X-Large	n/a
873448	17A20	R	56.9	X-Large	n/a
873449	17A21	R	51.4	Large	n/a
873450	17A21X	R	55.8	Large	n/a
873451	17A22	R	49.8	X-Large	n/a
873452	17B18	R	46.4	X-Large	n/a
873453	17B19	R	40.3	X-Large	n/a
873454	17B20	R	55.4	X-Large	n/a
873455	17B21	R	49.8	X-Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873456	17B21X	R	57.5	X-Large	n/a
873457	17B22	R	50.4	X-Large	n/a
873458	17C18	R	67.0	X-Large	n/a
873459	17C19	R	75.5	Large	n/a
873460	17C20	R	58.2	Large	n/a
873461	17C21	R	72.8	Large	n/a
873462	17C21X	R	69.0	Large	n/a
873463	17C22	R	71.8	Large	n/a
873464	17D19	R	64.6	X-Large	n/a
873465	17D21X	R	51.6	Large	n/a
873466	17E19	R	42.8	Large	n/a
873467	17E20	R	43.3	Large	n/a
873468	17E21	R	56.7	Large	n/a
873469	17F19	R	38.9	Large	n/a
873470	17F20	R	38.8	Large	n/a

Sampling Area: ***7 North*** **Sampled By:** ***Team 5 - July 14, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873471	7A48	I	52.2	Large	n/a
873472	7A49	I	52.4	Large	n/a
873473	7B46	I	40.9	Small	n/a
873474	7B47	I	44.7	Large	n/a
873475	7B48	I	44.7	Large	n/a
873476	7B49	I	45.0	Large	n/a
873477	7B50	I	56.1	Large	n/a
873478	7C46	I	47.6	Large	n/a
873479	7C47	I	42.7	Large	n/a
873480	7C48	I	52.9	Small	n/a
873481	7C49	I	48.6	Large	n/a
873482	7C50	I	61.6	Small	n/a
873483	7D46	I	53.9	Small	n/a
873484	7D47	I	50.8	Large	n/a
873485	7D48	I	51.4	Small	n/a
873486	7D49	I	55.5	Large	n/a
873487	7D50	I	61.0	Large	n/a
873488	7E46	I	60.4	Small	n/a
873489	7E47	I	57.2	Large	n/a
873490	7E48	I	54.9	Large	n/a
873491	7E49	I	66.1	Large	n/a
873492	7F46	I	46.9	Small	n/a
873493	7F47	I	37.5	Large	n/a
873494	7F48	I	67.9	Large	n/a

Sampling Area: *6 North* **Sampled By:** *Team 6 - July 14, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873495	7B10	I	61.0	Small	n/a
873496	7B11	I	60.7	Small	n/a
873497	7B12	I	54.7	Small	n/a
873498	7B7	I	62.2	Small	n/a
873499	7B8	I	53.5	Small	n/a
873500	7B9	I	56.6	Small	n/a
873501	7C11	I	64.9	Trace	n/a
873502	7C12	I	68.8	Small	n/a
873503	7C7	I	61.4	Trace	n/a
873504	7C8	I	58.2	Small	n/a
873505	7C9	I	57.3	Small	n/a
873506	7D7	I	70.0	Small	n/a
873507	7D8	I	80.5	Trace	n/a
873508	7D9	I	75.4	Small	n/a
873509	7E5X	I	73.5	Small	n/a
873510	7E7	I	74.6	Trace	n/a
873511	7E8	I	76.7	Trace	n/a
873512	7E9	I	75.7	Trace	n/a
873513	7F5	I	60.8	Small	n/a
873514	7F6	I	63.9	Trace	n/a
873515	7F7	I	65.0	Trace	n/a

Sampling Area: *8 North Mains* **Sampled By:** *Team 7 - July 14, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873516	9A5	I	47.7	Trace	n/a
873517	9A6	I	43.7	Large	n/a
873518	9A7	I	44.7	Large	n/a
873519	9A7X	I	44.6	Large	n/a
873520	9A8	I	45.9	Large	n/a
873521	9B5	I	48.2	Large	n/a
873522	9B6	I	47.9	Large	n/a
873523	9B7	I	46.9	Large	n/a
873524	9B7X	I	45.9	Large	n/a
873525	9B8	I	55.1	Large	n/a
873526	9C5	I	49.5	Large	n/a
873527	9C6	I	55.6	Large	n/a
873528	9C7	I	57.7	Large	n/a
873529	9C7X	I	47.5	Large	n/a
873530	9C8	I	50.5	Large	n/a
873531	9D5	I	46.4	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873532	9D6	I	47.9	Large	n/a
873533	9D7	I	48.4	Large	n/a
873534	9D7X	I	44.8	Large	n/a
873535	9D8	I	52.3	Large	n/a
873536	9E6	I	46.5	Large	n/a
873537	9E7	I	49.9	Large	n/a
873538	9E7X	I	43.6	Large	n/a
873539	9E8	I	51.2	Large	n/a
873540	9F6	I	37.2	Large	n/a
873541	9F7	I	42.6	Large	n/a
873542	9F8	I	48.3	Large	n/a

Sampling Area: *Sect. 10 8 North Mains* Sampled By: *Team 8 - July 14, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873543	10A10	I	46.5	Large	n/a
873544	10A10X	I	48.1	X-Large	n/a
873545	10A11	I	48.2	Large	n/a
873546	10A4	I	42.6	Large	n/a
873547	10A5	I	45.8	Large	n/a
873548	10A6	I	43.2	Large	n/a
873549	10A7	I	50.3	Large	n/a
873550	10A8	I	47.4	Large	n/a
873551	10A9	I	50.9	Large	n/a
873552	10B10	I	50.4	Large	n/a
873553	10B10X	I	48.9	Large	n/a
873554	10B11	I	45.5	X-Large	n/a
873555	10B4	I	42.2	Large	n/a
873556	10B5	I	39.1	Large	n/a
873557	10B6	I	41.4	Large	n/a
873558	10B7	I	44.7	Large	n/a
873559	10B8	I	43.3	Large	n/a
873560	10B9	I	48.9	Large	n/a
873561	10C4	I	40.0	Large	n/a
873562	10C5	I	40.4	Large	n/a
873563	10C6	I	50.1	Large	n/a
873564	10C7	I	46.3	Large	n/a
873565	10C8	I	39.7	Large	n/a
873566	10C9	I	43.3	Large	n/a
873567	10D4	I	53.5	Large	n/a
873568	10D5	I	46.7	Large	n/a
873569	10D6	I	38.9	Large	n/a
873570	10D7	I	41.8	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873571	10D8	I	40.7	Large	n/a
873572	10D9	I	46.1	Large	n/a

Sampling Area: ***Cut Out Between HG 1N and TG 1N***
Sampled By: ***Team 9 - July 14,2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873573	14C1	I	51.5	X-Large	n/a
873574	14C2	I	50.9	X-Large	n/a
873575	14C3	I	51.2	X-Large	n/a
873576	14C4	I	50.8	X-Large	n/a
873577	14C5	I	54.8	X-Large	n/a
873578	14C6	I	54.9	Large	n/a
873579	14C6X	I	48.7	Large	n/a
873580	14C7	I	50.8	Large	n/a
873581	14C8	I	50.1	Large	n/a
873582	14D1	I	54.8	X-Large	n/a
873583	14D2	I	56.0	X-Large	n/a
873584	14D3	I	51.6	X-Large	n/a
873585	14D4	I	48.3	X-Large	n/a
873586	14D5	I	61.1	X-Large	n/a
873587	14D6	I	51.5	X-Large	n/a
873588	14D6X	I	57.5	X-Large	n/a
873589	14D7	I	47.5	X-Large	n/a
873590	14D8	I	46.4	Large	n/a
873591	14E1	I	62.2	X-Large	n/a
873592	14E2	I	55.7	X-Large	n/a
873593	14E3	I	52.9	X-Large	n/a
873594	14E4	I	57.8	X-Large	n/a
873595	14E5	I	55.7	X-Large	n/a
873596	14E6	I	55.3	X-Large	n/a
873597	14E6X	I	57.5	X-Large	n/a
873598	14E7	I	52.7	X-Large	n/a
873599	14E8	I	52.0	X-Large	n/a
873600	14F6	I	60.4	X-Large	n/a
873601	14F6X	I	55.8	X-Large	n/a
873602	14F7	I	57.2	X-Large	n/a
873603	14F8	I	53.7	Large	n/a

Sampling Area: ***Section 16 TG*** **Sampled By:** ***Team 10 - July 14, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873604	16A10	I	55.7	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873605	16A11	I	49.8	Large	n/a
873606	16A12	I	44.5	Large	n/a
873607	16A8	I	59.1	Large	n/a
873608	16A9	I	47.9	Large	n/a
873609	16B10	I	57.3	Large	n/a
873610	16B11	I	57.2	Large	n/a
873611	16B12	I	51.0	Large	n/a
873612	16B8	I	59.8	Large	n/a
873613	16B9	I	61.9	Large	n/a
873614	16C10	I	67.3	Large	n/a
873615	16C11	I	67.8	Large	n/a
873616	16C12	I	63.8	Large	n/a
873617	16C8	I	71.2	Large	n/a
873618	16C9	I	60.1	Large	n/a
873619	16D10	I	72.7	Small	n/a
873620	16D11	I	58.0	Large	n/a
873621	16D12	I	65.4	Small	n/a
873622	16D8	I	66.8	Large	n/a
873623	16D9	I	68.5	Large	n/a
873624	16E10	I	55.0	Large	n/a
873625	16E11	I	53.8	Large	n/a
873626	16E12	I	46.9	Large	n/a
873627	16E9	I	51.5	Large	n/a
873628	16F10	I	57.9	Large	n/a
873629	16F11	I	53.1	Large	n/a
873630	16F12	I	44.3	Large	n/a
873631	16G12	I	50.8	Large	n/a

Sampling Area: ***5N Parallel Mains*** **Sampled By:** ***Team 1 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873632	6A10	I	63.0	None	n/a
873633	6A10X	I	66.2	None	n/a
873634	6A7	I	62.5	None	n/a
873635	6A8	I	32.5	None	n/a
873636	6A8X	I	41.9	None	n/a
873637	6A9	I	76.9	None	n/a
873638	6B10	I	78.9	None	n/a
873639	6B10X	I	73.9	None	n/a
873640	6B7	I	68.7	None	n/a
873641	6B8	I	40.8	None	n/a
873642	6B8X	I	79.6	None	n/a
873643	6B9	I	80.1	None	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873644	6C10	I	63.8	None	n/a
873645	6C10X	I	87.3	None	n/a
873646	6C11	I	77.9	None	n/a
873647	6C7	I	60.2	None	n/a
873648	6C9	I	81.2	None	n/a
873649	6D10	I	79.6	None	n/a
873650	6D10X	I	86.6	None	n/a
873651	6D11	I	78.0	None	n/a
873652	6D7	I	78.3	None	n/a
873653	6D9	I	68.5	None	n/a
873654	6E10	I	66.6	None	n/a
873655	6E11	I	73.1	None	n/a
873656	6E7	I	68.6	None	n/a

Sampling Area: ***5 North Section*** **Sampled By:** ***Team 2 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873657	5B13	R	67.3	None	n/a
873658	5B14	R	68.3	Trace	n/a
873659	5B14X	R	76.6	Trace	n/a
873660	5B15	R	62.2	Small	n/a
873661	5B16	R	62.5	Small	n/a
873662	5C12X	I	58.9	None	n/a
873663	5C13	R	60.3	None	n/a
873664	5C14	R	64.2	Small	n/a
873665	5C14X	I	72.2	Trace	n/a
873666	5C15	R	62.8	Trace	n/a
873667	5C16	R	59.7	Small	n/a
873668	5D12	I	45.9	None	n/a
873669	5D12X	I	58.8	None	n/a
873670	5D13	I	68.3	None	n/a
873671	5D14	I	75.8	None	n/a
873672	5D14X	I	71.1	None	n/a
873673	5E12	I	74.6	None	n/a
873674	5E13	I	87.6	None	n/a
873675	5E14	I	84.6	None	n/a
873676	5E14X	I	77.5	None	n/a
873677	5F13	I	95.2	None	n/a
873678	5F14	I	88.1	None	n/a
873679	5G13	I	61.9	None	n/a
873680	5G14	I	56.5	None	n/a

Sampling Area: ***HG 1 North*** **Sampled By:** ***Team 3 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873681	13B16	I	62.6	Large	n/a
873682	13B17	I	45.7	X-Large	n/a
873683	13B18	I	46.7	Large	n/a
873684	13B19	I	47.0	Large	n/a
873685	13C16	I	55.1	X-Large	n/a
873686	13C17	I	67.0	Large	n/a
873687	13C18	I	43.9	Large	n/a
873688	13C19	I	53.7	Large	n/a
873689	13D16	I	48.5	Large	n/a
873690	13D17	I	54.1	Large	n/a
873691	13D18	I	51.2	Large	n/a
873692	13D19	I	52.5	Large	n/a
873693	13E16	R	38.0	X-Large	n/a
873694	13E17	R	38.4	Large	n/a
873695	13E18	R	42.9	Large	n/a
873696	13E19	R	42.4	Large	n/a
873697	13F16	R	43.4	Large	n/a
873698	13F17	R	47.7	Large	n/a
873699	13F18	R	42.8	Large	n/a
873700	13F19	R	43.5	Large	n/a

Sampling Area: ***17 TG 1 North*** **Sampled By:** ***Team 4 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873701	17A14	R	41.4	Large	n/a
873702	17A15	R	45.5	Large	n/a
873703	17A16	R	42.7	X-Large	n/a
873704	17A17	R	50.1	X-Large	n/a
873705	17B14	R	37.9	X-Large	n/a
873706	17B15	R	40.1	X-Large	n/a
873707	17B16	R	51.8	Large	n/a
873708	17B17	R	48.7	X-Large	n/a
873709	17C14	I	48.0	Large	n/a
873710	17C15	R	61.7	Large	n/a
873711	17C16	R	56.9	Large	n/a
873712	17C17	R	57.4	X-Large	n/a
873713	17D15	R	60.0	X-Large	n/a
873714	17D16	R	55.8	Large	n/a
873715	17D17	R	57.8	Large	n/a
873716	17D18	R	50.7	X-Large	n/a
873717	17E15	R	46.1	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873718	17E16	R	42.2	X-Large	n/a
873719	17E17	R	48.2	Large	n/a
873720	17E18	R	42.1	Large	n/a
873721	17F15	R	38.8	Large	n/a
873722	17F16	R	44.5	Large	n/a
873723	17F17	R	38.6	Large	n/a
873724	17F18	R	33.9	Large	n/a

Sampling Area: *7 North* **Sampled By: *Team 5 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873725	7A45X	I	36.5	Large	n/a
873726	7A46	I	44.4	Large	n/a
873727	7A47	I	46.0	Large	n/a
873728	7B42	I	38.5	Small	n/a
873729	7B43	I	33.7	Small	n/a
873730	7B44	I	41.7	Trace	n/a
873731	7B45	I	40.5	Trace	n/a
873732	7B45X	I	39.3	Large	n/a
873733	7C42	I	43.9	Small	n/a
873734	7C43	I	39.8	Large	n/a
873735	7C44	I	42.8	Large	n/a
873736	7C45	I	39.3	Small	n/a
873737	7C45X	I	45.2	Large	n/a
873738	7D42	I	52.6	Large	n/a
873739	7D43	I	53.4	Small	n/a
873740	7D44	I	50.0	Small	n/a
873741	7D45	I	47.1	Small	n/a
873742	7D45X	I	53.5	Large	n/a
873743	7E42	I	65.5	Large	n/a
873744	7E43	I	45.6	Large	n/a
873745	7E44	I	51.2	Small	n/a
873746	7E45	I	56.5	Small	n/a
873747	7E45X	I	42.6	Large	n/a
873748	7F42	I	35.0	Large	n/a
873749	7F43	I	38.1	Large	n/a
873750	7F44	I	38.6	Small	n/a
873751	7F45	I	44.2	Small	n/a

Sampling Area: *6 North* **Sampled By: *Team 6 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873752	7B10X	I	52.7	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873753	7C10	I	61.9	Trace	n/a
873754	7C10X	I	58.4	Large	n/a
873755	7D10	I	67.6	Small	n/a
873756	7D10X	I	69.5	Small	n/a
873757	7D11	I	68.9	Small	n/a
873758	7D12	I	66.1	Small	n/a
873759	7E10	I	72.8	Trace	n/a
873760	7E10X	I	67.1	Trace	n/a
873761	7E11	I	78.2	Trace	n/a
873762	7E12	I	70.8	Small	n/a
873763	7F10	I	61.1	None	n/a
873764	7F11	I	64.3	None	n/a
873765	7F12	I	63.0	None	n/a
873766	7F13	I	54.2	None	n/a
873767	7F14	I	54.7	Trace	n/a

Sampling Area: ***9 North Mains*** **Sampled By:** ***Team 7 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873768	9A10	I	48.9	Large	n/a
873769	9A11	I	45.5	Large	n/a
873770	9A12	I	51.6	Large	n/a
873771	9A9	I	43.2	Large	n/a
873772	9B10	I	49.7	Large	n/a
873773	9B11	I	46.1	Large	n/a
873774	9B12	I	55.3	Large	n/a
873775	9B9	I	48.6	Large	n/a
873776	9C10	I	57.5	Large	n/a
873777	9C11	I	52.2	Large	n/a
873778	9C12	I	49.6	Large	n/a
873779	9C9	I	56.6	Large	n/a
873780	9D10	I	48.7	Large	n/a
873781	9D11	I	47.6	Large	n/a
873782	9D12	I	52.6	Large	n/a
873783	9D9	I	51.8	Large	n/a
873784	9E10	I	51.1	Large	n/a
873785	9E11	I	54.5	Large	n/a
873786	9E12	I	51.0	Large	n/a
873787	9E9	I	46.6	Large	n/a
873788	9F10	I	52.3	Large	n/a
873789	9F11	I	56.3	Large	n/a
873790	9F12	I	50.4	Large	n/a
873791	9F9	I	46.3	Large	n/a

Sampling Area: ***Sect. 10 8th North Mains*** **Sampled By:** ***Team 8 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873792	10A16	I	51.4	X-Large	n/a
873793	10A17	I	51.8	X-Large	n/a
873794	10A18	I	51.4	X-Large	n/a
873795	10A18X	I	58.9	X-Large	n/a
873796	10A19X	I	52.9	X-Large	n/a
873797	10B16	I	46.3	X-Large	n/a
873798	10B17	I	48.0	X-Large	n/a
873799	10B18	I	45.4	X-Large	n/a
873800	10B18X	I	42.0	X-Large	n/a
873801	10B19X	I	53.2	Large	n/a
873802	10C16	I	44.7	Large	n/a
873803	10C17	I	42.5	Large	n/a
873804	10D16	I	43.6	Large	n/a
873805	10D17	I	43.4	Large	n/a
873806	10E12	I	48.3	Large	n/a
873807	10E13	I	51.2	X-Large	n/a
873808	10E14	I	50.8	X-Large	n/a
873809	10E15	I	51.8	X-Large	n/a
873810	10E16	I	52.7	X-Large	n/a
873811	10F12	I	46.6	X-Large	n/a
873812	10F13	I	54.1	X-Large	n/a
873813	10F14	I	45.8	X-Large	n/a
873814	10F15	I	49.1	X-Large	n/a
873815	10F16	I	53.7	X-Large	n/a
873816	10F17	I	51.6	X-Large	n/a

Sampling Area: ***Cut-Out Between HG1N and TG1N / Crossover HG22-TG22***
Sampled By: ***Team 9 - July15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873817	12A1X	I	44.9	Large	n/a
873818	12B1	I	40.1	Small	n/a
873819	12B1X	I	46.7	Large	n/a
873820	12C1	I	45.9	Small	n/a
873821	12C1X	I	47.4	Large	n/a
873822	12D1	I	55.5	Trace	n/a
873823	14F2	I	54.6	Large	n/a
873824	14F3	I	60.6	X-Large	n/a
873825	14F4	I	55.8	X-Large	n/a
873826	14F5	I	59.8	Large	n/a
873827	14G4	I	67.8	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873828	14G5	I	59.1	Large	n/a
873829	14G6	I	54.8	Large	n/a
873830	14G7	I	47.5	Large	n/a
873831	14G8	I	48.0	Small	n/a

Sampling Area: ***TG 1 North*** **Sampled By:** ***Team 10 - July 15, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
873832	16A13	I	48.5	Large	n/a
873833	16A14	I	44.5	Large	n/a
873834	16A15	I	34.9	Large	n/a
873835	16A16	I	43.7	Large	n/a
873836	16B13	I	53.0	Large	n/a
873837	16B14	I	51.7	Large	n/a
873838	16B15	I	38.9	Large	n/a
873839	16B16	I	39.1	Large	n/a
873840	16C13	I	62.3	Large	n/a
873841	16C14	I	69.6	Large	n/a
873842	16C15	I	60.2	Large	n/a
873843	16C16	I	55.5	Large	n/a
873844	16D13	I	67.8	Large	n/a
873845	16D14	I	59.2	Large	n/a
873846	16D15	I	69.4	Large	n/a
873847	16D16	I	64.5	Large	n/a
873848	16E13	I	50.4	Large	n/a
873849	16E14	I	50.8	Large	n/a
873850	16E15	I	43.1	Large	n/a
873851	16E16	I	47.7	Large	n/a
873852	16F13	I	57.7	Large	n/a
873853	16F14	I	47.3	Large	n/a
873854	16F15	I	46.1	Large	n/a
873855	16F16	I	43.8	Large	n/a
873856	16G13	I	49.0	Large	n/a
873857	16G14	I	52.4	Large	n/a
873858	16G15	I	48.9	Large	n/a
873859	16G16	I	42.8	Large	n/a

Sampling Area: ***5N Parallel Mains*** **Sampled By:** ***Team 1 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874119	6A4	I	74.8	None	n/a
874120	6A4X	I	63.3	None	n/a
874121	6A5	I	68.6	None	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874122	6A6	I	69.8	None	n/a
874123	6A6X	I	71.7	None	n/a
874124	6B4	I	73.1	None	n/a
874125	6B4X	I	84.0	None	n/a
874126	6B5	I	71.1	None	n/a
874127	6B6	I	80.4	None	n/a
874128	6B6X	I	84.6	None	n/a
874129	6C4	I	80.3	None	n/a
874130	6C4X	I	73.8	None	n/a
874131	6C5	I	86.0	None	n/a
874132	6C6	I	81.9	None	n/a
874133	6C6X	I	80.6	None	n/a
874134	6D4	I	84.9	None	n/a
874135	6D4X	I	84.5	None	n/a
874136	6D5	I	82.5	None	n/a
874137	6D6	I	77.9	None	n/a
874138	6D6X	I	60.6	None	n/a
874139	6E4	I	74.6	None	n/a
874140	6E4X	I	74.8	None	n/a
874141	6E6	I	62.6	None	n/a
874142	6F4	I	81.8	None	n/a
874143	6F5	I	63.2	None	n/a
874144	6G5	I	64.1	None	n/a

Sampling Area: ***5 North Section*** **Sampled By:** ***Team 2 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874145	5B11	R	66.8	None	n/a
874146	5B12	R	64.3	None	n/a
874147	5B12X	R	58.8	None	n/a
874148	5C10	R	64.1	None	n/a
874149	5C10X	I	55.6	None	n/a
874150	5C11	R	71.4	None	n/a
874151	5C12	R	60.9	None	n/a
874152	5C9	R	57.3	None	n/a
874153	5D10	I	86.2	None	n/a
874154	5D11	I	76.5	None	n/a
874155	5D8X	I	64.1	None	n/a
874156	5D9	I	77.0	None	n/a
874157	5E10	I	89.0	None	n/a
874158	5E11	I	76.4	None	n/a
874159	5E8	I	96.3	None	n/a
874160	5E8X	I	93.3	None	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874161	5E9	I	92.9	None	n/a
874162	5F10	I	90.9	None	n/a
874163	5F10X	I	77.2	None	n/a
874164	5F11	I	80.4	None	n/a
874165	5F9	I	94.1	None	n/a
874166	5G10	I	83.2	None	n/a
874167	5G11	I	62.3	None	n/a
874168	5G12	I	53.3	None	n/a
874169	5G9	I	68.0	None	n/a
874170	5H11	I	60.4	None	n/a

Sampling Area: ***HG 1 North*** **Sampled By:** ***Team 3 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874171	13B19X	I	42.4	X-Large	n/a
874172	13B20	I	47.3	Large	n/a
874173	13B21	I	45.3	Large	n/a
874174	13B22	I	45.0	Large	n/a
874175	13C19X	I	40.9	Large	n/a
874176	13C20	I	47.4	Large	n/a
874177	13C21	I	50.9	Large	n/a
874178	13C22	I	41.7	Large	n/a
874179	13C23	R	45.6	Large	n/a
874180	13D19X	R	38.9	X-Large	n/a
874181	13D20	I	43.8	Large	n/a
874182	13D21	I	41.1	Large	n/a
874183	13D22	I	47.9	Large	n/a
874184	13D23	R	45.0	Small	n/a
874185	13E19X	R	41.6	X-Large	n/a
874186	13E20	R	41.9	Large	n/a
874187	13E21	R	43.2	Large	n/a
874188	13E22	R	42.2	Large	n/a
874189	13E23	R	38.9	Small	n/a
874190	13F20	R	47.0	Large	n/a
874191	13F21	R	48.9	Small	n/a
874192	13F22	R	40.1	Large	n/a
874193	13F23	R	44.9	Small	n/a

Sampling Area: ***Sect. 17 - TG 1 North*** **Sampled By:** ***Team 4 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874194	17A11X	R	45.7	X-Large	n/a
874195	17A12	R	45.9	X-Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874196	17A13	R	43.4	X-Large	n/a
874197	17B11X	I	47.3	X-Large	n/a
874198	17B12	R	48.4	X-Large	n/a
874199	17B13	R	44.2	X-Large	n/a
874200	17C11X	I	48.1	X-Large	n/a
874201	17C12	I	54.9	Large	n/a
874202	17C13	I	56.3	Large	n/a
874203	17D11X	I	44.2	X-Large	n/a
874204	17D12	I	46.4	Large	n/a
874205	17D13	I	56.6	Large	n/a
874206	17D14	I	51.6	Large	n/a
874207	17E11X	I	42.5	Large	n/a
874208	17E12	I	47.7	Large	n/a
874209	17E13	I	47.2	Large	n/a
874210	17E14	I	42.0	Large	n/a
874211	17F11X	I	51.3	X-Large	n/a
874212	17F12	I	44.3	Large	n/a
874213	17F13	I	41.8	Large	n/a
874214	17F14	I	35.9	Large	n/a
874215	17G11	I	38.9	Large	n/a
874216	17G12	I	40.8	Large	n/a
874217	17G13	I	44.1	Large	n/a
874218	17G14	I	38.7	Small	n/a

Sampling Area: ***7 North*** **Sampled By:** ***Team 5 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874219	7B38	I	47.5	Small	n/a
874220	7B39	I	45.2	Small	n/a
874221	7B40	I	42.4	Small	n/a
874222	7B40X	I	41.0	Large	n/a
874223	7B41	I	37.0	Small	n/a
874224	7C37	I	51.5	Small	n/a
874225	7C38	I	46.8	Trace	n/a
874226	7C39	I	50.3	Small	n/a
874227	7C40	I	41.4	Large	n/a
874228	7C40X	I	44.0	Large	n/a
874229	7C41	I	46.0	Small	n/a
874230	7D37	I	51.7	Small	n/a
874231	7D38	I	59.3	Small	n/a
874232	7D39	I	49.0	Small	n/a
874233	7D40	I	54.8	Small	n/a
874234	7D40X	I	54.2	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874235	7D41	I	48.9	Small	n/a
874236	7E37	I	56.3	Small	n/a
874237	7E38	I	57.1	Small	n/a
874238	7E39	I	57.7	Small	n/a
874239	7E40	I	49.8	Large	n/a
874240	7E40X	I	48.8	Large	n/a
874241	7E41	I	54.2	Large	n/a
874242	7F37	I	40.1	Small	n/a
874243	7F38	I	40.3	Small	n/a
874244	7F39	I	34.6	Large	n/a
874245	7F40	I	35.3	Small	n/a
874246	7F41	I	34.6	Small	n/a

Sampling Area: ***6 North*** **Sampled By:** ***Team 6 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874247	7B15X	I	55.1	Large	n/a
874248	7C13	I	67.9	Large	n/a
874249	7C14	I	76.3	Small	n/a
874250	7C15	I	65.6	Small	n/a
874251	7C15X	I	54.1	Large	n/a
874252	7C16	I	63.2	Large	n/a
874253	7D13	I	72.0	Large	n/a
874254	7D14	I	68.5	Large	n/a
874255	7D15	I	71.6	Large	n/a
874256	7D15X	I	61.1	X-Large	n/a
874257	7D16	I	68.7	Large	n/a
874258	7E13	I	66.1	Large	n/a
874259	7E14	I	71.7	Large	n/a
874260	7E15	I	67.5	Large	n/a
874261	7E15X	I	56.3	Large	n/a
874262	7E16	I	77.9	Large	n/a
874263	7F15	I	63.1	Small	n/a
874264	7F16	I	55.3	Small	n/a

Sampling Area: ***Section #9*** **Sampled By:** ***Team 7 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874265	9A12X	I	56.4	X-Large	n/a
874266	9A13	I	45.0	Large	n/a
874267	9A14	I	50.0	Large	n/a
874268	9A15	I	49.9	Large	n/a
874269	9A16	I	49.0	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874270	9B12X	I	47.4	X-Large	n/a
874271	9B13	I	63.1	Large	n/a
874272	9B14	I	53.7	Large	n/a
874273	9B15	I	52.2	Large	n/a
874274	9B16	I	47.1	Large	n/a
874275	9C12X	I	49.4	Large	n/a
874276	9C13	I	47.5	Large	n/a
874277	9C14	I	45.9	Large	n/a
874278	9C15	I	46.0	Large	n/a
874279	9C16	I	54.2	Large	n/a
874280	9D12X	I	53.7	X-Large	n/a
874281	9D13	I	46.1	Large	n/a
874282	9D14	I	47.1	Large	n/a
874283	9D15	I	53.0	Large	n/a
874284	9E12X	I	54.6	X-Large	n/a
874285	9E13	I	50.2	Large	n/a
874286	9E14	I	51.5	Large	n/a
874287	9E15	I	52.5	Large	n/a
874288	9F13	I	58.4	Large	n/a
874289	9F14	I	54.2	Large	n/a
874290	9F15	I	58.9	Large	n/a

Sampling Area: ***Sect. 9 & 10 - 8 North Mains*** **Sampled By:** ***Team 8 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874291	10A12	I	48.6	Large	n/a
874292	10A13	I	47.4	Large	n/a
874293	10A14	I	47.6	Large	n/a
874294	10A15	I	48.3	Large	n/a
874295	10B12	I	55.6	Large	n/a
874296	10B13	I	47.1	Large	n/a
874297	10B14	I	47.5	X-Large	n/a
874298	10B15	I	45.4	X-Large	n/a
874299	10C12	I	47.0	Large	n/a
874300	10C13	I	49.1	X-Large	n/a
874301	10C14	I	45.1	Large	n/a
874302	10C15	I	44.0	Large	n/a
874303	10D12	I	46.2	X-Large	n/a
874304	10D13	I	45.3	Large	n/a
874305	10D14	I	46.3	Large	n/a
874306	10D15	I	42.9	Large	n/a
874307	9A17X	I	48.0	Large	n/a
874308	9A18	I	48.6	Large	n/a

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874309	9B17X	I	43.1	Large	n/a
874310	9B18	I	46.0	Large	n/a
874311	9C17X	I	45.8	Large	n/a
874312	9C18	I	42.8	Large	n/a
874313	9D17X	I	44.4	Large	n/a
874314	9D18	I	42.5	Large	n/a
874315	9E17	I	52.1	Large	n/a
874316	9E17X	I	47.6	Large	n/a
874317	9E18	I	52.9	Large	n/a
874318	9F17	I	46.6	Large	n/a
874319	9F18	I	48.8	Large	n/a

Sampling Area: ***Crossover Between HG 22 and TG 22***
Sampled By: ***Team 9 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874320	12A1	R	47.4	Trace	n/a
874321	12A2	R	50.4	Trace	n/a
874322	12A3	R	48.3	Trace	n/a
874323	12B2	I	51.5	Small	n/a
874324	12B3	I	40.9	Small	n/a
874325	12C2	I	46.8	Small	n/a
874326	12C3	I	48.7	Small	n/a
874327	12C6X	I	47.7	Large	n/a
874328	12D2	I	51.8	Small	n/a
874329	12D3	I	56.4	Small	n/a
874330	12D4	I	61.0	Small	n/a
874331	12D5	I	56.9	Small	n/a
874332	12D6	I	64.1	Small	n/a

Sampling Area: ***TG 1 North*** **Sampled By:** ***Team 10 - July 17, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874333	16A16X	I	39.2	X-Large	n/a
874334	16A17	I	43.3	Large	n/a
874335	16A18	I	38.5	Large	n/a
874336	16A19	I	40.8	Large	n/a
874337	16B16X	I	40.9	X-Large	n/a
874338	16B17	I	39.3	Large	n/a
874339	16B18	I	41.0	Large	n/a
874340	16B19	I	44.7	Large	n/a
874341	16C16X	I	49.2	Large	Large
874342	16C17	I	50.5	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874343	16C18	I	56.7	Large	Large
874344	16C19	I	56.9	Large	Large
874345	16D16X	I	55.3	Large	Large
874346	16D17	I	60.2	Large	Large
874347	16D18	I	70.3	Large	Large
874348	16D19	I	68.0	Large	Large
874349	16E16X	I	45.5	Large	X-Large
874350	16E17	I	50.4	Large	Large
874351	16E18	I	42.1	Large	Large
874352	16E19	I	34.5	Large	Large
874353	16F16X	I	38.9	Large	Large
874354	16F17	I	53.0	Large	Large
874355	16F18	I	38.6	Large	Large
874356	16F19	I	38.3	Large	Large
874357	16G18	I	37.4	Large	Large
874358	16G19	I	37.0	Large	Large

Sampling Area: ***Section 6*** **Sampled By:** ***Team 1 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874359	6A1	I	65.9	None	None
874360	6A2	I	68.1	None	None
874361	6A2X	I	60.0	None	None
874362	6A3	I	62.7	None	None
874363	6B2	I	53.1	None	None
874364	6B2X	I	57.0	None	None
874365	6B3	I	75.9	None	None
874366	6C2	I	58.7	None	None
874367	6C2X	I	60.9	None	None
874368	6C3	I	83.3	None	None
874369	6D2	I	90.2	None	None
874370	6D2X	I	73.9	None	None
874371	6D3	I	65.2	None	None
874372	6E1	I	58.5	None	None
874373	6E2	I	79.3	None	None
874374	6E3	I	74.9	None	None
874375	6F1	I	72.0	None	None
874376	6F3	I	69.2	None	None

Sampling Area: ***5 North Section*** **Sampled By:** ***Team 2 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874377	5C5	R	70.3	None	None

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874378	5C6	R	66.9	None	None
874379	5C6X	I	68.8	None	None
874380	5C7	R	77.9	None	None
874381	5C8	R	65.6	None	None
874382	5C8X	I	76.1	None	None
874383	5D4X	I	48.6	None	None
874384	5D6	I	80.2	None	None
874385	5D6X	I	67.5	None	None
874386	5D7	I	72.7	None	None
874387	5D8	I	92.6	None	None
874388	5E4	I	98.0	None	None
874389	5E4X	I	84.8	None	None
874390	5E5	I	97.4	None	None
874391	5E6	I	92.4	None	None
874392	5E6X	I	95.0	None	None
874393	5E7	I	66.7	None	None
874394	5F4	I	92.2	None	None
874395	5F5	I	95.5	None	None
874396	5F6	I	94.7	None	None
874397	5F6X	I	72.9	None	None
874398	5F7	I	93.0	None	None
874399	5F8	I	92.2	None	None
874400	5F8X	I	65.6	None	None
874401	5G5	I	71.6	None	None
874402	5G6	I	46.1	None	None
874403	5G7	I	76.1	None	None
874404	5G8	I	54.7	None	None

Sampling Area: ***Area 13 Longwall 1 North*** **Sampled By:** ***Team 3 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874405	13B24X	R	37.8	Large	Large
874406	13C24	R	37.0	Large	Large
874407	13C24X	R	37.9	Large	Large
874408	13C25	R	40.5	Large	Large
874409	13C26	R	45.9	Large	Large
874410	13D24	R	44.0	Large	Large
874411	13D24X	R	41.7	Large	Large
874412	13D25	R	41.2	Large	Large
874413	13D26	R	42.1	Large	Large
874414	13E24	R	41.0	Large	Large
874415	13E24X	R	52.6	Large	Large
874416	13E25	R	41.5	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874417	13E26	R	35.2	Large	Large
874418	13F24	R	40.8	Large	Large
874419	13F24X	I	44.4	Large	Large
874420	13F25	I	39.9	Large	Large
874421	13F26	I	36.0	Small	Small
874422	13F27	I	33.0	Small	Small
874423	13G24	I	45.5	Large	Large
874424	13G25	I	43.0	Large	Large
874425	13G26	I	37.4	Large	Large
874426	13G27	I	38.9	Small	Small

Sampling Area: ***Section 17 TG 1 North*** **Sampled By:** ***Team 4 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874427	17A10	R	41.9	Large	Large
874428	17A11	R	43.6	X-Large	Large
874429	17A9	R	42.3	Large	Large
874430	17B10	R	38.9	Large	Large
874431	17B11	R	59.8	Large	Large
874432	17B9	R	40.3	Large	Large
874433	17C10	I	51.1	Large	Large
874434	17C11	I	54.6	Large	Large
874435	17C8	I	56.1	Large	Large
874436	17C9	I	61.9	Large	Large
874437	17D10	I	49.4	Large	Large
874438	17D11	I	50.7	Large	Large
874439	17D8	I	50.9	Large	Large
874440	17D9	I	51.6	Large	Large
874441	17E10	I	45.2	Large	Large
874442	17E11	I	46.4	Large	Large
874443	17E8	I	46.9	Large	Large
874444	17E9	I	42.6	Large	Large
874445	17F10	I	42.7	Large	Large
874446	17F11	I	40.4	Large	Large
874447	17F8	I	46.6	Large	Large
874448	17F9	I	46.8	Large	Large
874449	17G10	I	48.8	Large	Large
874450	17G8	I	41.7	Large	Large
874451	17G9	I	41.9	Large	Large

Sampling Area: *7 North* **Sampled By:** *Team 5 - July 18, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874452	7B33	I	49.0	Small	Small
874453	7B34	I	52.6	Small	Small
874454	7B35	I	45.0	Small	Small
874455	7B35X	I	59.4	Large	Large
874456	7B36	I	48.7	Small	Small
874457	7B37	I	47.0	Small	Small
874458	7C33	I	50.6	Small	Small
874459	7C34	I	45.4	Small	Small
874460	7C35	I	40.6	Small	Small
874461	7C35X	I	46.6	Small	Small
874462	7C36	I	47.5	Small	Trace
874463	7D33	I	50.6	Small	Small
874464	7D34	I	57.9	Small	Small
874465	7D35	I	53.8	Small	Large
874466	7D35X	I	64.7	Large	Large
874467	7D36	I	56.4	Small	Small
874468	7E33	I	74.8	Small	Small
874469	7E34	I	67.6	Small	Small
874470	7E35	I	63.1	Small	Small
874471	7E35X	I	49.7	Large	Large
874472	7E36	I	58.9	Large	Large
874473	7F33	I	39.8	Small	Small
874474	7F34	I	37.2	Small	Small
874475	7F35	I	42.7	Small	Small
874476	7F36	I	39.8	Small	Small

Sampling Area: *6 North* **Sampled By:** *Team 6 - July 18, 2010*

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874477	7B13	I	58.0	Large	Large
874478	7B14	I	54.6	Large	Large
874479	7B15	I	54.5	Large	Large
874480	7B16	I	59.6	Large	Large
874481	7B17	I	63.7	Large	Large
874482	7B18	I	52.3	Large	Large
874483	7B19	I	51.7	Large	Large
874484	7B20	I	56.5	Large	Large
874485	7B20X	I	55.2	X-Large	Large
874486	7C17	I	63.5	Large	Large
874487	7C18	I	61.0	Large	Large
874488	7C19	I	72.7	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874489	7C20	I	60.6	Large	Large
874490	7C20X	I	53.6	X-Large	Large
874491	7D17	I	72.9	Large	Large
874492	7D18	I	71.2	Large	Large
874493	7D19	I	72.2	Small	Small
874494	7D20	I	67.2	Small	Small
874495	7E18	I	77.5	Small	Small
874496	7E19	I	77.0	Small	Small
874497	7E20	I	67.3	Small	Small

Sampling Area: ***Section 8 North Main*** **Sampled By:** ***Team 7 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874498	8C1	I	52.0	Small	Small
874499	8C1X	I	50.4	Small	Small
874500	8C2	I	37.0	Small	Small
874501	8D1	I	62.6	Large	Large
874502	8D1X	I	60.0	Large	Large
874503	8D2	I	79.3	Small	Small
874504	8E1	I	82.5	Large	Large
874505	8E1X	I	64.1	Large	Large
874506	8E2	I	70.6	Large	Large
874507	9A17	I	52.1	Large	Large
874508	9B17	I	46.0	Large	Large
874509	9C17	I	41.7	Large	Large
874510	9D16	I	47.8	Large	Large
874511	9D17	I	47.0	Large	Large
874512	9E16	I	56.2	Large	Large
874513	9F16	I	44.5	Large	Large

Sampling Area: ***Section 11*** **Sampled By:** ***Team 8 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874514	11A1	I	49.5	Large	Large
874515	11A2	I	53.7	Large	Large
874516	11A2X	I	48.2	Large	Large
874517	11A3	I	44.3	Large	Large
874518	11A4	I	46.4	Large	Large
874519	11B1	I	51.9	Large	Large
874520	11B2	I	56.8	Large	Large
874521	11B2X	I	60.7	Large	Large
874522	11C1	I	59.0	Large	Large
874523	11C2	I	58.4	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874524	11C2X	I	66.1	Large	Large
874525	11C3	I	64.3	Small	Small
874526	11D1	I	66.8	Large	Large
874527	11D2	I	62.9	Large	Large
874528	11D2X	I	76.8	Small	Small
874529	11D3	I	70.7	Large	Large
874530	11E1	I	69.9	Large	Large
874531	11E2	I	69.9	Large	Small
874532	11E3	I	81.8	Small	Small

Sampling Area: ***Section 12*** **Sampled By:** ***Team 9 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874533	12A4	R	43.8	Small	Small
874534	12A5	R	50.6	Small	Small
874535	12A6	R	50.0	Small	Trace
874536	12A6X	I	72.4	Large	Large
874537	12A7	R	51.2	Small	Trace
874538	12A8	R	52.6	Small	Trace
874539	12B4	I	45.6	Small	Small
874540	12B5	I	44.8	Small	Trace
874541	12B6	I	49.2	Small	Small
874542	12B6X	I	43.2	Large	Large
874543	12B7	I	54.6	Small	Small
874544	12B8	I	64.5	Small	Small
874545	12C4	I	51.3	Small	Small
874546	12C5	I	74.6	Small	Small
874547	12C6	I	64.7	Large	Small
874548	12C7	I	51.6	Small	Small
874549	12C8	I	58.4	Small	Small
874550	12D8	I	56.6	Large	Large

Sampling Area: ***TG 1 North*** **Sampled By:** ***Team 10 - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874551	16A20	I	35.4	Large	Large
874552	16A21	I	38.9	Large	Large
874553	16A22	I	42.2	Large	Large
874554	16A23	I	46.5	Large	Large
874555	16B20	I	41.3	Large	Large
874556	16B21	I	32.4	X-Large	Large
874557	16B22	I	40.3	Large	Large
874558	16B23	I	42.0	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874559	16C20	I	55.3	X-Large	Large
874560	16C21	I	46.8	Large	Large
874561	16C22	I	52.1	Large	Large
874562	16C23	I	45.8	Large	Large
874563	16D20	I	62.2	Large	Large
874564	16D21	I	53.2	Large	Large
874565	16D22	I	54.3	Large	Large
874566	16D23	I	46.2	Large	Large
874567	16E20	I	41.7	Large	Large
874568	16E21	I	36.5	Large	Large
874569	16E22	I	44.4	Large	Large
874570	16E23	I	37.4	Large	Large
874571	16F20	I	28.0	Large	Large
874572	16F21	I	35.7	Large	Large
874573	16F22	I	36.9	Large	Large
874574	16F23	I	38.4	Large	Large
874575	16G20	I	38.4	Large	Large
874576	16G21	I	39.2	Large	Large
874577	16G22	I	44.5	Large	Large
874578	16G23	I	44.2	Large	Large

Sampling Area: ***1 North Mains*** **Sampled By:** ***Team 1A - July 18, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874579	1A3	R	55.9	None	None
874580	1A3X	R	52.4	None	None
874581	1A4	R	64.0	None	None
874582	1B3	R	64.6	None	None
874583	1B3X	I	61.0	None	None
874584	1B4	R	93.5	None	None
874585	1B5X	I	74.2	None	None
874586	1C3	I	96.5	None	None
874587	1C3X	I	52.5	None	None
874588	1D5	I	74.1	None	None
874589	1E5X	I	78.3	None	None

Sampling Area: ***Section 1 North Mains*** **Sampled By:** ***Team 1 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874590	1A1	R	49.8	None	None
874591	1A1X	R	44.7	None	None
874592	1A2	R	75.5	None	None
874593	1B1	R	49.0	None	None

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874594	1B1X	I	80.4	None	None
874595	1B2	R	40.1	None	None
874596	1C1	I	98.4	None	None
874597	1C1X	I	76.9	None	None
874598	1C2	I	96.8	None	None
874599	1D1	I	93.1	None	None
874600	1D1X	I	52.8	None	None
874601	1D2	I	94.9	None	None
874602	1D3	I	93.1	None	None
874603	1D3X	I	75.5	None	None
874604	1G1	R	72.9	None	None
874605	1G1X	R	70.9	None	None
874606	1H1	R	63.3	None	None
874607	1H1X	R	62.6	None	None
874608	1I1	R	61.1	None	None

Sampling Area: ***2 Section and 5 Section North Parallel Mains***
Sampled By: ***Team 2 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874609	2C5X	I	83.3	None	None
874610	2D5	I	98.1	None	None
874611	2D5X	I	91.5	None	None
874612	5C2	I	59.7	None	None
874613	5C3	R	53.7	None	None
874614	5C4	R	61.5	None	None
874615	5D1	I	67.2	None	None
874616	5D2	I	77.3	None	None
874617	5D2X	I	74.0	None	None
874618	5D3	I	86.8	None	None
874619	5D4	I	82.5	None	None
874620	5D4X	I	45.3	None	None
874621	5E1	I	91.1	None	None
874622	5E2	I	97.9	None	None
874623	5E2X	I	70.3	None	None
874624	5E3	I	98.0	None	None
874625	5F1	I	93.1	None	None
874626	5F2	I	75.3	None	None
874627	5F3	I	93.3	None	None
874628	5F4X	I	58.2	None	None
874629	5G1	I	63.0	None	None
874630	5G2	I	81.3	None	None
874631	5G3	I	68.1	None	None

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874632	5G4	I	55.9	None	None

Sampling Area: ***Area 13 TG 22*** **Sampled By:** ***Team 3 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874633	13B29X	R	38.2	Trace	Trace
874634	13C27	R	38.9	Trace	Trace
874635	13C28	R	41.6	Trace	Trace
874636	13C29	R	38.0	Trace	Trace
874637	13C29X	R	64.3	Trace	Trace
874638	13C30	R	48.8	None	Trace
874639	13C31	R	41.6	Trace	Trace
874640	13C32	R	42.3	Trace	None
874641	13C33	R	46.8	None	None
874642	13C34	R	51.2	None	None
874643	13D27	R	46.3	Trace	Trace
874644	13D28	R	39.7	Small	Trace
874645	13D29	R	51.0	Small	Trace
874646	13E27	R	40.3	Large	Large
874647	13E28	R	36.0	Large	Large
874648	13E29	R	39.9	Large	Large
874649	13F28	I	48.4	Large	Large
874650	13G28	I	33.5	Large	Large

Sampling Area: ***Section 17 TG 1 North*** **Sampled By:** ***Team 4 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874651	17A4	R	45.7	Large	Large
874652	17A5	R	44.3	Large	Large
874653	17A6	R	41.4	Large	Large
874654	17A7	R	41.1	Large	Large
874655	17A8	R	44.4	Large	Large
874656	17B4	R	40.7	Large	Large
874657	17B5	R	40.8	X-Large	Large
874658	17B6	R	47.1	Large	Large
874659	17B7	R	41.9	Large	Large
874660	17B8	R	47.5	Large	Large
874661	17C4	I	57.1	Large	Large
874662	17C5	I	51.9	Large	Large
874663	17C6	I	58.7	Large	Large
874664	17C7	I	58.7	Large	Large
874665	17D4	I	47.9	X-Large	Large
874666	17D5	I	51.5	X-Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874667	17D6	I	55.8	Large	Large
874668	17D7	I	45.3	Large	Large
874669	17E4	I	40.0	X-Large	Large
874670	17E5	I	45.7	Large	Large
874671	17E6	I	40.2	Large	Large
874672	17E7	I	46.1	Large	Large
874673	17F5	I	45.9	Large	Large
874674	17F6	I	47.3	Large	Large
874675	17F7	I	35.2	Large	Large
874676	17G4	I	52.6	X-Large	Large
874677	17G5	I	46.1	Large	Large
874678	17G6	I	41.4	Large	Large
874679	17G7	I	40.9	Large	Large

Sampling Area: ***7 North*** **Sampled By:** ***Team 5 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874680	7B27	I	67.4	Large	Large
874681	7B28	I	64.9	Small	Small
874682	7B29B	I	59.7	Small	Small
874683	7B30	I	64.2	Small	Small
874684	7B30X	I	65.5	Small	Small
874685	7B31A	I	57.2	Large	Large
874686	7B31B	I	54.7	Large	Large
874687	7B32	I	52.4	Small	Small
874688	7C27	I	66.3	Small	Trace
874689	7C28	I	61.6	Small	Trace
874690	7C29	I	61.7	Large	Large
874691	7C30	I	56.9	Large	Large
874692	7C30X	I	50.3	Small	Trace
874693	7C31	I	52.6	Small	Small
874694	7C32	I	48.3	Small	Small
874695	7D27	I	71.3	Trace	Trace
874696	7D28	I	79.4	Small	Trace
874697	7D29	I	65.4	Small	Trace
874698	7D30	I	66.1	Small	Trace
874699	7D30X	I	72.7	Large	Small
874700	7D31	I	67.3	Small	Small
874701	7D32	I	56.7	Large	Small
874702	7E27	I	72.1	Small	Small
874703	7E28	I	75.2	Small	Trace
874704	7E29	I	81.3	Small	Trace
874705	7E30	I	68.6	Small	Small

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874706	7E30X	I	55.0	Large	Large
874707	7E31	I	68.1	Small	Small
874708	7E32	I	70.4	Large	Small
874709	7F27	I	44.7	Small	Small
874710	7F28	I	44.6	Small	Small
874711	7F29	I	47.8	Small	Small
874712	7F30	I	53.4	Small	Small
874713	7F31	I	44.5	Large	Small
874714	7F32	I	41.2	Large	Small

Sampling Area: ***6 North*** **Sampled By:** ***Team 6 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874715	7B21	I	51.6	Large	Large
874716	7B22	I	55.9	Large	Large
874717	7B23	I	53.7	Large	Large
874718	7B24	I	59.1	Small	Small
874719	7C21	I	58.4	Large	Small
874720	7C22	I	54.1	Large	Large
874721	7C23	I	65.0	Small	Small
874722	7C24	I	75.5	Small	Small
874723	7D21	I	69.0	Small	Small
874724	7D22	I	62.1	Small	Small
874725	7D23	I	61.8	Small	Small
874726	7D24	I	57.3	Small	Small
874727	7E17	I	76.8	Trace	Trace
874728	7E20X	I	57.6	Trace	Trace
874729	7E21	I	67.7	Trace	Trace
874730	7E22	I	68.5	Trace	Trace
874731	7E23	I	65.4	Trace	Trace
874732	7E24	I	66.1	Trace	Trace
874733	7F17	I	55.2	Trace	Trace
874734	7F18	I	58.1	Trace	Trace
874735	7F19	I	50.1	Trace	Trace
874736	7F20	I	49.7	Trace	Trace
874737	7F21	I	46.1	Trace	Trace
874738	7F22	I	43.0	Large	Large
874739	7F23	I	44.8	Large	Large

Sampling Area: ***Section 8*** **Sampled By:** ***Team 7 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874740	8F1	I	64.7	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874741	8F1X	I	63.8	Large	Large
874742	8F2	I	60.7	Large	Large
874743	8F3	I	56.1	Large	Large
874744	8F4	I	54.8	X-Large	X-Large
874745	8G1	I	58.6	Large	Large
874746	8G1X	I	77.3	Large	Large
874747	8G2	I	72.5	Large	Large
874748	8G3	I	74.2	Large	Large
874749	8G4	I	65.6	X-Large	X-Large
874750	8G6	I	53.6	Large	Large
874751	8G6X	I	51.6	Large	Large
874752	8H1	I	56.3	Large	Large
874753	8H1X	I	47.4	Large	Large
874754	8H2	I	45.2	Large	Large
874755	8H3	I	46.0	Large	Large
874756	8H4	I	58.5	Large	Large
874757	8H5	I	51.8	Large	Large
874758	8H6	I	43.1	X-Large	X-Large
874759	8H6X	I	49.1	X-Large	X-Large
874760	8I1	I	48.9	Large	Large
874761	8I2	I	44.0	Large	Large
874762	8I3	I	50.1	Large	Large
874763	8I5	I	56.0	Large	Large
874764	8I6	I	52.9	X-Large	X-Large

Sampling Area: ***HG 22 Section 11 Development Section***
Sampled By: Team 8 - July 19, 2010

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874765	11A22	I	43.6	Large	Large
874766	11A22X	I	35.6	Large	Large
874767	11A23	I	41.4	Large	Large
874768	11A24	I	40.6	Large	Large
874769	11A25	I	48.5	Large	Large
874770	11A26	I	55.6	Large	Large
874771	11A27	I	53.7	Large	Large
874772	11A27X	I	64.4	Large	Large
874773	11A28	I	56.2	Large	Large
874774	11A29	I	54.5	Large	Large
874775	11B22	I	44.6	Large	Large
874776	11B22X	I	47.2	Large	Large
874777	11B23	I	46.0	Large	Large
874778	11B24	I	49.2	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874779	11B25	I	53.4	Large	Large
874780	11B26	I	54.6	Large	Large
874781	11B27	I	59.3	Large	Large
874782	11B27X	I	59.5	Large	Large
874783	11B28	I	54.7	Large	Large
874784	11B29	I	56.0	Large	Large
874785	11C22	R	47.4	Large	Large
874786	11C23	R	47.7	Large	Large
874787	11C24	R	47.1	Large	Large
874788	11C25	R	55.8	Large	Large
874789	11C26	R	55.7	Large	Large
874790	11C28	R	62.8	Large	Large
874791	11C29	R	54.5	Large	Large

Sampling Area: ***TG 1 North*** **Sampled By:** ***Team 10 - July 19, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874792	16A24	I	44.7	Large	Large
874793	16A25	I	41.6	Large	Large
874794	16A26	I	47.4	Large	Large
874795	16A26X	I	39.2	X-Large	X-Large
874796	16B24	I	42.3	Large	Large
874797	16B25	I	46.3	Large	Large
874798	16B26	I	36.0	Large	Large
874799	16B26X	I	39.5	Large	Large
874800	16C24	I	45.0	Large	Large
874801	16C25	I	45.6	Large	Large
874802	16C26	I	42.9	Large	Large
874803	16C26X	I	38.1	Large	Large
874804	16D24	I	55.2	Large	Large
874805	16D25	I	59.6	Large	Large
874806	16D26	I	55.4	Large	Large
874807	16D26X	I	44.2	Large	Large
874808	16E24	I	43.1	Large	Large
874809	16E25	I	39.0	Large	Large
874810	16E26	I	37.0	Large	Large
874811	16E26X	I	41.6	Large	Large
874812	16F24	I	37.6	Large	Large
874813	16F25	I	38.0	Large	Large
874814	16F26	I	41.0	Large	Large
874815	16F26X	I	38.6	Large	Large
874816	16G24	I	42.4	Large	Large
874817	16G25	I	41.5	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874818	16G26	I	44.4	Large	Large
874819	16G27	I	39.3	Large	Large
874820	16G28	I	40.4	Small	Small

Sampling Area: ***Section 7*** **Sampled By:** ***Team 1 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874821	7B25	I	57.7	Large	Large
874822	7B25X	I	65.7	Small	Small
874823	7B26	I	67.9	Small	Small
874824	7C25X	I	64.6	Large	Small
874825	7D25	I	65.6	Small	Small
874826	7D25X	I	64.0	Large	Large
874827	7D26A	I	68.8	Large	Large
874828	7D26B	I	81.0	Large	Large
874829	7E25	I	60.1	Large	Large
874830	7E25X	I	57.6	Small	Small
874831	7E26	I	77.0	Small	Small
874832	7F24	I	43.8	Small	Small
874833	7F25	I	45.4	Small	Small
874834	7F26	I	46.9	Small	Small

Sampling Area: ***Section 16*** **Sampled By:** ***Team 2 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874835	16A27	I	48.1	Large	Large
874836	16A28	I	48.4	Large	Large
874837	16A29	I	47.9	Large	Large
874838	16A30	I	50.0	Large	Large
874839	16A31	I	44.8	Large	Large
874840	16B27	I	40.7	Large	Large
874841	16B28	I	40.3	Large	Large
874842	16B29	I	36.3	Large	Large
874843	16B30	I	40.2	Large	Large
874844	16B31	I	42.4	Large	Large
874845	16C27	I	48.6	Large	Large
874846	16C28	I	56.5	Large	Large
874847	16C29	I	46.0	Large	Large
874848	16C30	I	49.9	Large	Large
874849	16C31	I	48.9	Large	Large
874850	16D27	I	55.2	Large	Large
874851	16D28	I	56.0	Large	Large
874852	16D29	I	53.7	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874853	16D30	I	56.2	Large	Large
874854	16D31	I	58.8	Large	Large
874855	16E27	I	45.1	Large	Large
874856	16E28	I	41.3	Large	Large
874857	16E29	I	39.5	Large	Large
874858	16E30	I	40.8	Large	Large
874859	16E31	I	41.7	Large	Large
874860	16E32	I	45.1	Large	Large
874861	16F27	I	37.5	Large	Large
874862	16F28	I	41.6	Large	Large
874863	16F29	I	37.9	Large	Large
874864	16F30	I	36.8	Large	Large
874865	16F31	I	40.0	Large	Large
874866	16F32	I	42.1	Large	Large
874867	16G30	I	40.2	Large	Large
874868	16G31	I	39.3	Large	Large
874869	16G32	I	38.4	Large	Large

Sampling Area: ***Areas 15 and 16*** **Sampled By:** ***Teams 3 & 6 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874870	15A7	R	48.8	Large	Large
874871	15A8	R	52.8	Large	Large
874872	15B5	R	51.8	Large	Large
874873	15B6	R	53.5	Large	Large
874874	15B7	R	53.9	Small	Small
874875	15B8	R	48.7	Large	Large
874876	15C5	I	56.9	Large	Large
874877	15C6	I	53.6	Large	Large
874878	15C7	I	61.7	Small	Small
874879	15C8	I	45.2	Large	Large
874880	15D5	I	50.0	Large	Large
874881	15D6	I	51.7	Small	Small
874882	15D7	I	51.2	Small	Small
874883	15D8	I	46.8	Small	Small
874884	15E5	I	48.4	Large	Large
874885	15E6	I	53.2	Large	Large
874886	15E7	I	56.5	Small	Small
874887	15E8	I	52.1	Small	Small
874888	16E33	I	48.3	Large	Large
874889	16E34	I	48.2	Large	Large
874890	16E35	I	46.3	Large	Large
874891	16F33	I	49.8	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874892	16F34	I	51.9	Large	Large
874893	16F35	I	50.3	Large	Large
874894	16G33	I	48.2	Small	Small
874895	16G34	I	49.5	Small	Small
874896	16G35	I	47.7	Large	Large

Sampling Area: *Section 17 TG 1 North* **Sampled By: *Team 4 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874897	17A1	R	41.2	X-Large	Large
874898	17A1X	R	46.2	X-Large	X-Large
874899	17A2	R	40.0	Large	Large
874900	17A3	R	39.2	Large	Large
874901	17B1	R	46.0	Large	X-Large
874902	17B1X	I	48.9	Large	Large
874903	17B2	R	39.2	Large	Large
874904	17B3	R	38.2	Large	Large
874905	17C1	I	59.5	Large	Large
874906	17C1X	I	66.0	Large	Large
874907	17C2	I	58.7	Large	Large
874908	17C3	I	68.0	Large	Large
874909	17D1	I	53.3	Large	Large
874910	17D1X	I	54.3	Large	Large
874911	17D2	I	57.3	Large	Large
874912	17D3	I	55.4	Large	Large
874913	17E1	I	51.6	Large	Large
874914	17E1X	I	50.7	Large	Large
874915	17E2	I	48.3	Large	X-Large
874916	17E3	I	46.7	Large	Large
874917	17F1	I	50.8	Large	Large
874918	17F1X	I	53.4	X-Large	X-Large
874919	17F2	I	51.8	Large	Large
874920	17G1	I	46.0	Large	Large
874921	17G2	I	51.1	Large	Large
874922	17G3	I	48.0	Large	Large

Sampling Area: *Section 19* **Sampled By: *Team 5 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874923	19A2	R	39.9	Large	Large
874924	19A2X	R	39.7	Large	Large
874925	19B2	R	42.5	Large	Large
874926	19B2X	R	48.1	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874927	19B3	R	63.5	Large	Large
874928	19B3X	R	62.9	Large	Large
874929	19C2	R	61.4	Large	Large
874930	19C2X	R	60.7	Large	Large
874931	19C3	R	65.2	Large	Large
874932	19C3X	R	60.1	Large	Large
874933	19C4	R	62.8	Large	Large
874934	19C4X	R	55.6	Large	Large
874935	19D2	R	53.4	Large	Large
874936	19D2X	R	46.0	Large	Large
874937	19D3	R	60.5	Large	Large
874938	19D3X	R	62.5	Large	Large
874939	19D4	R	52.5	Large	Large
874940	19D4X	R	45.1	Large	Large
874941	19E2	R	50.2	Large	Large
874942	19E2X	R	46.4	Large	Large
874943	19E4	R	54.3	Large	Large
874944	19F2	R	48.5	Small	Small
874945	19F2X	R	46.0	Large	Large

Sampling Area: ***Section 15*** **Sampled By:** ***Team 6 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874946	15B1	R	55.5	Trace	Small
874947	15B2	R	52.5	Small	Small
874948	15B3	R	55.7	Large	Large
874949	15B3X	R	50.3	Large	Large
874950	15B4	R	51.8	Large	Large
874951	15C1	I	54.2	Trace	Trace
874952	15C2	I	60.7	Small	Small
874953	15C3	I	53.5	Large	Large
874954	15C3X	I	49.4	Large	Large
874955	15C4	I	54.1	Large	Large
874956	15D1	I	48.9	Small	Small
874957	15D2	I	47.1	Small	Small
874958	15D3	I	50.5	Large	Large
874959	15D3X	I	52.1	Large	Large
874960	15D4	I	53.1	Large	Large
874961	15E1	I	45.7	Large	Large
874962	15E2	I	44.8	Large	Large
874963	15E3	I	46.9	Large	Large
874964	15E4	I	52.3	Large	Large

Sampling Area: ***Section 8*** **Sampled By:** ***Team 7 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874965	8A6	I	47.8	Large	Large
874966	8A6X	I	59.0	Large	Large
874967	8B4	I	44.9	Large	Large
874968	8B5	I	44.7	Large	Large
874969	8B6	I	57.8	Large	Large
874970	8B6X	I	43.7	Large	Large
874971	8C3	I	40.5	Large	Large
874972	8C4	I	45.4	Large	Large
874973	8C5	I	45.6	Large	Large
874974	8C6	I	46.9	Large	Large
874975	8C6X	I	40.6	Large	Large
874976	8D5	I	49.3	Large	Large
874977	8D6	I	43.6	X-Large	X-Large
874978	8D6X	I	48.4	Large	Large
874979	8E3	I	67.1	Large	Large
874980	8E4	I	61.7	Large	Large
874981	8E5	I	73.5	Large	Large
874982	8E6	I	60.5	Large	Large
874983	8E6X	I	45.6	Large	Large
874984	8F5	I	62.0	X-Large	X-Large
874985	8F6	I	58.2	X-Large	X-Large
874986	8F6X	I	57.5	Large	Large

Sampling Area: ***Section 11 HG 22 Development Section***
Sampled By: ***Team 8 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
874987	11A10	I	44.9	Small	Small
874988	11A11	I	49.9	Large	Large
874989	11A13	I	36.1	Large	Large
874990	11A15	I	36.3	Large	Large
874991	11A17	I	44.9	Large	Large
874992	11A17X	I	39.5	Large	Large
874993	11A19	I	40.9	Large	Large
874994	11A21	I	45.3	Large	Large
874995	11B14	I	35.7	Large	Large
874996	11B15	I	37.2	Large	Large
874997	11B16	I	46.3	Large	Large
874998	11B17	I	43.6	Large	Large
874999	11B17X	I	52.7	X-Large	X-Large
875000	11B18	I	43.4	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875001	11B19	I	46.0	Large	Large
875002	11B20	I	50.1	Large	Large
875003	11B21	I	45.8	Large	Large
875004	11C14	R	50.9	Large	Large
875005	11C15	R	49.1	Large	Large
875006	11C16	R	46.2	Large	Large
875007	11C17	R	46.4	Large	Large
875008	11C18	R	48.0	Large	Large
875009	11C19	R	45.1	Large	Large
875010	11C20	R	48.4	Large	Large
875011	11C21	R	42.9	Large	Large

Sampling Area: ***Section 11 HG 22*** **Sampled By:** ***Team 9 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875012	11A12	I	40.6	Large	Large
875013	11A12X	I	44.0	Large	Large
875014	11A14	I	37.1	Large	Large
875015	11A16	I	39.0	Large	Large
875016	11A18	I	36.4	Large	Large
875017	11A20	I	43.4	Large	Large
875018	11A7X	I	49.1	Large	Large
875019	11B10	I	48.7	Large	Large
875020	11B3	I	48.3	Large	Large
875021	11B6	I	56.8	Large	Large
875022	11B7	I	65.0	Large	Large
875023	11B7X	I	57.4	Large	Large
875024	11B8	I	56.0	Large	Large
875025	11B9	I	51.2	Large	Large
875026	11C6	R	52.5	Small	Small
875027	11C7	R	54.9	Small	Small
875028	11C8	R	52.8	Small	Small
875029	11C9	R	49.2	Large	Large

Sampling Area: ***TG 1 North*** **Sampled By:** ***Team 10 - July 20, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875030	16A32	I	54.0	Large	Large
875031	16A33	I	48.6	Large	Large
875032	16A34	I	52.1	Large	Large
875033	16A35	R	46.0	Large	Large
875034	16B32	I	47.9	Large	Large
875035	16B33	I	50.1	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875036	16B34	I	50.4	Large	Large
875037	16B35	R	46.8	Large	Large
875038	16C32	I	52.5	Large	Large
875039	16C33	I	55.9	Large	Large
875040	16C34	I	54.6	Large	Large
875041	16C35	I	56.0	Large	Large
875042	16D32	I	51.6	Large	Large
875043	16D33	I	57.1	Large	Large
875044	16D34	I	55.4	Large	Large
875045	16D35	I	54.3	Large	Large

Sampling Area: ***4 North Section 4*** **Sampled By:** ***Team 1 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875046	4A2	I	70.7	None	None
875047	4A3	I	81.5	None	None
875048	4A3X	I	77.2	None	None
875049	4B2	I	92.0	None	None
875050	4B3X	I	73.0	None	None
875051	4C3	I	79.4	None	None

Sampling Area: ***Section 2*** **Sampled By:** ***Team 2 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875052	2A3X	I	61.3	None	Trace
875053	2B3	I	72.6	None	None
875054	2B3X	I	62.3	None	None
875055	2C3	I	76.5	None	None

Sampling Area: ***Ellis PortalMains Area 3*** **Sampled By:** ***Team 3 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875056	3A1X	I	68.2	None	None
875057	3A2	I	84.9	None	None
875058	3B1	I	95.8	None	None
875059	3B1X	I	71.1	None	None
875060	3B2	I	90.4	None	None
875061	3B3	I	92.4	None	None
875062	3C1	I	58.1	None	None

Sampling Area: ***4 North*** **Sampled By:** ***Team 4 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875063	4B3	I	83.0	None	None
875064	4D3	I	71.1	None	None

Sampling Area: ***Section 19*** **Sampled By:** ***Team 5 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875065	19A1	R	49.7	Large	Large
875066	19A1X	R	54.1	Large	Large
875067	19B1	R	41.4	Large	Large
875068	19B1X	R	47.0	Large	Large
875069	19C1	R	61.3	Large	Large
875070	19C1X	R	51.2	Large	Large
875071	19D1	R	47.0	Large	Large
875072	19D1X	R	40.5	Large	Large
875073	19E1	R	49.7	Large	Large
875074	19E1X	R	44.1	Large	Large
875075	19F1	R	43.2	Large	Large
875076	19F1X	R	38.9	Large	Large

Sampling Area: ***Section 2*** **Sampled By:** ***Team 6 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875077	2B2	I	68.6	None	None
875078	2C1X	I	79.0	None	None
875079	2D1X	I	59.5	None	None
875080	2E1	I	66.6	None	None

Sampling Area: ***HG 22 Section 11 Development Section***
Collected By: ***Team 8 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875081	11A5	I	39.3	Large	Large
875082	11A6	I	47.0	Large	Large
875083	11A7	I	35.7	Large	Large
875084	11A8	I	38.0	Large	Large
875085	11A9	I	38.8	Large	Large
875086	11B11	I	41.5	Large	Large
875087	11B12	I	47.9	Large	Large
875088	11B12X	I	42.7	X-Large	Large
875089	11B13	I	39.9	Large	Large
875090	11C11	R	49.5	Small	Small
875091	11C12	R	50.7	Large	Large

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875092	11C13	R	53.8	Large	Large

Sampling Area: ***Section 3 Ellis Portal Mains*** **Sampled By:** ***Team 9 - July 21, 2010***

Lab ID	Sample Bag No.	Int / Ret	TIC Analysis	Pre-Scr Coke	Post-Scr Coke
875093	3A4	I	76.1	None	None
875094	3A5	I	55.2	None	None
875095	3A5X	I	39.5	None	None
875096	3B4	I	92.6	None	None
875097	3B5	I	91.4	None	None
875098	3B5X	I	60.3	None	None
875099	3C4	I	49.7	None	None
875100	3C5	I	56.6	None	None

STANDARD LABORATORIES, INC.
8451 River King Drive, Freeburg, IL 62243 (618) 539-5836

MINE SAFETY AND HEALTH ADMINISTRATION
P.O. BOX 18233
PITTSBURGH, PA 15236
ATTN: MARK WESOLOWSKI

Date: 11/15/2010 8:43:52 AM

Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
Team 1 - July 13, 2010 - 5N PARALLEL MAINS						
201002333-001	873039	6A20X	TRACE	1.42	63.15	64.57
201002333-002	873040	6A21	TRACE	1.44	68.52	69.96
201002333-003	873041	6A22	TRACE	1.26	60.15	61.41
201002333-004	873042	6A23	TRACE	1.40	57.25	58.65
201002333-005	873043	6A24	TRACE	1.32	57.08	58.40
201002333-006	873044	6B20	TRACE	1.38	63.99	65.37
201002333-007	873045	6B20X	TRACE	1.44	58.09	59.53
201002333-008	873046	6B21	TRACE	1.34	56.90	58.24
201002333-009	873047	6B22	TRACE	1.36	54.20	55.56
201002333-010	873048	6B23	TRACE	1.28	65.25	66.53
201002333-011	873049	6B24	TRACE	1.30	59.88	61.18
201002333-012	873050	6B25	TRACE	1.46	60.02	61.48
201002333-013	873051	6B26	TRACE	1.42	54.43	55.85
201002333-014	873052	6C17	TRACE	2.26	51.57	53.83
201002333-015	873053	6C18	TRACE	1.24	66.51	67.75
201002333-016	873054	6C19	TRACE	1.76	58.93	60.69
201002333-017	873055	6C20X	TRACE	1.54	64.70	66.24
201002333-018	873056	6C21	TRACE	1.36	51.49	52.85
201002333-019	873057	6C22	TRACE	1.44	52.38	53.82
201002333-020	873058	6C23	TRACE	1.38	53.17	54.55
201002333-021	873059	6C24	TRACE	1.32	53.52	54.84
201002333-022	873060	6C25	TRACE	1.34	50.54	51.88
201002333-023	873061	6C26	TRACE	1.32	58.47	59.79
201002333-024	873062	6C27	TRACE	1.26	60.18	61.44
201002333-025	873063	6D17	TRACE	1.67	59.46	61.13
201002333-026	873064	6D18	TRACE	1.30	59.59	60.89
201002333-027	873065	6D19	TRACE	1.54	66.04	67.58
201002333-028	873066	6D20	TRACE	1.24	57.72	58.96
201002333-029	873067	6D20X	TRACE	1.12	69.87	70.99
201002333-030	873068	6D21	TRACE	1.34	58.59	59.93
201002333-031	873069	6D22	TRACE	1.32	64.68	66.00

Respectfully Submitted, *Richard L. Wilburn*

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002333-032	873070	6D23	TRACE	1.26	60.75	62.01
201002333-033	873071	6D24	TRACE	1.36	54.36	55.72
201002333-034	873072	6D25	TRACE	1.44	53.49	54.93
201002333-035	873073	6D26	TRACE	1.36	55.81	57.17
201002333-036	873074	6D27	TRACE	1.50	47.70	49.20
201002333-037	873075	6E17	NONE	1.08	74.80	75.88
201002333-038	873076	6E22	TRACE	1.66	64.86	66.52
201002333-039	873077	6E23	TRACE	1.76	56.41	58.17
Team 2 - July 13, 2010 - 5 NORTH SECTION						
201002434-001	873078	5A21X	TRACE	1.12	73.95	75.07
201002434-002	873079	5A22	TRACE	1.59	57.65	59.24
201002434-003	873080	5B20	TRACE	1.40	63.21	64.61
201002434-004	873081	5B21	TRACE	1.36	62.23	63.59
201002434-005	873082	5B21X	TRACE	1.48	54.02	55.50
201002434-006	873083	5B22	SMALL	1.76	50.50	52.26
201002434-007	873084	5B23	SMALL	1.72	46.15	47.87
201002434-008	873085	5C20	TRACE	1.40	58.79	60.19
201002434-009	873086	5C21	TRACE	1.46	54.13	55.59
201002434-010	873087	5C21X	TRACE	1.32	67.73	69.05
201002434-011	873088	5C22	TRACE	1.50	59.86	61.36
201002434-012	873089	5C23	SMALL	1.56	47.78	49.34
201002434-013	873090	5D20	TRACE	1.20	68.41	69.61
201002434-014	873091	5D21	TRACE	1.26	70.71	71.97
201002434-015	873092	5D22	TRACE	1.26	60.83	62.09
201002434-016	873093	5D23	TRACE	1.32	57.76	59.08
201002434-017	873094	5E20	TRACE	0.84	76.12	76.96
201002434-018	873095	5E21	TRACE	0.90	75.41	76.31
201002434-019	873096	5E21X	TRACE	1.20	66.45	67.65
201002434-020	873097	5E22	TRACE	0.90	76.01	76.91
201002434-021	873098	5E23	TRACE	1.12	73.30	74.42
201002434-022	873099	5F21X	TRACE	1.56	66.23	67.79
201002434-023	873100	5F22	NONE	0.56	85.69	86.25

Respectfully Submitted, *Richard L. Wilburn*

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002434-024	873101	5F23	NONE	0.74	81.08	81.82
201002434-025	873102	5G21	TRACE	1.30	74.01	75.31
201002434-026	873103	5G22	TRACE	1.44	69.44	70.88
201002434-027	873104	5G23	TRACE	1.36	68.55	69.91
Team 3 - July 13, 2010 - HG 1 NORTH						
201002438-001	873105	13A1	SMALL	1.20	66.26	67.46
201002438-002	873106	13A2	SMALL	1.40	55.23	56.63
201002438-003	873107	13A3	SMALL	1.60	52.12	53.72
201002438-004	873108	13A4	SMALL	1.34	53.72	55.06
201002438-005	873109	13A5	SMALL	1.62	48.75	50.37
201002438-006	873110	13A6	SMALL	1.90	43.87	45.77
201002438-007	873111	13A7	SMALL	1.71	48.32	50.03
201002438-008	873112	13A8	LARGE	1.79	43.23	45.02
201002438-009	873113	13B2	SMALL	1.82	48.17	49.99
201002438-010	873114	13B3	LARGE	1.85	48.80	50.65
201002438-011	873115	13B4	SMALL	1.72	45.33	47.05
201002438-012	873116	13B5	SMALL	1.66	47.42	49.08
201002438-013	873117	13B6	SMALL	1.98	40.93	42.91
201002438-014	873118	13B7	SMALL	1.76	41.80	43.56
201002438-015	873119	13B8	SMALL	1.66	51.08	52.74
201002438-016	873120	13B9	SMALL	1.78	48.80	50.58
201002438-017	873121	13C3	SMALL	1.71	44.82	46.53
201002438-018	873122	13C4	SMALL	1.45	56.74	58.19
201002438-019	873123	13C4X	TRACE	1.74	46.41	48.15
201002438-020	873124	13C5	SMALL	1.79	46.02	47.81
201002438-021	873125	13C5X	SMALL	1.84	39.56	41.40
201002438-022	873126	13C6	SMALL	1.65	51.08	52.73
201002438-023	873127	13C7	SMALL	1.61	58.91	60.52
201002438-024	873128	13C8	SMALL	1.16	66.57	67.73
201002438-025	873129	13C9	SMALL	1.56	55.03	56.59
201002438-026	873130	13D7	SMALL	1.66	38.68	40.34
201002438-027	873131	13D8	SMALL	1.64	47.11	48.75

Respectfully Submitted, *Richard L. Wilburn*

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002438-028	873132	13D9	SMALL	1.28	60.49	61.77
201002438-029	873133	13E7	SMALL	1.74	25.30	27.04
201002438-030	873134	13E8	SMALL	1.84	35.12	36.96
201002438-031	873135	13E9	SMALL	1.46	48.93	50.39
Team 4 - July 13, 2010 - SECTION 17 TG 1 NORTH						
201002474-001	873136	17A23	LARGE	2.07	45.88	47.95
201002474-002	873137	17A24	LARGE	1.96	46.27	48.23
201002474-003	873138	17A25	LARGE	2.28	47.92	50.20
201002474-004	873139	17A26	LARGE	2.06	49.72	51.78
201002474-005	873140	17A27	LARGE	1.94	47.92	49.86
201002474-006	873141	17B23	X LARGE	2.05	46.81	48.86
201002474-007	873142	17B24	X LARGE	1.94	42.60	44.54
201002474-008	873143	17B25	LARGE	2.44	41.27	43.71
201002474-009	873144	17B26	LARGE	2.08	48.74	50.82
201002474-010	873145	17B27	X LARGE	2.16	48.71	50.87
201002474-011	873146	17C23	LARGE	1.38	63.27	64.65
201002474-012	873147	17C24	LARGE	1.42	65.03	66.45
201002474-013	873148	17C25	LARGE	1.62	60.53	62.15
201002474-014	873149	17C26	LARGE	1.59	57.80	59.39
201002474-015	873150	17C27	SMALL	1.38	63.91	65.29
201002474-016	873151	17D22	SMALL	1.44	57.82	59.26
201002474-017	873152	17D23	SMALL	1.36	55.24	56.60
201002474-018	873153	17D24	SMALL	1.58	47.03	48.61
201002474-019	873154	17D25	LARGE	1.62	53.28	54.90
201002474-020	873155	17D26	LARGE	1.74	52.20	53.94
201002474-021	873156	17D27	LARGE	1.62	55.57	57.19
201002474-022	873157	17E22	SMALL	1.72	43.92	45.64
201002474-023	873158	17E23	SMALL	1.65	52.07	53.72
201002474-024	873159	17E24	SMALL	1.46	50.87	52.33
201002474-025	873160	17E25	LARGE	1.64	51.10	52.74
201002474-026	873161	17E26	SMALL	1.90	50.83	52.73
201002474-027	873162	17E27	SMALL	1.66	44.84	46.50

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002474-028	873163	17F24	LARGE	1.88	48.38	50.26
201002474-029	873164	17F25	SMALL	1.55	35.27	36.82
201002474-030	873165	17F26	LARGE	1.88	48.07	49.95
201002474-031	873166	17F27	LARGE	1.72	41.26	42.98
Team 5 - July 13, 2010 - 7 NORTH						
201002475-001	873167	7A50	SMALL	1.86	40.55	42.41
201002475-002	873168	7A50X	SMALL	1.95	40.20	42.15
201002475-003	873169	7B50X	SMALL	1.80	48.38	50.18
201002475-004	873170	7B51	SMALL	1.66	43.56	45.22
201002475-005	873171	7B52	SMALL	1.38	51.28	52.66
201002475-006	873172	7B53	SMALL	1.56	51.02	52.58
201002475-007	873173	7B54	SMALL	1.46	67.09	68.55
201002475-008	873174	7B55	SMALL	1.42	67.62	69.04
201002475-009	873175	7C51	SMALL	1.38	52.26	53.64
201002475-010	873176	7C52	SMALL	1.16	61.41	62.57
201002475-011	873177	7C53	TRACE	1.34	61.76	63.10
201002475-012	873178	7C54	TRACE	1.12	66.44	67.56
201002475-013	873179	7C55	SMALL	1.30	58.40	59.70
201002475-014	873180	7D50X	TRACE	1.06	66.34	67.40
201002475-015	873181	7D51	TRACE	1.34	55.63	56.97
201002475-016	873182	7D52	TRACE	0.90	70.68	71.58
201002475-017	873183	7D53	SMALL	1.69	56.22	57.91
201002475-018	873184	7E50	SMALL	1.18	67.72	68.90
201002475-019	873185	7E50X	LARGE	1.66	62.70	64.36
201002475-020	873186	7E51	TRACE	1.90	70.71	72.61
201002475-021	873187	7E52	TRACE	5.29	51.65	56.94
201002475-022	873188	7F50	SMALL	0.62	89.67	90.29
201002475-023	873189	7F51	SMALL	1.95	83.71	85.66
Team 6 - July 13, 2010 - 6 NORTH						
201002478-001	873190	7B5X	TRACE	1.50	50.03	51.53
201002478-002	873191	7B6	TRACE	1.30	55.52	56.82
201002478-003	873192	7C5	TRACE	1.16	56.90	58.06

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002478-004	873193	7C5X	TRACE	1.12	65.61	66.73
201002478-005	873194	7C6	TRACE	1.16	62.85	64.01
201002478-006	873195	7D3	TRACE	0.82	82.95	83.77
201002478-007	873196	7D4	TRACE	1.16	66.19	67.35
201002478-008	873197	7D5	TRACE	1.28	64.28	65.56
201002478-009	873198	7D5X	TRACE	1.30	63.31	64.61
201002478-010	873199	7D6	TRACE	1.10	67.59	68.69
201002478-011	873200	7E1	NONE	1.06	89.76	90.82
201002478-012	873201	7E2	TRACE	0.64	87.09	87.73
201002478-013	873202	7E3	TRACE	1.00	71.97	72.97
201002478-014	873203	7E4	TRACE	1.08	69.78	70.86
201002478-015	873204	7E5	TRACE	1.20	67.11	68.31
201002478-016	873205	7E6	TRACE	1.06	68.86	69.92
201002478-017	873206	7F1	NONE	1.28	64.65	65.93
201002478-018	873207	7F2	NONE	1.14	67.37	68.51
201002478-019	873208	7F3	TRACE	1.22	66.47	67.69
201002478-020	873209	7F4	TRACE	1.40	62.31	63.71
Team 7 - July 13, 2010 - 8 NORTH MAINS						
201002479-001	873210	9A1	TRACE	1.59	61.74	63.33
201002479-002	873211	9A2	SMALL	1.84	43.40	45.24
201002479-003	873212	9A2X	LARGE	2.19	46.21	48.40
201002479-004	873213	9A3	SMALL	1.70	46.55	48.25
201002479-005	873214	9A4	SMALL	1.68	45.26	46.94
201002479-006	873215	9B1	SMALL	2.00	47.38	49.38
201002479-007	873216	9B2	SMALL	1.40	54.87	56.27
201002479-008	873217	9B2X	SMALL	1.88	43.71	45.59
201002479-009	873218	9B3	SMALL	1.56	47.37	48.93
201002479-010	873219	9B4	SMALL	1.20	59.08	60.28
201002479-011	873220	9C1	SMALL	1.28	52.68	53.96
201002479-012	873221	9C2	SMALL	1.56	54.20	55.76
201002479-013	873222	9C2X	SMALL	2.10	42.13	44.23
201002479-014	873223	9C3	SMALL	1.93	46.03	47.96

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002479-015	873224	9C4	SMALL	1.50	45.64	47.14
201002479-016	873225	9D1	SMALL	1.85	55.20	57.05
201002479-017	873226	9D2	SMALL	1.92	43.72	45.64
201002479-018	873227	9D2X	SMALL	2.22	39.78	42.00
201002479-019	873228	9D3	SMALL	1.68	46.57	48.25
201002479-020	873229	9D4	SMALL	1.46	42.93	44.39
201002479-021	873230	9E1	SMALL	2.24	40.13	42.37
201002479-022	873231	9E2	TRACE	1.73	64.95	66.68
201002479-023	873232	9E2X	SMALL	2.24	48.21	50.45
201002479-024	873233	9E4	SMALL	2.18	42.89	45.07
201002479-025	873234	9E5	SMALL	2.17	37.64	39.81
201002479-026	873235	9F4	SMALL	2.14	42.71	44.85
201002479-027	873236	9F5	SMALL	2.16	44.55	46.71
Team 8 - July 13, 2010 - SECT. 10 8N MAINS						
201002480-001	873237	10A1	LARGE	2.12	47.59	49.71
201002480-002	873238	10A1X	LARGE	2.08	44.65	46.73
201002480-003	873239	10A2	LARGE	2.41	44.64	47.05
201002480-004	873240	10A3	SMALL	1.88	40.23	42.11
201002480-005	873241	10B1	LARGE	2.28	45.34	47.62
201002480-006	873242	10B1X	LARGE	2.29	42.68	44.97
201002480-007	873243	10B2	LARGE	2.00	50.60	52.60
201002480-008	873244	10B3	SMALL	2.02	42.88	44.90
201002480-009	873245	10C1	X LARGE	2.62	49.81	52.43
201002480-010	873246	10C10	LARGE	2.16	42.35	44.51
201002480-011	873247	10C10X	SMALL	2.00	40.50	42.50
201002480-012	873248	10C11	LARGE	1.86	39.72	41.58
201002480-013	873249	10C1X	LARGE	2.28	38.80	41.08
201002480-014	873250	10D1	LARGE	2.45	42.23	44.68
201002480-015	873251	10D10	LARGE	2.07	41.95	44.02
201002480-016	873252	10D10X	LARGE	2.14	40.35	42.49
201002480-017	873253	10D11	LARGE	1.80	56.45	58.25
201002480-018	873254	10D1X	LARGE	1.94	46.16	48.10

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201002480-019	873255	10E1	LARGE	1.98	35.74	37.72
201002480-020	873256	10E10	LARGE	2.30	36.99	39.29
201002480-021	873257	10E10X	X LARGE	2.54	40.91	43.45
201002480-022	873258	10E11	SMALL	2.10	43.66	45.76
201002480-023	873259	10E1X	SMALL	2.16	36.11	38.27
201002480-024	873260	10E2	SMALL	1.96	38.19	40.15
201002480-025	873261	10E3	SMALL	2.26	38.68	40.94
201002480-026	873262	10E4	SMALL	2.00	37.70	39.70
201002480-027	873263	10E5	SMALL	1.97	38.99	40.96
201002480-028	873264	10E6	SMALL	2.07	36.06	38.13
201002480-029	873265	10E7	SMALL	2.16	38.17	40.33
201002480-030	873266	10E8	LARGE	2.27	38.53	40.80
201002480-031	873267	10E9	LARGE	1.87	42.59	44.46
201002480-032	873268	10F1	SMALL	2.42	40.33	42.75
201002480-033	873269	10F10	LARGE	2.32	46.91	49.23
201002480-034	873270	10F11	LARGE	2.42	43.22	45.64
201002480-035	873271	10F2	SMALL	2.38	40.35	42.73
201002480-036	873272	10F3	SMALL	2.04	39.24	41.28
201002480-037	873273	10F4	SMALL	1.86	41.06	42.92
201002480-038	873274	10F5	SMALL	2.14	37.95	40.09
201002480-039	873275	10F6	LARGE	2.10	38.44	40.54
201002480-040	873276	10F7	LARGE	1.84	42.01	43.85
201002480-041	873277	10F8	X LARGE	2.34	41.82	44.16
201002480-042	873278	10F9	X LARGE	1.92	46.04	47.96
Team 9 - July 13, 2010 - CUT OUT BETWEEN HG 1N AND TG 1N						
201002481-001	873279	14A10	SMALL	1.52	46.32	47.84
201002481-002	873280	14A2	X LARGE	2.40	42.80	45.20
201002481-003	873281	14A3	X LARGE	2.73	37.84	40.57
201002481-004	873282	14A4	X LARGE	2.66	39.97	42.63
201002481-005	873283	14A5	X LARGE	2.25	46.33	48.58
201002481-006	873284	14A6	X LARGE	2.41	41.46	43.87
201002481-007	873285	14A6X	X LARGE	2.42	45.56	47.98

Respectfully Submitted, *Richard L. Wilburn*

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Date: 11/15/2010 8:43:53 AM

Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002481-008	873286	14A7	X LARGE	2.10	43.46	45.56
201002481-009	873287	14A8	LARGE	1.88	44.65	46.53
201002481-010	873288	14A9	LARGE	2.01	41.77	43.78
201002481-011	873289	14B1	X LARGE	2.29	45.82	48.11
201002481-012	873290	14B10	SMALL	1.71	44.79	46.50
201002481-013	873291	14B2	X LARGE	2.73	44.21	46.94
201002481-014	873292	14B3	X LARGE	2.92	43.28	46.20
201002481-015	873293	14B4	X LARGE	2.67	46.77	49.44
201002481-016	873294	14B5	X LARGE	2.24	51.76	54.00
201002481-017	873295	14B6	X LARGE	2.27	45.03	47.30
201002481-018	873296	14B6X	X LARGE	2.16	48.32	50.48
201002481-019	873297	14B7	LARGE	2.09	45.09	47.18
201002481-020	873298	14B8	LARGE	1.84	44.20	46.04
201002481-021	873299	14B9	LARGE	1.93	40.26	42.19
201002481-022	873300	14C10	SMALL	1.68	45.84	47.52
201002481-023	873301	14C9	SMALL	1.84	45.29	47.13
201002481-024	873302	14D10	SMALL	1.87	44.41	46.28
201002481-025	873303	14D9	SMALL	1.90	44.86	46.76
201002481-026	873304	14E10	TRACE	1.68	42.69	44.37
201002481-027	873305	14E9	SMALL	1.74	46.36	48.10
201002481-028	873306	14F10	TRACE	0.96	60.79	61.75
201002481-029	873307	14F9	SMALL	1.32	47.23	48.55
201002481-030	873308	14G10	TRACE	1.18	51.58	52.76
201002481-031	873309	14G9	TRACE	1.42	44.62	46.04
Team 10 - July 13, 2010 - SECTION 16 TG						
201002529-001	873310	16A1	TRACE	1.46	54.60	56.06
201002529-002	873311	16A2	TRACE	1.57	53.31	54.88
201002529-003	873312	16A3	TRACE	1.92	49.30	51.22
201002529-004	873313	16A4	TRACE	1.36	52.22	53.58
201002529-005	873314	16A5	TRACE	1.48	44.82	46.30
201002529-006	873315	16A6	TRACE	1.58	38.67	40.25
201002529-007	873316	16A7	SMALL	1.50	47.33	48.83

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201002529-008	873317	16A7X	SMALL	1.72	47.03	48.75
201002529-009	873318	16B1	TRACE	1.18	59.84	61.02
201002529-010	873319	16B2	TRACE	1.32	58.81	60.13
201002529-011	873320	16B3	SMALL	1.40	57.27	58.67
201002529-012	873321	16B4	TRACE	1.20	62.67	63.87
201002529-013	873322	16B5	TRACE	1.26	62.98	64.24
201002529-014	873323	16B6	TRACE	1.36	59.64	61.00
201002529-015	873324	16B7	TRACE	1.36	58.85	60.21
201002529-016	873325	16B7X	SMALL	1.54	55.73	57.27
201002529-017	873326	16C1	NONE	1.18	79.34	80.52
201002529-018	873327	16C2	TRACE	1.04	73.58	74.62
201002529-019	873328	16C3	TRACE	1.14	66.96	68.10
201002529-020	873329	16C4	TRACE	1.00	71.01	72.01
201002529-021	873330	16C5	TRACE	1.06	72.55	73.61
201002529-022	873331	16C6	TRACE	1.02	68.51	69.53
201002529-023	873332	16C7	SMALL	1.10	68.65	69.75
201002529-024	873333	16C7X	SMALL	1.58	56.50	58.08
201002529-025	873334	16D1	TRACE	0.86	77.34	78.20
201002529-026	873335	16D3	TRACE	1.30	79.53	80.83
201002529-027	873336	16D4	TRACE	1.48	63.99	65.47
201002529-028	873337	16D5	TRACE	1.46	60.94	62.40
201002529-029	873338	16D6	TRACE	1.75	62.42	64.17
201002529-030	873339	16D7	TRACE	1.28	65.27	66.55
Team 1 - July 14, 2010 - 5N PARALLEL MAINS						
201002530-001	873340	6A12	NONE	0.94	69.14	70.08
201002530-002	873341	6A12X	NONE	1.08	66.75	67.83
201002530-003	873342	6A13	NONE	1.08	75.59	76.67
201002530-004	873343	6A14	TRACE	1.12	61.91	63.03
201002530-005	873344	6A14X	NONE	0.96	73.09	74.05
201002530-006	873345	6A15	TRACE	1.30	59.17	60.47
201002530-007	873346	6A16	TRACE	1.34	60.24	61.58
201002530-008	873347	6A17	TRACE	1.26	60.83	62.09

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201002530-009	873348	6A18	TRACE	1.66	55.13	56.79
201002530-010	873349	6A19	TRACE	1.56	58.40	59.96
201002530-011	873350	6A20	TRACE	1.20	61.37	62.57
201002530-012	873351	6B12	NONE	1.22	61.62	62.84
201002530-013	873352	6B12X	NONE	1.34	48.51	49.85
201002530-014	873353	6B13	TRACE	0.70	84.59	85.29
201002530-015	873354	6B14	TRACE	1.22	75.04	76.26
201002530-016	873355	16B14X	NONE	0.80	82.88	83.68
201002530-017	873356	6B15	TRACE	1.40	61.68	63.08
201002530-018	873357	6B16	TRACE	1.24	57.12	58.36
201002530-019	873358	6B17	TRACE	1.12	64.46	65.58
201002530-020	873359	6B18	TRACE	1.26	62.53	63.79
201002530-021	873360	6C12	NONE	1.24	70.64	71.88
201002530-022	873361	6C12X	NONE	1.24	72.63	73.87
201002530-023	873362	6C13	TRACE	0.72	83.98	84.70
201002530-024	873363	6C14	TRACE	1.20	74.94	76.14
201002530-025	873364	6C14X	TRACE	1.20	74.38	75.58
201002530-026	873365	6C15	TRACE	1.22	75.98	77.20
201002530-027	873366	6C16	TRACE	1.40	58.42	59.82
201002530-028	873367	6D12	NONE	1.32	51.27	52.59
201002530-029	873368	6D12X	NONE	1.32	61.89	63.21
201002530-030	873369	6D13	NONE	1.06	80.35	81.41
201002530-031	873370	6D14	NONE	1.04	77.40	78.44
201002530-032	873371	6D14X	NONE	0.90	81.94	82.84
201002530-033	873372	6E12	NONE	1.42	56.59	58.01
201002530-034	873373	6E13	NONE	1.08	73.31	74.39
201002530-035	873374	6E14	NONE	1.14	74.37	75.51
201002530-036	873375	6E16	TRACE	1.42	75.38	76.80
201002530-037	873376	6E18	TRACE	1.43	63.08	64.51
201002530-038	873377	6F15	NONE	1.16	72.96	74.12
201002530-039	873378	6F16	NONE	1.12	68.16	69.28
201002530-040	873379	6F17	NONE	1.26	58.38	59.64

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
Team 2 - July 14, 2010 - 5 NORTH SECTION						
201002531-001	873380	5B17	TRACE	1.65	60.47	62.12
201002531-002	873381	5B18	SMALL	1.44	53.92	55.36
201002531-003	873382	5B19	TRACE	1.26	64.24	65.50
201002531-004	873383	5C17	TRACE	1.42	60.51	61.93
201002531-005	873384	5C18	TRACE	1.36	59.05	60.41
201002531-006	873385	5C19	TRACE	1.16	61.89	63.05
201002531-007	873386	5D15	TRACE	1.22	67.59	68.81
201002531-008	873387	5D16	TRACE	1.24	65.11	66.35
201002531-009	873388	5D17	TRACE	1.20	63.68	64.88
201002531-010	873389	5D18	TRACE	1.12	69.47	70.59
201002531-011	873390	5D19	SMALL	1.20	62.87	64.07
201002531-012	873391	5E15	TRACE	0.84	82.46	83.30
201002531-013	873392	5E16	TRACE	0.96	76.82	77.78
201002531-014	873393	5E17	TRACE	0.72	86.13	86.85
201002531-015	873394	5E18	TRACE	1.02	75.32	76.34
201002531-016	873395	5E19	TRACE	0.98	70.72	71.70
201002531-017	873396	5F15	TRACE	1.00	76.49	77.49
201002531-018	873397	5F16	TRACE	0.64	85.03	85.67
201002531-019	873398	5F17	TRACE	0.78	83.16	83.94
201002531-020	873399	5F18	TRACE	0.84	81.85	82.69
201002531-021	873400	5F19	TRACE	0.62	86.45	87.07
201002531-022	873401	5F20	NONE	0.56	88.50	89.06
201002531-023	873402	5F21	NONE	0.72	83.43	84.15
201002531-024	873403	5G15	TRACE	1.43	64.43	65.86
201002531-025	873404	5G16	TRACE	1.50	58.73	60.23
201002531-026	873405	5G17	TRACE	1.38	60.39	61.77
201002531-027	873406	5G18	TRACE	1.28	68.72	70.00
201002531-028	873407	5G19	TRACE	1.30	70.56	71.86
201002531-029	873408	5G20	TRACE	1.43	68.75	70.18
Team 3 - July 14, 2010 - HG 1 NORTH						
201002532-001	873409	13B10	LARGE	1.78	48.74	50.52

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002532-002	873410	13B11	LARGE	1.54	52.15	53.69
201002532-003	873411	13B12	LARGE	1.52	58.99	60.51
201002532-004	873412	13B13	X LARGE	1.76	58.31	60.07
201002532-005	873413	13B14	X LARGE	1.72	54.14	55.86
201002532-006	873414	13B14X	X LARGE	1.66	63.52	65.18
201002532-007	873415	13B15	LARGE	1.54	60.25	61.79
201002532-008	873416	13B9X	X LARGE	1.90	61.21	63.11
201002532-009	873417	13C10	SMALL	1.26	61.61	62.87
201002532-010	873418	13C11	SMALL	1.60	61.86	63.46
201002532-011	873419	13C12	LARGE	1.63	63.55	65.18
201002532-012	873420	13C13	SMALL	1.30	66.83	68.13
201002532-013	873421	13C14	X LARGE	1.56	60.65	62.21
201002532-014	873422	13C14X	X LARGE	2.17	50.24	52.41
201002532-015	873423	13C15	LARGE	1.46	58.60	60.06
201002532-016	873424	13C9X	X LARGE	2.04	49.07	51.11
201002532-017	873425	13D10	SMALL	1.14	61.64	62.78
201002532-018	873426	13D11	SMALL	1.12	64.27	65.39
201002532-019	873427	13D12	LARGE	1.16	61.78	62.94
201002532-020	873428	13D13	LARGE	1.18	61.02	62.20
201002532-021	873429	13D14	SMALL	1.34	54.23	55.57
201002532-022	873430	13D14X	X LARGE	2.54	41.05	43.59
201002532-023	873431	13D15	X LARGE	1.44	49.92	51.36
201002532-024	873432	13E10	X LARGE	1.90	43.13	45.03
201002532-025	873433	13E11	X LARGE	1.78	42.41	44.19
201002532-026	873434	13E12	LARGE	1.66	47.19	48.85
201002532-027	873435	13E13	X LARGE	1.98	40.32	42.30
201002532-028	873436	13E14	X LARGE	1.66	46.17	47.83
201002532-029	873437	13E14X	X LARGE	2.38	43.10	45.48
201002532-030	873438	13E15	X LARGE	1.98	39.34	41.32
201002532-031	873439	13E9X	X LARGE	2.41	37.07	39.48
201002532-032	873440	13F10	X LARGE	2.34	39.49	41.83
201002532-033	873441	13F11	LARGE	1.78	43.16	44.94

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201002532-034	873442	13F12	LARGE	1.91	42.11	44.02
201002532-035	873443	13F13	X LARGE	1.93	38.56	40.49
201002532-036	873444	13F14	LARGE	1.94	34.08	36.02
201002532-037	873445	13F15	LARGE	1.76	37.33	39.09
Team 4 - July 14, 2010 - 17 TG 1 NORTH						
201002566-001	873446	17A18	LARGE	2.01	49.54	51.55
201002566-002	873447	17A19	X LARGE	1.88	48.90	50.78
201002566-003	873448	17A20	LARGE	2.11	51.63	53.74
201002566-004	873449	17A21	SMALL	2.00	51.82	53.82
201002566-005	873450	17A21X	SMALL	1.93	50.80	52.73
201002566-006	873451	17A22	SMALL	1.79	45.55	47.34
201002566-007	873452	17B18	LARGE	2.10	50.34	52.44
201002566-008	873453	17B19	SMALL	2.14	32.67	34.81
201002566-009	873454	17B20	SMALL	1.92	48.59	50.51
201002566-010	873455	17B21	LARGE	2.12	45.18	47.30
201002566-011	873456	17B21X	LARGE	1.92	51.89	53.81
201002566-012	873457	17B22	LARGE	2.16	44.56	46.72
201002566-013	873458	17C18	LARGE	1.48	63.43	64.91
201002566-014	873459	17C19	SMALL	1.08	72.46	73.54
201002566-015	873460	17C20	LARGE	1.61	51.68	53.29
201002566-016	873461	17C21	SMALL	1.18	71.18	72.36
201002566-017	873462	17C21X	LARGE	1.28	65.35	66.63
201002566-018	873463	17C22	SMALL	1.36	68.06	69.42
201002566-019	873464	17D19	LARGE	1.60	56.61	58.21
201002566-020	873465	17D21X	LARGE	2.05	48.49	50.54
201002566-021	873466	17E19	LARGE	1.78	38.19	39.97
201002566-022	873467	17E20	LARGE	1.94	37.76	39.70
201002566-023	873468	17E21	SMALL	1.66	51.83	53.49
201002566-024	873469	17F19	SMALL	2.35	34.64	36.99
201002566-025	873470	17F20	SMALL	1.74	35.19	36.93
Team 5 - July 14, 2010 - 7 NORTH						
201002567-001	873471	7A48	SMALL	1.68	43.90	45.58

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201002567-002	873472	7A49	SMALL	1.68	44.19	45.87
201002567-003	873473	7B46	TRACE	1.56	32.44	34.00
201002567-004	873474	7B47	SMALL	1.60	34.70	36.30
201002567-005	873475	7B48	SMALL	1.66	33.36	35.02
201002567-006	873476	7B49	SMALL	1.62	38.27	39.89
201002567-007	873477	7B50	SMALL	1.53	50.83	52.36
201002567-008	873478	7C46	TRACE	1.46	39.62	41.08
201002567-009	873479	7C47	SMALL	1.54	35.99	37.53
201002567-010	873480	7C48	SMALL	1.40	49.53	50.93
201002567-011	873481	7C49	SMALL	1.46	49.71	51.17
201002567-012	873482	7C50	SMALL	1.34	54.89	56.23
201002567-013	873483	7D46	TRACE	1.46	45.70	47.16
201002567-014	873484	7D47	SMALL	1.54	44.47	46.01
201002567-015	873485	7D48	TRACE	1.36	47.83	49.19
201002567-016	873486	7D49	SMALL	1.55	50.38	51.93
201002567-017	873487	7D50	SMALL	1.34	56.91	58.25
201002567-018	873488	7E46	TRACE	1.20	54.56	55.76
201002567-019	873489	7E47	SMALL	1.30	51.79	53.09
201002567-020	873490	7E48	SMALL	1.28	47.56	48.84
201002567-021	873491	7E49	SMALL	1.14	59.88	61.02
201002567-022	873492	7F46	SMALL	1.52	38.03	39.55
201002567-023	873493	7F47	SMALL	1.58	30.86	32.44
201002567-024	873494	7F48	SMALL	1.16	63.88	65.04
Team 6 - July 14, 2010 - 6 NORTH						
201002568-001	873495	7B10	TRACE	1.44	59.52	60.96
201002568-002	873496	7B11	TRACE	1.18	59.22	60.40
201002568-003	873497	7B12	SMALL	1.66	53.52	55.18
201002568-004	873498	7B7	SMALL	1.34	57.48	58.82
201002568-005	873499	7B8	SMALL	1.40	52.24	53.64
201002568-006	873500	7B9	TRACE	1.44	51.78	53.22
201002568-007	873501	7C11	TRACE	1.12	62.10	63.22
201002568-008	873502	7C12	TRACE	1.16	64.90	66.06

Respectfully Submitted, *Richard L. Wilburn*

STANDARD LABORATORIES, INC.
8451 River King Drive, Freeburg, IL 62243 (618) 539-5836

MINE SAFETY AND HEALTH ADMINISTRATION
P.O. BOX 18233
PITTSBURGH, PA 15236
ATTN: MARK WESOLOWSKI

Date: 11/15/2010 8:43:53 AM

Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002568-009	873503	7C7	TRACE	1.16	57.58	58.74
201002568-010	873504	7C8	TRACE	1.24	55.56	56.80
201002568-011	873505	7C9	TRACE	1.38	55.35	56.73
201002568-012	873506	7D7	TRACE	1.12	66.25	67.37
201002568-013	873507	7D8	TRACE	0.92	78.72	79.64
201002568-014	873508	7D9	TRACE	1.04	72.47	73.51
201002568-015	873509	7E5X	TRACE	1.22	72.15	73.37
201002568-016	873510	7E7	TRACE	1.06	73.94	75.00
201002568-017	873511	7E8	TRACE	0.82	76.74	77.56
201002568-018	873512	7E9	TRACE	0.82	74.72	75.54
201002568-019	873513	7F5	TRACE	1.32	57.38	58.70
201002568-020	873514	7F6	TRACE	1.44	56.32	57.76
201002568-021	873515	7F7	NONE	1.30	60.88	62.18
Team 7 - July 14, 2010 - 8 NORTH MAINS						
201002569-001	873516	9A5	TRACE	2.64	45.34	47.98
201002569-002	873517	9A6	SMALL	1.80	41.31	43.11
201002569-003	873518	9A7	SMALL	2.03	40.97	43.00
201002569-004	873519	9A7X	LARGE	2.02	42.68	44.70
201002569-005	873520	9A8	SMALL	1.92	40.32	42.24
201002569-006	873521	9B5	SMALL	2.62	45.52	48.14
201002569-007	873522	9B6	SMALL	2.11	43.19	45.30
201002569-008	873523	9B7	SMALL	2.29	44.83	47.12
201002569-009	873524	9B7X	SMALL	2.36	44.17	46.53
201002569-010	873525	9B8	SMALL	1.72	48.94	50.66
201002569-011	873526	9C5	SMALL	1.61	47.28	48.89
201002569-012	873527	9C6	SMALL	1.42	52.17	53.59
201002569-013	873528	9C7	SMALL	1.49	56.41	57.90
201002569-014	873529	9C7X	LARGE	2.12	43.86	45.98
201002569-015	873530	9C8	SMALL	1.89	42.47	44.36
201002569-016	873531	9D5	SMALL	1.76	45.07	46.83
201002569-017	873532	9D6	SMALL	1.80	41.51	43.31
201002569-018	873533	9D7	SMALL	1.86	43.29	45.15

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Date: 11/15/2010 8:43:53 AM

Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002569-019	873534	9D7X	SMALL	2.44	42.10	44.54
201002569-020	873535	9D8	SMALL	1.60	50.06	51.66
201002569-021	873536	9E6	SMALL	2.25	42.61	44.86
201002569-022	873537	9E7	SMALL	1.68	46.94	48.62
201002569-023	873538	9E7X	LARGE	2.07	39.64	41.71
201002569-024	873539	9E8	SMALL	1.88	46.44	48.32
201002569-025	873540	9F6	SMALL	2.49	34.58	37.07
201002569-026	873541	9F7	SMALL	1.60	42.51	44.11
201002569-027	873542	9F8	SMALL	1.85	41.14	42.99
Team 8 - July 14, 2010 - SECT. 10 8 NORTH MAINS						
201002570-001	873543	10A10	LARGE	1.64	46.01	47.65
201002570-002	873544	10A10X	X LARGE	1.77	44.86	46.63
201002570-003	873545	10A11	SMALL	1.74	45.60	47.34
201002570-004	873546	10A4	SMALL	1.84	38.30	40.14
201002570-005	873547	10A5	SMALL	1.78	43.11	44.89
201002570-006	873548	10A6	SMALL	1.72	39.56	41.28
201002570-007	873549	10A7	SMALL	1.60	46.47	48.07
201002570-008	873550	10A8	SMALL	1.68	47.40	49.08
201002570-009	873551	10A9	LARGE	1.70	48.53	50.23
201002570-010	873552	10B10	X LARGE	2.03	47.02	49.05
201002570-011	873553	10B10X	X LARGE	1.87	44.14	46.01
201002570-012	873554	10B11	X LARGE	2.15	40.93	43.08
201002570-013	873555	10B4	SMALL	2.06	37.94	40.00
201002570-014	873556	10B5	SMALL	1.90	35.12	37.02
201002570-015	873557	10B6	SMALL	1.83	38.54	40.37
201002570-016	873558	10B7	SMALL	2.09	39.32	41.41
201002570-017	873559	10B8	SMALL	2.18	40.26	42.44
201002570-018	873560	10B9	LARGE	1.86	43.27	45.13
201002570-019	873561	10C4	SMALL	2.04	38.41	40.45
201002570-020	873562	10C5	SMALL	1.88	38.84	40.72
201002570-021	873563	10C6	SMALL	1.59	47.44	49.03
201002570-022	873564	10C7	SMALL	1.86	41.07	42.93

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002570-023	873565	10C8	SMALL	2.14	37.33	39.47
201002570-024	873566	10C9	SMALL	2.14	38.04	40.18
201002570-025	873567	10D4	SMALL	1.62	52.86	54.48
201002570-026	873568	10D5	SMALL	2.00	44.05	46.05
201002570-027	873569	10D6	SMALL	2.08	37.63	39.71
201002570-028	873570	10D7	SMALL	1.84	39.48	41.32
201002570-029	873571	10D8	SMALL	2.08	38.75	40.83
201002570-030	873572	10D9	SMALL	2.07	44.19	46.26
Team 9 - July 14, 2010 - CUT OUT BETWEEN HG 1N AND 1N						
201002588-001	873573	14C1	X LARGE	2.40	47.42	49.82
201002588-002	873574	14C2	X LARGE	1.98	48.15	50.13
201002588-003	873575	14C3	X LARGE	1.93	46.72	48.65
201002588-004	873576	14C4	X LARGE	1.91	47.52	49.43
201002588-005	873577	14C5	X LARGE	1.79	49.37	51.16
201002588-006	873578	14C6	LARGE	1.32	52.49	53.81
201002588-007	873579	14C6X	LARGE	1.54	45.00	46.54
201002588-008	873580	14C7	LARGE	1.52	48.47	49.99
201002588-009	873581	14C8	LARGE	1.56	43.79	45.35
201002588-010	873582	14D1	X LARGE	1.90	51.67	53.57
201002588-011	873583	14D2	X LARGE	1.82	52.65	54.47
201002588-012	873584	14D3	LARGE	2.02	48.71	50.73
201002588-013	873585	14D4	X LARGE	1.82	46.00	47.82
201002588-014	873586	14D5	X LARGE	1.34	59.16	60.50
201002588-015	873587	14D6	X LARGE	1.92	45.31	47.23
201002588-016	873588	14D6X	LARGE	1.56	52.36	53.92
201002588-017	873589	14D7	X LARGE	1.83	45.28	47.11
201002588-018	873590	14D8	SMALL	1.70	43.71	45.41
201002588-019	873591	14E1	X LARGE	1.82	59.06	60.88
201002588-020	873592	14E2	LARGE	1.74	54.55	56.29
201002588-021	873593	14E3	SMALL	1.39	53.63	55.02
201002588-022	873594	14E4	X LARGE	1.89	48.69	50.58
201002588-023	873595	14E5	X LARGE	1.70	53.08	54.78

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002588-024	873596	14E6	X LARGE	1.60	52.13	53.73
201002588-025	873597	14E6X	X LARGE	1.51	54.57	56.08
201002588-026	873598	14E7	X LARGE	1.86	48.52	50.38
201002588-027	873599	14E8	LARGE	1.80	48.49	50.29
201002588-028	873600	14F6	LARGE	1.30	56.55	57.85
201002588-029	873601	14F6X	SMALL	1.43	52.78	54.21
201002588-030	873602	14F7	LARGE	1.46	53.22	54.68
201002588-031	873603	14F8	SMALL	1.22	51.01	52.23
Team 10 - July 14, 2010 - SECTION 16 TG						
201002589-001	873604	16A10	SMALL	1.56	52.16	53.72
201002589-002	873605	16A11	SMALL	1.94	46.96	48.90
201002589-003	873606	16A12	SMALL	2.10	41.18	43.28
201002589-004	873607	16A8	TRACE	1.54	54.15	55.69
201002589-005	873608	16A9	TRACE	1.72	48.11	49.83
201002589-006	873609	16B10	SMALL	1.74	55.69	57.43
201002589-007	873610	16B11	SMALL	1.58	54.20	55.78
201002589-008	873611	16B12	SMALL	1.78	50.84	52.62
201002589-009	873612	16B8	SMALL	1.46	57.32	58.78
201002589-010	873613	16B9	SMALL	1.38	59.47	60.85
201002589-011	873614	16C10	SMALL	1.18	66.73	67.91
201002589-012	873615	16C11	SMALL	1.42	65.75	67.17
201002589-013	873616	16C12	SMALL	1.16	65.66	66.82
201002589-014	873617	16C8	TRACE	1.22	69.82	71.04
201002589-015	873618	16C9	SMALL	1.42	59.04	60.46
201002589-016	873619	16D10	SMALL	1.40	70.68	72.08
201002589-017	873620	16D11	SMALL	1.85	55.17	57.02
201002589-018	873621	16D12	SMALL	1.44	63.64	65.08
201002589-019	873622	16D8	SMALL	1.44	63.52	64.96
201002589-020	873623	16D9	SMALL	1.46	66.21	67.67
201002589-021	873624	16E10	SMALL	1.66	49.61	51.27
201002589-022	873625	16E11	SMALL	1.70	51.56	53.26
201002589-023	873626	16E12	SMALL	1.89	42.83	44.72

Respectfully Submitted, Richard L. Wilburn

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002589-024	873627	16E9	SMALL	1.78	49.76	51.54
201002589-025	873628	16F10	SMALL	1.66	55.37	57.03
201002589-026	873629	16F11	SMALL	2.38	50.65	53.03
201002589-027	873630	16F12	LARGE	2.06	41.81	43.87
201002589-028	873631	16G12	LARGE	1.93	47.48	49.41
Team 1 - July 15, 2010 - 5N PARALLEL MAINS						
201002590-001	873632	6A10	NONE	1.38	59.24	60.62
201002590-002	873633	6A10X	NONE	1.42	62.71	64.13
201002590-003	873634	6A7	NONE	1.38	66.19	67.57
201002590-004	873635	6A8	NONE	1.66	29.19	30.85
201002590-005	873636	6A8X	NONE	1.53	41.22	42.75
201002590-006	873637	6A9	NONE	1.34	77.58	78.92
201002590-007	873638	6B10	NONE	0.90	78.37	79.27
201002590-008	873639	6B10X	NONE	1.12	73.33	74.45
201002590-009	873640	6B7	NONE	1.08	71.51	72.59
201002590-010	873641	6B8	NONE	1.26	36.87	38.13
201002590-011	873642	6B8X	NONE	1.30	79.60	80.90
201002590-012	873643	6B9	NONE	1.14	67.00	68.14
201002590-013	873644	6C10	NONE	1.20	75.41	76.61
201002590-014	873645	6C10X	NONE	0.68	84.46	85.14
201002590-015	873646	6C11	NONE	0.86	77.50	78.36
201002590-016	873647	6C7	NONE	1.38	59.59	60.97
201002590-017	873648	6C9	NONE	0.88	80.77	81.65
201002590-018	873649	6D10	NONE	1.04	79.66	80.70
201002590-019	873650	6D10X	NONE	0.78	83.72	84.50
201002590-020	873651	6D11	NONE	1.14	73.17	74.31
201002590-021	873652	6D7	NONE	1.14	77.30	78.44
201002590-022	873653	6D9	NONE	0.94	68.75	69.69
201002590-023	873654	6E10	NONE	1.28	64.78	66.06
201002590-024	873655	6E11	NONE	0.94	72.83	73.77
201002590-025	873656	6E7	NONE	1.68	64.19	65.87
Team 2 - July 15, 2010 - 5 NORTH SECTION						

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002604-001	873657	5B13	TRACE	1.14	63.64	64.78
201002604-002	873658	5B14	TRACE	1.24	66.41	67.65
201002604-003	873659	5B14X	TRACE	1.08	74.08	75.16
201002604-004	873660	5B15	TRACE	1.58	56.90	58.48
201002604-005	873661	5B16	TRACE	1.58	59.82	61.40
201002604-006	873662	5C12X	NONE	1.22	56.69	57.91
201002604-007	873663	5C13	TRACE	1.36	59.08	60.44
201002604-008	873664	5C14	TRACE	1.42	61.72	63.14
201002604-009	873665	5C14X	TRACE	1.30	69.27	70.57
201002604-010	873666	5C15	TRACE	1.34	57.45	58.79
201002604-011	873667	5C16	TRACE	1.47	57.57	59.04
201002604-012	873668	5D12	NONE	1.34	45.26	46.60
201002604-013	873669	5D12X	NONE	1.20	56.16	57.36
201002604-014	873670	5D13	NONE	1.38	66.23	67.61
201002604-015	873671	5D14	TRACE	1.10	73.47	74.57
201002604-016	873672	5D14X	TRACE	1.18	70.54	71.72
201002604-017	873673	5E12	NONE	1.92	73.03	74.95
201002604-018	873674	5E13	NONE	0.80	85.81	86.61
201002604-019	873675	5E14	TRACE	0.90	84.03	84.93
201002604-020	873676	5E14X	NONE	0.96	77.59	78.55
201002604-021	873677	5F13	NONE	0.48	95.60	96.08
201002604-022	873678	5F14	NONE	1.26	84.57	85.83
201002604-023	873679	5G13	NONE	1.94	56.19	58.13
201002604-024	873680	5G14	NONE	2.26	54.41	56.67
Team 3 - July 15, 2010 - HG 1 NORTH						
201002609-001	873681	13B16	LARGE	1.62	57.29	58.91
201002609-002	873682	13B17	X LARGE	2.35	40.12	42.47
201002609-003	873683	13B18	LARGE	2.24	41.68	43.92
201002609-004	873684	13B19	LARGE	1.62	49.70	51.32
201002609-005	873685	13C16	X LARGE	1.74	52.15	53.89
201002609-006	873686	13C17	LARGE	1.22	63.92	65.14
201002609-007	873687	13C18	X LARGE	1.77	44.31	46.08

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002609-008	873688	13C19	SMALL	1.54	49.94	51.48
201002609-009	873689	13D16	SMALL	1.42	49.11	50.53
201002609-010	873690	13D17	LARGE	1.32	53.22	54.54
201002609-011	873691	13D18	LARGE	1.48	47.30	48.78
201002609-012	873692	13D19	SMALL	1.34	53.47	54.81
201002609-013	873693	13E16	X LARGE	2.22	35.20	37.42
201002609-014	873694	13E17	X LARGE	1.62	36.91	38.53
201002609-015	873695	13E18	LARGE	1.74	39.21	40.95
201002609-016	873696	13E19	LARGE	1.68	41.96	43.64
201002609-017	873697	13F16	LARGE	1.66	43.18	44.84
201002609-018	873698	13F17	LARGE	1.64	44.34	45.98
201002609-019	873699	13F18	LARGE	1.52	41.21	42.73
201002609-020	873700	13F19	LARGE	1.66	41.50	43.16
Team 4 - July 15, 2010 - 17 TG 1 NORTH						
201002611-001	873701	17A14	X LARGE	1.98	40.89	42.87
201002611-002	873702	17A15	X LARGE	2.06	38.68	40.74
201002611-003	873703	17A16	X LARGE	1.90	38.90	40.80
201002611-004	873704	17A17	X LARGE	1.94	49.57	51.51
201002611-005	873705	17B14	X LARGE	2.04	33.37	35.41
201002611-006	873706	17B15	X LARGE	1.98	36.31	38.29
201002611-007	873707	17B16	LARGE	1.54	45.33	46.87
201002611-008	873708	17B17	X LARGE	2.09	44.17	46.26
201002611-009	873709	17C14	LARGE	1.48	48.40	49.88
201002611-010	873710	17C15	LARGE	1.16	60.56	61.72
201002611-011	873711	17C16	X LARGE	1.53	52.93	54.46
201002611-012	873712	17C17	X LARGE	1.58	52.62	54.20
201002611-013	873713	17D15	X LARGE	1.38	55.35	56.73
201002611-014	873714	17D16	LARGE	1.44	52.81	54.25
201002611-015	873715	17D17	LARGE	1.46	52.60	54.06
201002611-016	873716	17D18	LARGE	1.82	49.02	50.84
201002611-017	873717	17E15	LARGE	1.58	40.23	41.81
201002611-018	873718	17E16	LARGE	1.71	39.88	41.59

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002611-019	873719	17E17	LARGE	1.50	44.89	46.39
201002611-020	873720	17E18	X LARGE	1.78	39.38	41.16
201002611-021	873721	17F15	SMALL	1.57	36.16	37.73
201002611-022	873722	17F16	SMALL	1.51	41.60	43.11
201002611-023	873723	17F17	X LARGE	1.85	34.44	36.29
201002611-024	873724	17F18	SMALL	1.83	29.80	31.63
Team 5 - July 15, 2010 - 7 NORTH						
201002612-001	873725	7A45X	SMALL	1.62	34.67	36.29
201002612-002	873726	7A46	SMALL	1.64	39.78	41.42
201002612-003	873727	7A47	SMALL	1.57	42.74	44.31
201002612-004	873728	7B42	TRACE	1.74	34.26	36.00
201002612-005	873729	7B43	TRACE	1.62	35.77	37.39
201002612-006	873730	7B44	TRACE	1.60	37.13	38.73
201002612-007	873731	7B45	TRACE	1.72	40.55	42.27
201002612-008	873732	7B45X	SMALL	1.70	34.74	36.44
201002612-009	873733	7C42	TRACE	1.46	43.35	44.81
201002612-010	873734	7C43	TRACE	1.56	39.69	41.25
201002612-011	873735	7C44	TRACE	1.60	39.76	41.36
201002612-012	873736	7C45	TRACE	1.50	39.93	41.43
201002612-013	873737	7C45X	SMALL	1.62	42.65	44.27
201002612-014	873738	7D42	TRACE	1.58	47.16	48.74
201002612-015	873739	7D43	TRACE	1.50	47.70	49.20
201002612-016	873740	7D44	TRACE	1.56	47.04	48.60
201002612-017	873741	7D45	TRACE	1.62	44.03	45.65
201002612-018	873742	7D45X	SMALL	1.66	52.51	54.17
201002612-019	873743	7E42	SMALL	1.14	62.18	63.32
201002612-020	873744	7E43	SMALL	1.62	42.72	44.34
201002612-021	873745	7E44	TRACE	1.40	48.80	50.20
201002612-022	873746	7E45	TRACE	1.41	48.70	50.11
201002612-023	873747	7E45X	SMALL	1.81	40.68	42.49
201002612-024	873748	7F42	SMALL	1.60	31.33	32.93
201002612-025	873749	7F43	TRACE	1.60	35.95	37.55

Respectfully Submitted, *Richard L. Wilburn*

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Date: 11/15/2010 8:43:53 AM

Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002612-026	873750	7F44	TRACE	1.74	34.35	36.09
201002612-027	873751	7F45	TRACE	1.56	41.78	43.34
Team 6 - July 15, 2010 - 6 NORTH						
201002613-001	873752	7B10X	SMALL	1.66	50.87	52.53
201002613-002	873753	7C10	TRACE	3.65	57.48	61.13
201002613-003	873754	7C10X	SMALL	3.83	53.17	57.00
201002613-004	873755	7D10	TRACE	1.70	65.64	67.34
201002613-005	873756	7D10X	TRACE	1.42	67.82	69.24
201002613-006	873757	7D11	TRACE	1.81	68.51	70.32
201002613-007	873758	7D12	TRACE	1.34	65.58	66.92
201002613-008	873759	7E10	TRACE	1.00	71.53	72.53
201002613-009	873760	7E10X	TRACE	1.50	65.40	66.90
201002613-010	873761	7E11	TRACE	2.08	76.66	78.74
201002613-011	873762	7E12	TRACE	1.08	71.45	72.53
201002613-012	873763	7F10	TRACE	1.56	59.53	61.09
201002613-013	873764	7F11	TRACE	2.96	61.13	64.09
201002613-014	873765	7F12	TRACE	2.83	58.86	61.69
201002613-015	873766	7F13	TRACE	1.82	52.50	54.32
201002613-016	873767	7F14	TRACE	1.76	52.17	53.93
Team 7 - July 15, 2010 - 9 NORTH MAINS						
201002614-001	873768	9A10	LARGE	1.94	44.56	46.50
201002614-002	873769	9A11	LARGE	1.78	42.58	44.36
201002614-003	873770	9A12	LARGE	1.89	46.29	48.18
201002614-004	873771	9A9	LARGE	2.07	40.36	42.43
201002614-005	873772	9B10	SMALL	1.82	43.87	45.69
201002614-006	873773	9B11	SMALL	1.69	44.23	45.92
201002614-007	873774	9B12	SMALL	1.61	53.85	55.46
201002614-008	873775	9B9	SMALL	1.70	48.90	50.60
201002614-009	873776	9C10	SMALL	1.68	56.06	57.74
201002614-010	873777	9C11	SMALL	1.58	52.51	54.09
201002614-011	873778	9C12	SMALL	1.61	47.79	49.40
201002614-012	873779	9C9	SMALL	1.54	53.90	55.44

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201002614-013	873780	9D10	SMALL	1.76	43.98	45.74
201002614-014	873781	9D11	LARGE	1.78	46.41	48.19
201002614-015	873782	9D12	LARGE	1.62	50.23	51.85
201002614-016	873783	9D9	SMALL	1.64	47.75	49.39
201002614-017	873784	9E10	SMALL	1.52	49.75	51.27
201002614-018	873785	9E11	SMALL	1.46	52.80	54.26
201002614-019	873786	9E12	LARGE	1.78	52.20	53.98
201002614-020	873787	9E9	SMALL	1.62	46.13	47.75
201002614-021	873788	9F10	LARGE	1.80	52.87	54.67
201002614-022	873789	9F11	LARGE	1.70	54.65	56.35
201002614-023	873790	9F12	LARGE	1.74	46.96	48.70
201002614-024	873791	9F9	LARGE	2.50	42.02	44.52
Team 8 - July 15, 2010 - SECT. 10 8TH NORTH MAINS						
201002615-001	873792	10A16	X LARGE	2.43	46.74	49.17
201002615-002	873793	10A17	X LARGE	2.85	46.78	49.63
201002615-003	873794	10A18	X LARGE	3.45	44.22	47.67
201002615-004	873795	10A18X	X LARGE	2.78	54.49	57.27
201002615-005	873796	10A19X	X LARGE	3.30	41.12	44.42
201002615-006	873797	10B16	X LARGE	2.76	43.61	46.37
201002615-007	873798	10B17	X LARGE	2.92	43.99	46.91
201002615-008	873799	10B18	X LARGE	2.57	40.17	42.74
201002615-009	873800	10B18X	LARGE	2.50	39.16	41.66
201002615-010	873801	10B19X	X LARGE	5.03	45.91	50.94
201002615-011	873802	10C16	LARGE	2.47	39.71	42.18
201002615-012	873803	10C17	X LARGE	2.36	38.23	40.59
201002615-013	873804	10D16	X LARGE	2.53	39.01	41.54
201002615-014	873805	10D17	LARGE	2.59	37.51	40.10
201002615-015	873806	10E12	LARGE	2.17	45.98	48.15
201002615-016	873807	10E13	X LARGE	2.51	48.79	51.30
201002615-017	873808	10E14	X LARGE	2.45	46.03	48.48
201002615-018	873809	10E15	X LARGE	2.61	50.07	52.68
201002615-019	873810	10E16	X LARGE	2.53	45.93	48.46

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201002615-020	873811	10F12	LARGE	2.44	43.73	46.17
201002615-021	873812	10F13	X LARGE	2.04	53.23	55.27
201002615-022	873813	10F14	X LARGE	3.07	42.28	45.35
201002615-023	873814	10F15	X LARGE	3.31	44.66	47.97
201002615-024	873815	10F16	X LARGE	2.11	54.43	56.54
201002615-025	873816	10F17	X LARGE	3.74	46.63	50.37
Team 9 - July 15, 2010 - CUT-OUT BETWEEN HG1N AND TG1N/CROSSOVER HG22-TG22						
201002616-001	873817	12A1X	SMALL	1.82	45.91	47.73
201002616-002	873818	12B1	TRACE	1.52	37.11	38.63
201002616-003	873819	12B1X	LARGE	1.64	44.07	45.71
201002616-004	873820	12C1	TRACE	1.38	43.88	45.26
201002616-005	873821	12C1X	LARGE	1.76	44.55	46.31
201002616-006	873822	12D1	TRACE	1.16	54.04	55.20
201002616-007	873823	14F2	SMALL	1.79	51.81	53.60
201002616-008	873824	14F3	LARGE	1.76	56.19	57.95
201002616-009	873825	14F4	X LARGE	1.84	52.66	54.50
201002616-010	873826	14F5	LARGE	1.52	57.63	59.15
201002616-011	873827	14G4	SMALL	0.98	65.53	66.51
201002616-012	873828	14G5	SMALL	1.40	57.81	59.21
201002616-013	873829	14G6	SMALL	1.52	52.37	53.89
201002616-014	873830	14G7	SMALL	1.56	43.90	45.46
201002616-015	873831	14G8	SMALL	1.60	44.60	46.20
Team 10 - July 15, 2010 - TG 1 NORTH						
201002617-001	873832	16A13	SMALL	1.78	44.92	46.70
201002617-002	873833	16A14	LARGE	2.23	41.14	43.37
201002617-003	873834	16A15	LARGE	2.28	34.07	36.35
201002617-004	873835	16A16	X LARGE	2.21	40.09	42.30
201002617-005	873836	16B13	LARGE	1.74	50.37	52.11
201002617-006	873837	16B14	LARGE	1.60	51.51	53.11
201002617-007	873838	16B15	LARGE	1.77	33.34	35.11
201002617-008	873839	16B16	SMALL	1.97	37.77	39.74
201002617-009	873840	16C13	SMALL	1.22	62.78	64.00

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002617-010	873841	16C14	SMALL	1.14	65.68	66.82
201002617-011	873842	16C15	SMALL	1.36	58.37	59.73
201002617-012	873843	16C16	LARGE	1.60	48.07	49.67
201002617-013	873844	16D13	SMALL	1.46	65.72	67.18
201002617-014	873845	16D14	SMALL	1.48	58.19	59.67
201002617-015	873846	16D15	SMALL	1.14	66.46	67.60
201002617-016	873847	16D16	LARGE	1.24	60.56	61.80
201002617-017	873848	16E13	LARGE	1.64	44.63	46.27
201002617-018	873849	16E14	LARGE	1.86	42.87	44.73
201002617-019	873850	16E15	LARGE	1.76	40.78	42.54
201002617-020	873851	16E16	LARGE	1.70	38.80	40.50
201002617-021	873852	16F13	LARGE	1.70	48.01	49.71
201002617-022	873853	16F14	LARGE	1.76	48.50	50.26
201002617-023	873854	16F15	LARGE	1.78	45.42	47.20
201002617-024	873855	16F16	LARGE	1.92	42.22	44.14
201002617-025	873856	16G13	LARGE	1.95	45.14	47.09
201002617-026	873857	16G14	X LARGE	1.67	49.47	51.14
201002617-027	873858	16G15	LARGE	1.85	46.69	48.54
201002617-028	873859	16G16	LARGE	2.04	41.07	43.11
Team 1 - July 17, 2010 - 5N PARALLEL MAINS						
201002620-001	874119	6A4	NONE	0.90	71.79	72.69
201002620-002	874120	6A4X	NONE	1.04	61.28	62.32
201002620-003	874121	6A5	NONE	1.24	67.53	68.77
201002620-004	874122	6A6	NONE	1.28	68.04	69.32
201002620-005	874123	6A6X	NONE	1.14	68.92	70.06
201002620-006	874124	6B4	NONE	1.00	70.04	71.04
201002620-007	874125	6B4X	NONE	0.74	83.88	84.62
201002620-008	874126	6B5	NONE	1.44	68.94	70.38
201002620-009	874127	6B6	NONE	1.02	80.18	81.20
201002620-010	874128	6B6X	NONE	0.72	84.29	85.01
201002620-011	874129	6C4	NONE	1.18	77.13	78.31
201002620-012	874130	6C4X	NONE	1.18	69.55	70.73

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002620-013	874131	6C5	NONE	0.88	82.79	83.67
201002620-014	874132	6C6	NONE	0.88	80.13	81.01
201002620-015	874133	6C6X	NONE	1.10	81.24	82.34
201002620-016	874134	6D4	NONE	0.84	83.08	83.92
201002620-017	874135	6D4X	NONE	0.94	81.53	82.47
201002620-018	874136	6D5	NONE	0.82	81.74	82.56
201002620-019	874137	6D6	NONE	0.96	77.97	78.93
201002620-020	874138	6D6X	NONE	1.46	57.95	59.41
201002620-021	874139	6E4	NONE	1.06	71.37	72.43
201002620-022	874140	6E4X	NONE	1.18	72.76	73.94
201002620-023	874141	6E6	NONE	1.50	61.90	63.40
201002620-024	874142	6F4	NONE	0.92	80.80	81.72
201002620-025	874143	6F5	NONE	1.70	59.63	61.33
201002620-026	874144	6G5	NONE	1.52	66.33	67.85
Team 2 - July 17, 2010 - 5 NORTH SECTION						
201002657-001	874145	5B11	NONE	1.54	65.71	67.25
201002657-002	874146	5B12	NONE	1.74	59.32	61.06
201002657-003	874147	5B12X	NONE	1.44	57.18	58.62
201002657-004	874148	5C10	NONE	1.52	61.87	63.39
201002657-005	874149	5C10X	NONE	1.46	52.35	53.81
201002657-006	874150	5C11	NONE	1.44	68.12	69.56
201002657-007	874151	5C12	NONE	1.26	57.77	59.03
201002657-008	874152	5C9	NONE	1.44	51.74	53.18
201002657-009	874153	5D10	NONE	0.68	85.93	86.61
201002657-010	874154	5D11	NONE	1.06	75.46	76.52
201002657-011	874155	5D8X	NONE	1.44	60.57	62.01
201002657-012	874156	5D9	NONE	0.80	77.21	78.01
201002657-013	874157	5E10	NONE	0.62	89.50	90.12
201002657-014	874158	5E11	NONE	0.98	73.81	74.79
201002657-015	874159	5E8	NONE	0.42	96.45	96.87
201002657-016	874160	5E8X	NONE	0.56	93.23	93.79
201002657-017	874161	5E9	NONE	0.54	92.59	93.13

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002657-018	874162	5F10	NONE	0.46	90.89	91.35
201002657-019	874163	5F10X	NONE	1.56	75.54	77.10
201002657-020	874164	5F11	NONE	0.70	80.12	80.82
201002657-021	874165	5F9	NONE	0.44	93.87	94.31
201002657-022	874166	5G10	NONE	1.80	80.80	82.60
201002657-023	874167	5G11	NONE	1.50	54.65	56.15
201002657-024	874168	5G12	NONE	1.48	52.24	53.72
201002657-025	874169	5G9	NONE	1.52	67.23	68.75
201002657-026	874170	5H11	NONE	1.32	58.85	60.17
Team 3 - July 17, 2010 - HG 1 NORTH						
201002658-001	874171	13B19X	X LARGE	1.75	40.75	42.50
201002658-002	874172	13B20	X LARGE	2.30	43.51	45.81
201002658-003	874173	13B21	LARGE	1.94	43.11	45.05
201002658-004	874174	13B22	SMALL	3.04	39.66	42.70
201002658-005	874175	13C19X	LARGE	1.70	39.36	41.06
201002658-006	874176	13C20	LARGE	1.64	45.52	47.16
201002658-007	874177	13C21	SMALL	1.32	49.23	50.55
201002658-008	874178	13C22	SMALL	1.50	41.15	42.65
201002658-009	874179	13C23	TRACE	1.50	41.93	43.43
201002658-010	874180	13D19X	X LARGE	2.07	35.77	37.84
201002658-011	874181	13D20	SMALL	1.76	42.24	44.00
201002658-012	874182	13D21	SMALL	1.56	40.69	42.25
201002658-013	874183	13D22	TRACE	1.36	47.53	48.89
201002658-014	874184	13D23	TRACE	1.38	42.66	44.04
201002658-015	874185	13E19X	X LARGE	2.45	37.22	39.67
201002658-016	874186	13E20	LARGE	1.61	40.39	42.00
201002658-017	874187	13E21	SMALL	1.54	41.16	42.70
201002658-018	874188	13E22	TRACE	1.48	41.68	43.16
201002658-019	874189	13E23	TRACE	1.42	37.61	39.03
201002658-020	874190	13F20	TRACE	1.58	45.31	46.89
201002658-021	874191	13F21	TRACE	1.52	45.67	47.19
201002658-022	874192	13F22	SMALL	1.44	39.70	41.14

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201002658-023	874193	13F23	TRACE	1.32	42.10	43.42
Team 4 - July 17, 2010 - SECT. 17 - TG 1 NORTH						
201002659-001	874194	17A11X	X LARGE	2.41	39.43	41.84
201002659-002	874195	17A12	LARGE	2.07	41.85	43.92
201002659-003	874196	17A13	X LARGE	2.16	39.61	41.77
201002659-004	874197	17B11X	X LARGE	2.17	43.33	45.50
201002659-005	874198	17B12	X LARGE	1.90	44.70	46.60
201002659-006	874199	17B13	X LARGE	2.14	39.71	41.85
201002659-007	874200	17C11X	X LARGE	1.66	44.26	45.92
201002659-008	874201	17C12	X LARGE	1.34	48.31	49.65
201002659-009	874202	17C13	SMALL	1.26	53.34	54.60
201002659-010	874203	17D11X	X LARGE	2.00	41.70	43.70
201002659-011	874204	17D12	LARGE	1.60	43.65	45.25
201002659-012	874205	17D13	LARGE	1.42	48.31	49.73
201002659-013	874206	17D14	LARGE	1.24	54.33	55.57
201002659-014	874207	17E11X	X LARGE	1.88	40.90	42.78
201002659-015	874208	17E12	LARGE	1.68	44.27	45.95
201002659-016	874209	17E13	LARGE	1.68	40.92	42.60
201002659-017	874210	17E14	LARGE	1.64	37.47	39.11
201002659-018	874211	17F11X	X LARGE	2.42	43.05	45.47
201002659-019	874212	17F12	LARGE	1.64	43.57	45.21
201002659-020	874213	17F13	SMALL	1.62	39.88	41.50
201002659-021	874214	17F14	LARGE	1.66	33.29	34.95
201002659-022	874215	17G11	LARGE	1.92	34.49	36.41
201002659-023	874216	17G12	LARGE	1.78	39.84	41.62
201002659-024	874217	17G13	LARGE	1.66	42.12	43.78
201002659-025	874218	17G14	SMALL	1.50	37.71	39.21
Team 5 - July 17, 2010 - 7 NORTH						
201002660-001	874219	7B38	TRACE	1.36	41.63	42.99
201002660-002	874220	7B39	TRACE	1.55	37.07	38.62
201002660-003	874221	7B40	TRACE	1.57	36.29	37.86
201002660-004	874222	7B40X	LARGE	1.67	37.15	38.82

Respectfully Submitted, *Richard L. Wilburn*

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MINE SAFETY AND HEALTH ADMINISTRATION
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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002660-005	874223	7B41	TRACE	1.66	32.79	34.45
201002660-006	874224	7C37	TRACE	1.38	47.62	49.00
201002660-007	874225	7C38	TRACE	1.50	41.53	43.03
201002660-008	874226	7C39	TRACE	1.36	50.14	51.50
201002660-009	874227	7C40	SMALL	1.60	38.62	40.22
201002660-010	874228	7C40X	LARGE	1.74	40.17	41.91
201002660-011	874229	7C41	TRACE	1.48	44.16	45.64
201002660-012	874230	7D37	SMALL	1.34	47.57	48.91
201002660-013	874231	7D38	TRACE	1.20	56.57	57.77
201002660-014	874232	7D39	SMALL	1.50	47.47	48.97
201002660-015	874233	7D40	SMALL	1.32	52.11	53.43
201002660-016	874234	7D40X	LARGE	1.64	50.14	51.78
201002660-017	874235	7D41	SMALL	1.46	44.92	46.38
201002660-018	874236	7E37	TRACE	1.44	52.51	53.95
201002660-019	874237	7E38	TRACE	1.40	53.40	54.80
201002660-020	874238	7E39	TRACE	1.32	56.80	58.12
201002660-021	874239	7E40	TRACE	1.56	45.10	46.66
201002660-022	874240	7E40X	LARGE	1.87	45.94	47.81
201002660-023	874241	7E41	SMALL	1.53	47.07	48.60
201002660-024	874242	7F37	TRACE	1.84	32.90	34.74
201002660-025	874243	7F38	TRACE	1.78	31.75	33.53
201002660-026	874244	7F39	TRACE	1.66	34.39	36.05
201002660-027	874245	7F40	TRACE	1.63	34.56	36.19
201002660-028	874246	7F41	TRACE	1.72	31.13	32.85
Team 6 - July 17, 2010 - 6 NORTH						
201002680-001	874247	7B15X	SMALL	1.48	54.19	55.67
201002680-002	874248	7C13	TRACE	1.04	67.90	68.94
201002680-003	874249	7C14	TRACE	0.86	75.04	75.90
201002680-004	874250	7C15	TRACE	1.12	65.86	66.98
201002680-005	874251	7C15X	X LARGE	1.70	53.63	55.33
201002680-006	874252	7C16	SMALL	1.22	62.30	63.52
201002680-007	874253	7D13	TRACE	1.06	70.63	71.69

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002680-008	874254	7D14	SMALL	1.12	69.18	70.30
201002680-009	874255	7D15	SMALL	1.12	69.73	70.85
201002680-010	874256	7D15X	X LARGE	1.38	59.26	60.64
201002680-011	874257	7D16	SMALL	1.16	66.98	68.14
201002680-012	874258	7E13	SMALL	1.16	64.75	65.91
201002680-013	874259	7E14	SMALL	1.04	69.80	70.84
201002680-014	874260	7E15	SMALL	1.04	67.37	68.41
201002680-015	874261	7E15X	LARGE	1.48	54.93	56.41
201002680-016	874262	7E16	SMALL	0.92	76.22	77.14
201002680-017	874263	7F15	TRACE	1.42	59.69	61.11
201002680-018	874264	7F16	TRACE	1.56	54.18	55.74
Team 7 - July 17, 2010 - SECTION #9						
201002681-001	874265	9A12X	X LARGE	1.96	52.58	54.54
201002681-002	874266	9A13	LARGE	1.70	41.65	43.35
201002681-003	874267	9A14	LARGE	1.72	46.38	48.10
201002681-004	874268	9A15	LARGE	1.72	44.87	46.59
201002681-005	874269	9A16	SMALL	1.67	45.51	47.18
201002681-006	874270	9B12X	X LARGE	2.30	42.86	45.16
201002681-007	874271	9B13	SMALL	1.34	60.23	61.57
201002681-008	874272	9B14	SMALL	1.44	50.01	51.45
201002681-009	874273	9B15	SMALL	1.30	50.59	51.89
201002681-010	874274	9B16	SMALL	1.58	43.60	45.18
201002681-011	874275	9C12X	LARGE	2.39	46.96	49.35
201002681-012	874276	9C13	SMALL	1.89	43.68	45.57
201002681-013	874277	9C14	LARGE	1.94	42.46	44.40
201002681-014	874278	9C15	LARGE	1.57	45.06	46.63
201002681-015	874279	9C16	SMALL	1.59	50.82	52.41
201002681-016	874280	9D12X	X LARGE	2.39	47.75	50.14
201002681-017	874281	9D13	SMALL	1.96	42.20	44.16
201002681-018	874282	9D14	LARGE	1.58	43.85	45.43
201002681-019	874283	9D15	SMALL	1.62	48.57	50.19
201002681-020	874284	9E12X	LARGE	2.18	51.39	53.57

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201002681-021	874285	9E13	SMALL	1.76	48.28	50.04
201002681-022	874286	9E14	LARGE	1.78	48.13	49.91
201002681-023	874287	9E15	SMALL	1.46	54.78	56.24
201002681-024	874288	9F13	LARGE	1.72	44.92	46.64
201002681-025	874289	9F14	LARGE	1.78	48.16	49.94
201002681-026	874290	9F15	SMALL	1.84	53.87	55.71
Team 8 - July 17, 2010 - SECT. 9 & 10 - 8 NORTH MAINS						
201002682-001	874291	10A12	SMALL	2.09	45.30	47.39
201002682-002	874292	10A13	LARGE	2.05	44.87	46.92
201002682-003	874293	10A14	LARGE	2.06	45.39	47.45
201002682-004	874294	10A15	LARGE	2.32	45.84	48.16
201002682-005	874295	10B12	X LARGE	1.96	53.83	55.79
201002682-006	874296	10B13	X LARGE	2.08	44.37	46.45
201002682-007	874297	10B14	X LARGE	2.22	44.81	47.03
201002682-008	874298	10B15	X LARGE	2.59	43.38	45.97
201002682-009	874299	10C12	X LARGE	2.23	43.05	45.28
201002682-010	874300	10C13	X LARGE	2.29	43.97	46.26
201002682-011	874301	10C14	X LARGE	2.28	41.97	44.25
201002682-012	874302	10C15	X LARGE	2.48	39.76	42.24
201002682-013	874303	10D12	X LARGE	2.48	44.52	47.00
201002682-014	874304	10D13	X LARGE	2.49	39.13	41.62
201002682-015	874305	10D14	X LARGE	2.28	43.17	45.45
201002682-016	874306	10D15	X LARGE	2.52	39.62	42.14
201002682-017	874307	9A17X	LARGE	2.08	45.01	47.09
201002682-018	874308	9A18	SMALL	1.68	45.31	46.99
201002682-019	874309	9B17X	LARGE	2.05	41.50	43.55
201002682-020	874310	9B18	SMALL	1.66	42.55	44.21
201002682-021	874311	9C17X	LARGE	2.19	43.42	45.61
201002682-022	874312	9C18	SMALL	2.02	40.65	42.67
201002682-023	874313	9D17X	LARGE	2.38	42.40	44.78
201002682-024	874314	9D18	SMALL	1.98	38.09	40.07
201002682-025	874315	9E17	LARGE	1.90	47.44	49.34

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201002682-026	874316	9E17X	LARGE	2.54	44.79	47.33
201002682-027	874317	9E18	LARGE	1.77	48.51	50.28
201002682-028	874318	9F17	LARGE	2.19	44.05	46.24
201002682-029	874319	9F18	SMALL	1.98	45.12	47.10
Team 9 - July 17, 2010 - CROSSOVER BETWEEN HG 22 & TG 22						
201002683-001	874320	12A1	TRACE	1.84	44.41	46.25
201002683-002	874321	12A2	TRACE	1.86	52.15	54.01
201002683-003	874322	12A3	TRACE	2.12	44.88	47.00
201002683-004	874323	12B2	TRACE	1.50	48.06	49.56
201002683-005	874324	12B3	TRACE	1.58	39.59	41.17
201002683-006	874325	12C2	TRACE	1.42	42.19	43.61
201002683-007	874326	12C3	TRACE	1.42	46.40	47.82
201002683-008	874327	12C6X	SMALL	1.73	45.57	47.30
201002683-009	874328	12D2	TRACE	1.34	48.64	49.98
201002683-010	874329	12D3	TRACE	1.26	54.87	56.13
201002683-011	874330	12D4	TRACE	1.04	60.89	61.93
201002683-012	874331	12D5	TRACE	1.10	58.51	59.61
201002683-013	874332	12D6	TRACE	1.14	62.17	63.31
Team 10 - July 17, 2010 - TG 1 NORTH						
201002684-001	874333	16A16X	X LARGE	2.77	36.56	39.33
201002684-002	874334	16A17	LARGE	1.60	43.19	44.79
201002684-003	874335	16A18	LARGE	1.88	34.87	36.75
201002684-004	874336	16A19	X LARGE	2.05	35.39	37.44
201002684-005	874337	16B16X	X LARGE	2.01	35.82	37.83
201002684-006	874338	16B17	LARGE	1.76	36.54	38.30
201002684-007	874339	16B18	LARGE	1.84	38.26	40.10
201002684-008	874340	16B19	X LARGE	1.72	41.06	42.78
201002684-009	874341	16C16X	X LARGE	1.84	44.11	45.95
201002684-010	874342	16C17	LARGE	1.50	50.95	52.45
201002684-011	874343	16C18	LARGE	1.40	53.97	55.37
201002684-012	874344	16C19	SMALL	1.18	53.99	55.17
201002684-013	874345	16D16X	X LARGE	2.04	52.60	54.64

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201002684-014	874346	16D17	LARGE	1.40	57.99	59.39
201002684-015	874347	16D18	LARGE	1.12	68.45	69.57
201002684-016	874348	16D19	SMALL	1.12	66.67	67.79
201002684-017	874349	16E16X	X LARGE	1.92	40.66	42.58
201002684-018	874350	16E17	LARGE	1.60	45.51	47.11
201002684-019	874351	16E18	X LARGE	1.86	37.80	39.66
201002684-020	874352	16E19	LARGE	1.79	34.64	36.43
201002684-021	874353	16F16X	X LARGE	1.96	34.05	36.01
201002684-022	874354	16F17	SMALL	1.52	51.55	53.07
201002684-023	874355	16F18	LARGE	1.96	35.29	37.25
201002684-024	874356	16F19	LARGE	1.83	34.18	36.01
201002684-025	874357	16G18	LARGE	2.08	35.35	37.43
201002684-026	874358	16G19	LARGE	2.09	34.31	36.40
Team 1 - July 18, 2010 - Section 6						
201002685-001	874359	6A1	NONE	1.34	69.68	71.02
201002685-002	874360	6A2	NONE	1.30	69.16	70.46
201002685-003	874361	6A2X	NONE	1.34	57.37	58.71
201002685-004	874362	6A3	NONE	1.24	59.53	60.77
201002685-005	874363	6B2	NONE	1.20	45.79	46.99
201002685-006	874364	6B2X	NONE	1.24	54.01	55.25
201002685-007	874365	6B3	NONE	0.80	69.70	70.50
201002685-008	874366	6C2	NONE	1.10	55.48	56.58
201002685-009	874367	6C2X	NONE	1.50	59.55	61.05
201002685-010	874368	6C3	NONE	0.78	81.14	81.92
201002685-011	874369	6D2	NONE	0.42	89.74	90.16
201002685-012	874370	6D2X	NONE	1.26	70.81	72.07
201002685-013	874371	6D3	NONE	0.72	59.83	60.55
201002685-014	874372	6E1	NONE	1.20	54.93	56.13
201002685-015	874373	6E2	NONE	1.10	77.06	78.16
201002685-016	874374	6E3	NONE	1.08	76.07	77.15
201002685-017	874375	6F1	NONE	1.18	69.64	70.82
201002685-018	874376	6F3	NONE	1.04	71.35	72.39

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
Team 2 - July 18, 2010 - 5 NORTH SECTION						
201002686-001	874377	5C5	NONE	1.66	70.98	72.64
201002686-002	874378	5C6	NONE	1.40	65.05	66.45
201002686-003	874379	5C6X	NONE	1.44	65.19	66.63
201002686-004	874380	5C7	NONE	1.46	73.36	74.82
201002686-005	874381	5C8	NONE	1.40	63.60	65.00
201002686-006	874382	5C8X	NONE	1.89	72.91	74.80
201002686-007	874383	5D4X	NONE	2.09	47.37	49.46
201002686-008	874384	5D6	NONE	1.18	76.33	77.51
201002686-009	874385	5D6X	NONE	1.24	64.41	65.65
201002686-010	874386	5D7	NONE	1.20	69.87	71.07
201002686-011	874387	5D8	NONE	0.46	92.60	93.06
201002686-012	874388	5E4	NONE	0.36	98.38	98.74
201002686-013	874389	5E4X	NONE	1.00	82.74	83.74
201002686-014	874390	5E5	NONE	0.30	97.47	97.77
201002686-015	874391	5E6	NONE	0.54	93.15	93.69
201002686-016	874392	5E6X	NONE	0.44	94.87	95.31
201002686-017	874393	5E7	NONE	1.20	66.37	67.57
201002686-018	874394	5F4	NONE	0.92	91.57	92.49
201002686-019	874395	5F5	NONE	0.48	96.05	96.53
201002686-020	874396	5F6	NONE	0.40	94.41	94.81
201002686-021	874397	5F6X	NONE	1.74	69.60	71.34
201002686-022	874398	5F7	NONE	0.58	92.20	92.78
201002686-023	874399	5F8	NONE	0.48	92.15	92.63
201002686-024	874400	5F8X	NONE	1.56	68.23	69.79
201002686-025	874401	5G5	NONE	1.52	69.01	70.53
201002686-026	874402	5G6	NONE	1.48	74.55	76.03
201002686-027	874403	5G7	NONE	1.74	72.74	74.48
201002686-028	874404	5G8	NONE	1.76	52.26	54.02
Team 3 - July 18, 2010 - AREA 13 LONGWALL 1 NORTH						
201002687-001	874405	13B24X	TRACE	1.88	35.67	37.55
201002687-002	874406	13C24	SMALL	1.73	36.38	38.11

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201002687-003	874407	13C24X	TRACE	2.03	35.71	37.74
201002687-004	874408	13C25	TRACE	1.72	39.80	41.52
201002687-005	874409	13C26	SMALL	1.64	44.20	45.84
201002687-006	874410	13D24	TRACE	1.62	41.45	43.07
201002687-007	874411	13D24X	SMALL	1.70	37.38	39.08
201002687-008	874412	13D25	SMALL	2.14	38.16	40.30
201002687-009	874413	13D26	TRACE	1.64	40.92	42.56
201002687-010	874414	13E24	TRACE	1.60	37.16	38.76
201002687-011	874415	13E24X	TRACE	1.36	51.40	52.76
201002687-012	874416	13E25	TRACE	1.62	39.54	41.16
201002687-013	874417	13E26	SMALL	1.89	32.42	34.31
201002687-014	874418	13F24	SMALL	1.74	39.96	41.70
201002687-015	874419	13F24X	SMALL	1.40	42.30	43.70
201002687-016	874420	13F25	SMALL	1.71	37.18	38.89
201002687-017	874421	13F26	SMALL	1.94	32.50	34.44
201002687-018	874422	13F27	SMALL	1.88	29.80	31.68
201002687-019	874423	13G24	LARGE	1.80	40.95	42.75
201002687-020	874424	13G25	SMALL	1.59	40.82	42.41
201002687-021	874425	13G26	SMALL	1.90	36.26	38.16
201002687-022	874426	13G27	SMALL	1.66	34.07	35.73
Team 4 - July 18, 2010 - SECTION 17 TG 1 NORTH						
201002741-001	874427	17A10	LARGE	2.00	37.95	39.95
201002741-002	874428	17A11	X LARGE	2.12	39.33	41.45
201002741-003	874429	17A9	LARGE	1.61	38.32	39.93
201002741-004	874430	17B10	X LARGE	2.06	32.33	34.39
201002741-005	874431	17B11	X LARGE	1.54	56.65	58.19
201002741-006	874432	17B9	X LARGE	1.74	35.68	37.42
201002741-007	874433	17C10	LARGE	1.50	48.97	50.47
201002741-008	874434	17C11	LARGE	1.30	53.98	55.28
201002741-009	874435	17C8	LARGE	1.26	53.24	54.50
201002741-010	874436	17C9	LARGE	1.14	59.05	60.19
201002741-011	874437	17D10	X LARGE	1.52	45.11	46.63

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002741-012	874438	17D11	X LARGE	1.32	47.34	48.66
201002741-013	874439	17D8	LARGE	1.49	47.79	49.28
201002741-014	874440	17D9	LARGE	1.50	48.97	50.47
201002741-015	874441	17E10	X LARGE	1.92	43.47	45.39
201002741-016	874442	17E11	X LARGE	1.71	42.64	44.35
201002741-017	874443	17E8	X LARGE	1.74	42.92	44.66
201002741-018	874444	17E9	X LARGE	1.86	39.39	41.25
201002741-019	874445	17F10	X LARGE	1.66	39.90	41.56
201002741-020	874446	17F11	X LARGE	1.87	35.29	37.16
201002741-021	874447	17F8	LARGE	1.54	43.35	44.89
201002741-022	874448	17F9	X LARGE	1.74	37.41	39.15
201002741-023	874449	17G10	SMALL	1.42	47.16	48.58
201002741-024	874450	17G8	X LARGE	1.70	37.84	39.54
201002741-025	874451	17G9	X LARGE	2.04	37.25	39.29
Team 5 - July 18, 2010 - 7 NORTH						
201002742-001	874452	7B33	TRACE	1.42	47.03	48.45
201002742-002	874453	7B34	SMALL	1.45	49.71	51.16
201002742-003	874454	7B35	SMALL	1.46	40.94	42.40
201002742-004	874455	7B35X	SMALL	1.24	57.21	58.45
201002742-005	874456	7B36	SMALL	1.52	45.37	46.89
201002742-006	874457	7B37	SMALL	1.60	39.78	41.38
201002742-007	874458	7C33	SMALL	1.50	47.04	48.54
201002742-008	874459	7C34	SMALL	1.46	38.61	40.07
201002742-009	874460	7C35	TRACE	1.54	39.42	40.96
201002742-010	874461	7C35X	SMALL	1.78	44.22	46.00
201002742-011	874462	7C36	SMALL	1.58	42.26	43.84
201002742-012	874463	7D33	SMALL	1.62	48.06	49.68
201002742-013	874464	7D34	TRACE	1.54	54.36	55.90
201002742-014	874465	7D35	SMALL	1.60	49.84	51.44
201002742-015	874466	7D35X	SMALL	1.32	61.87	63.19
201002742-016	874467	7D36	TRACE	1.54	49.40	50.94
201002742-017	874468	7E33	TRACE	0.98	73.30	74.28

Respectfully Submitted, *Richard L. Wilburn*

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MINE SAFETY AND HEALTH ADMINISTRATION
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ATTN: MARK WESOLOWSKI

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002742-018	874469	7E34	TRACE	1.20	66.42	67.62
201002742-019	874470	7E35	TRACE	1.24	61.93	63.17
201002742-020	874471	7E35X	SMALL	1.88	46.48	48.36
201002742-021	874472	7E36	SMALL	1.47	52.63	54.10
201002742-022	874473	7F33	SMALL	1.80	36.32	38.12
201002742-023	874474	7F34	SMALL	1.82	34.82	36.64
201002742-024	874475	7F35	SMALL	1.84	37.74	39.58
201002742-025	874476	7F36	TRACE	1.67	36.33	38.00
Team 6 - July 18, 2010 - 6 NORTH						
201002743-001	874477	7B13	SMALL	1.34	51.91	53.25
201002743-002	874478	7B14	SMALL	1.36	52.27	53.63
201002743-003	874479	7B15	SMALL	1.40	56.03	57.43
201002743-004	874480	7B16	SMALL	1.34	57.57	58.91
201002743-005	874481	7B17	SMALL	1.34	59.27	60.61
201002743-006	874482	7B18	SMALL	1.68	48.88	50.56
201002743-007	874483	7B19	SMALL	1.50	51.14	52.64
201002743-008	874484	7B20	SMALL	1.48	55.89	57.37
201002743-009	874485	7B20X	X LARGE	1.88	52.22	54.10
201002743-010	874486	7C17	SMALL	1.32	62.34	63.66
201002743-011	874487	7C18	SMALL	1.36	60.94	62.30
201002743-012	874488	7C19	SMALL	1.10	70.73	71.83
201002743-013	874489	7C20	SMALL	1.38	59.04	60.42
201002743-014	874490	7C20X	LARGE	1.78	51.98	53.76
201002743-015	874491	7D17	SMALL	1.44	71.25	72.69
201002743-016	874492	7D18	SMALL	1.43	69.59	71.02
201002743-017	874493	7D19	TRACE	1.22	70.89	72.11
201002743-018	874494	7D20	TRACE	1.20	67.57	68.77
201002743-019	874495	7E18	TRACE	0.88	73.80	74.68
201002743-020	874496	7E19	TRACE	1.14	74.85	75.99
201002743-021	874497	7E20	TRACE	1.26	66.91	68.17
Team 7 - July 18, 2010 - SECTION 8 NORTH MAIN						
201002744-001	874498	8C1	TRACE	1.88	48.18	50.06

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201002744-002	874499	8C1X	TRACE	2.76	45.76	48.52
201002744-003	874500	8C2	SMALL	1.94	34.45	36.39
201002744-004	874501	8D1	SMALL	1.50	57.90	59.40
201002744-005	874502	8D1X	SMALL	1.72	57.10	58.82
201002744-006	874503	8D2	TRACE	1.36	76.27	77.63
201002744-007	874504	8E1	SMALL	1.42	75.51	76.93
201002744-008	874505	8E1X	LARGE	1.34	61.21	62.55
201002744-009	874506	8E2	X LARGE	1.64	66.57	68.21
201002744-010	874507	9A17	LARGE	1.55	48.56	50.11
201002744-011	874508	9B17	SMALL	1.72	42.04	43.76
201002744-012	874509	9C17	LARGE	2.03	39.37	41.40
201002744-013	874510	9D16	SMALL	1.68	44.40	46.08
201002744-014	874511	9D17	SMALL	2.00	42.52	44.52
201002744-015	874512	9E16	SMALL	1.40	55.99	57.39
201002744-016	874513	9F16	LARGE	1.95	48.54	50.49
Team 8 - July 18, 2010 - SECTION 11						
201002745-001	874514	11A1	LARGE	1.89	46.75	48.64
201002745-002	874515	11A2	SMALL	1.57	49.81	51.38
201002745-003	874516	11A2X	SMALL	1.70	47.96	49.66
201002745-004	874517	11A3	SMALL	1.94	41.80	43.74
201002745-005	874518	11A4	SMALL	1.48	44.81	46.29
201002745-006	874519	11B1	LARGE	1.60	48.61	50.21
201002745-007	874520	11B2	SMALL	1.28	56.79	58.07
201002745-008	874521	11B2X	SMALL	1.28	57.02	58.30
201002745-009	874522	11C1	SMALL	1.50	53.51	55.01
201002745-010	874523	11C2	SMALL	1.20	53.75	54.95
201002745-011	874524	11C2X	SMALL	1.14	64.41	65.55
201002745-012	874525	11C3	TRACE	1.26	60.03	61.29
201002745-013	874526	11D1	LARGE	1.16	65.50	66.66
201002745-014	874527	11D2	SMALL	1.08	62.18	63.26
201002745-015	874528	11D2X	TRACE	0.88	74.88	75.76
201002745-016	874529	11D3	SMALL	1.30	65.35	66.65

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002745-017	874530	11E1	SMALL	1.02	70.98	72.00
201002745-018	874531	11E2	TRACE	1.12	68.05	69.17
201002745-019	874532	11E3	TRACE	0.76	82.32	83.08
Team 9 - July 18, 2010 - SECTION 12						
201002746-001	874533	12A4	TRACE	2.03	39.09	41.12
201002746-002	874534	12A5	TRACE	2.07	47.04	49.11
201002746-003	874535	12A6	TRACE	1.40	47.51	48.91
201002746-004	874536	12A6X	SMALL	1.00	71.26	72.26
201002746-005	874537	12A7	TRACE	1.48	43.66	45.14
201002746-006	874538	12A8	TRACE	2.36	45.55	47.91
201002746-007	874539	12B4	TRACE	1.52	40.63	42.15
201002746-008	874540	12B5	TRACE	1.64	37.89	39.53
201002746-009	874541	12B6	SMALL	1.80	45.38	47.18
201002746-010	874542	12B6X	SMALL	1.83	40.20	42.03
201002746-011	874543	12B7	TRACE	1.58	53.76	55.34
201002746-012	874544	12B8	TRACE	1.38	62.24	63.62
201002746-013	874545	12C4	TRACE	1.30	47.46	48.76
201002746-014	874546	12C5	TRACE	0.92	71.90	72.82
201002746-015	874547	12C6	TRACE	1.16	62.69	63.85
201002746-016	874548	12C7	TRACE	1.36	47.97	49.33
201002746-017	874549	12C8	SMALL	1.26	55.93	57.19
201002746-018	874550	12D8	SMALL	1.32	53.34	54.66
Team 10 - July 18, 2010 - TG 1 NORTH						
201002747-001	874551	16A20	LARGE	1.82	38.02	39.84
201002747-002	874552	16A21	X LARGE	2.04	35.52	37.56
201002747-003	874553	16A22	LARGE	2.14	40.73	42.87
201002747-004	874554	16A23	LARGE	1.92	43.54	45.46
201002747-005	874555	16B20	LARGE	1.92	38.66	40.58
201002747-006	874556	16B21	X LARGE	2.04	33.49	35.53
201002747-007	874557	16B22	LARGE	1.64	39.94	41.58
201002747-008	874558	16B23	X LARGE	1.88	40.51	42.39
201002747-009	874559	16C20	LARGE	1.28	51.61	52.89

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002747-010	874560	16C21	LARGE	1.70	44.69	46.39
201002747-011	874561	16C22	LARGE	1.52	46.39	47.91
201002747-012	874562	16C23	LARGE	1.64	41.52	43.16
201002747-013	874563	16D20	SMALL	1.16	62.19	63.35
201002747-014	874564	16D21	SMALL	1.66	50.13	51.79
201002747-015	874565	16D22	SMALL	1.61	52.06	53.67
201002747-016	874566	16D23	LARGE	1.76	44.63	46.39
201002747-017	874567	16E20	X LARGE	1.92	37.41	39.33
201002747-018	874568	16E21	X LARGE	1.86	35.83	37.69
201002747-019	874569	16E22	LARGE	1.74	40.53	42.27
201002747-020	874570	16E23	LARGE	1.72	35.18	36.90
201002747-021	874571	16F20	LARGE	2.43	27.82	30.25
201002747-022	874572	16F21	LARGE	2.00	30.83	32.83
201002747-023	874573	16F22	LARGE	2.00	32.20	34.20
201002747-024	874574	16F23	LARGE	1.94	37.67	39.61
201002747-025	874575	16G20	SMALL	2.17	37.23	39.40
201002747-026	874576	16G21	SMALL	1.91	37.33	39.24
201002747-027	874577	16G22	SMALL	1.96	40.14	42.10
201002747-028	874578	16G23	SMALL	1.59	41.75	43.34
Team 1A - July 18, 2010 - 1 NORTH MAINS						
201002759-001	874579	1A3	NONE	3.31	50.58	53.89
201002759-002	874580	1A3X	NONE	1.78	50.56	52.34
201002759-003	874581	1A4	NONE	1.36	59.25	60.61
201002759-004	874582	1B3	NONE	2.23	58.33	60.56
201002759-005	874583	1B3X	NONE	4.65	56.62	61.27
201002759-006	874584	1B4	NONE	0.50	92.93	93.43
201002759-007	874585	1B5X	NONE	1.88	68.68	70.56
201002759-008	874586	1C3	NONE	0.56	95.26	95.82
201002759-009	874587	1C3X	NONE	1.57	48.40	49.97
201002759-010	874588	1D5	NONE	1.40	70.63	72.03
201002759-011	874589	1E5X	NONE	1.24	76.21	77.45

Team 1 - July 19, 2010 - SECTION 1 NORTH MAINS

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002760-001	874590	1A1	NONE	1.56	50.52	52.08
201002760-002	874591	1A1X	NONE	1.77	41.43	43.20
201002760-003	874592	1A2	NONE	1.60	69.53	71.13
201002760-004	874593	1B1	NONE	1.72	41.93	43.65
201002760-005	874594	1B1X	NONE	1.38	78.35	79.73
201002760-006	874595	1B2	NONE	2.00	37.54	39.54
201002760-007	874596	1C1	NONE	0.26	98.05	98.31
201002760-008	874597	1C1X	NONE	1.76	77.62	79.38
201002760-009	874598	1C2	NONE	0.40	96.65	97.05
201002760-010	874599	1D1	NONE	0.52	92.53	93.05
201002760-011	874600	1D1X	NONE	1.98	52.00	53.98
201002760-012	874601	1D2	NONE	0.38	94.43	94.81
201002760-013	874602	1D3	NONE	0.46	92.03	92.49
201002760-014	874603	1D3X	NONE	0.90	73.02	73.92
201002760-015	874604	1G1	NONE	1.68	71.65	73.33
201002760-016	874605	1G1X	NONE	1.42	64.91	66.33
201002760-017	874606	1H1	NONE	1.10	63.40	64.50
201002760-018	874607	1H1X	NONE	1.46	59.68	61.14
201002760-019	874608	1I1	NONE	1.34	60.83	62.17
Team 2 - July 19, 2010 - 2 SECTION AND 5 SECTION NORTH PARALLEL MAINS						
201002761-001	874609	2C5X	NONE	3.66	79.80	83.46
201002761-002	874610	2D5	NONE	2.30	95.37	97.67
201002761-003	874611	2D5X	NONE	3.79	87.70	91.49
201002761-004	874612	5C2	NONE	1.92	55.36	57.28
201002761-005	874613	5C3	NONE	1.77	48.78	50.55
201002761-006	874614	5C4	NONE	1.60	59.04	60.64
201002761-007	874615	5D1	NONE	2.33	64.74	67.07
201002761-008	874616	5D2	NONE	1.84	73.66	75.50
201002761-009	874617	5D2X	NONE	1.64	73.43	75.07
201002761-010	874618	5D3	NONE	1.04	84.39	85.43
201002761-011	874619	5D4	NONE	1.75	79.89	81.64
201002761-012	874620	5D4X	NONE	2.00	41.60	43.60

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002761-013	874621	5E1	NONE	0.56	90.03	90.59
201002761-014	874622	5E2	NONE	0.28	97.59	97.87
201002761-015	874623	5E2X	NONE	2.04	66.78	68.82
201002761-016	874624	5E3	NONE	1.10	96.56	97.66
201002761-017	874625	5F1	NONE	0.48	91.92	92.40
201002761-018	874626	5F2	NONE	1.56	73.00	74.56
201002761-019	874627	5F3	NONE	0.54	92.59	93.13
201002761-020	874628	5F4X	NONE	2.40	52.35	54.75
201002761-021	874629	5G1	NONE	2.60	60.03	62.63
201002761-022	874630	5G2	NONE	2.17	78.79	80.96
201002761-023	874631	5G3	NONE	2.39	63.37	65.76
201002761-024	874632	5G4	NONE	3.01	50.01	53.02
Team 3 - July 19, 2010 - AREA 13 TG 22						
201002762-001	874633	13B29X	TRACE	2.52	33.73	36.25
201002762-002	874634	13C27	TRACE	2.00	34.79	36.79
201002762-003	874635	13C28	TRACE	2.66	37.01	39.67
201002762-004	874636	13C29	TRACE	2.20	34.43	36.63
201002762-005	874637	13C29X	TRACE	1.88	59.87	61.75
201002762-006	874638	13C30	TRACE	1.94	44.75	46.69
201002762-007	874639	13C31	TRACE	2.10	37.38	39.48
201002762-008	874640	13C32	TRACE	1.70	41.28	42.98
201002762-009	874641	13C33	TRACE	1.88	42.37	44.25
201002762-010	874642	13C34	TRACE	1.90	43.08	44.98
201002762-011	874643	13D27	TRACE	2.32	42.57	44.89
201002762-012	874644	13D28	TRACE	2.26	36.90	39.16
201002762-013	874645	13D29	TRACE	1.84	48.63	50.47
201002762-014	874646	13E27	SMALL	2.38	35.92	38.30
201002762-015	874647	13E28	TRACE	2.29	31.60	33.89
201002762-016	874648	13E29	SMALL	4.29	30.93	35.22
201002762-017	874649	13F28	SMALL	1.90	43.71	45.61
201002762-018	874650	13G28	SMALL	2.20	30.06	32.26

Team 4 - July 19, 2010 - SECTION 17 TG 1 NORTH

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201002764-001	874651	17A4	LARGE	1.62	40.30	41.92
201002764-002	874652	17A5	X LARGE	1.79	43.57	45.36
201002764-003	874653	17A6	LARGE	1.78	39.55	41.33
201002764-004	874654	17A7	LARGE	1.83	40.02	41.85
201002764-005	874655	17A8	LARGE	1.89	40.22	42.11
201002764-006	874656	17B4	LARGE	2.06	38.34	40.40
201002764-007	874657	17B5	X LARGE	1.82	37.35	39.17
201002764-008	874658	17B6	LARGE	1.69	40.66	42.35
201002764-009	874659	17B7	LARGE	1.72	38.65	40.37
201002764-010	874660	17B8	LARGE	1.68	41.59	43.27
201002764-011	874661	17C4	SMALL	1.28	57.84	59.12
201002764-012	874662	17C5	SMALL	1.54	47.97	49.51
201002764-013	874663	17C6	X LARGE	1.26	55.29	56.55
201002764-014	874664	17C7	SMALL	1.32	54.73	56.05
201002764-015	874665	17D4	X LARGE	1.96	45.47	47.43
201002764-016	874666	17D5	X LARGE	1.76	47.93	49.69
201002764-017	874667	17D6	SMALL	1.32	54.37	55.69
201002764-018	874668	17D7	LARGE	1.62	44.07	45.69
201002764-019	874669	17E4	LARGE	1.70	40.99	42.69
201002764-020	874670	17E5	X LARGE	1.38	45.01	46.39
201002764-021	874671	17E6	X LARGE	2.11	36.39	38.50
201002764-022	874672	17E7	LARGE	1.74	41.11	42.85
201002764-023	874673	17F5	X LARGE	1.77	43.65	45.42
201002764-024	874674	17F6	LARGE	1.49	47.57	49.06
201002764-025	874675	17F7	X LARGE	1.96	33.61	35.57
201002764-026	874676	17G4	X LARGE	1.48	48.78	50.26
201002764-027	874677	17G5	X LARGE	1.68	46.44	48.12
201002764-028	874678	17G6	X LARGE	1.76	41.48	43.24
201002764-029	874679	17G7	LARGE	1.66	39.24	40.90
Team 5 - July 19, 2010 - 7 NORTH						
201002777-001	874680	7B27	SMALL	1.14	64.48	65.62
201002777-002	874681	7B28	TRACE	1.10	62.68	63.78

Respectfully Submitted, *Richard L. Wilburn*

STANDARD LABORATORIES, INC.

8451 River King Drive, Freeburg, IL 62243 (618) 539-5836

MINE SAFETY AND HEALTH ADMINISTRATION
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ATTN: MARK WESOLOWSKI

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002777-003	874682	7B29B	TRACE	1.28	57.00	58.28
201002777-004	874683	7B30	SMALL	1.28	62.44	63.72
201002777-005	874684	7B30X	SMALL	1.26	62.06	63.32
201002777-006	874685	7B31A	SMALL	1.48	55.18	56.66
201002777-007	874686	7B31B	SMALL	1.56	51.28	52.84
201002777-008	874687	7B32	TRACE	1.28	50.51	51.79
201002777-009	874688	7C27	TRACE	2.21	63.26	65.47
201002777-010	874689	7C28	TRACE	1.82	58.65	60.47
201002777-011	874690	7C29	SMALL	1.30	62.31	63.61
201002777-012	874691	7C30	SMALL	1.52	56.23	57.75
201002777-013	874692	7C30X	TRACE	1.56	49.27	50.83
201002777-014	874693	7C31	SMALL	1.49	49.28	50.77
201002777-015	874694	7C32	TRACE	1.60	42.08	43.68
201002777-016	874695	7D27	TRACE	1.08	69.75	70.83
201002777-017	874696	7D28	TRACE	0.88	78.10	78.98
201002777-018	874697	7D29	TRACE	1.18	63.92	65.10
201002777-019	874698	7D30	TRACE	1.26	61.24	62.50
201002777-020	874699	7D30X	TRACE	1.10	70.75	71.85
201002777-021	874700	7D31	TRACE	1.22	65.43	66.65
201002777-022	874701	7D32	TRACE	1.58	52.13	53.71
201002777-023	874702	7E27	TRACE	2.34	69.34	71.68
201002777-024	874703	7E28	TRACE	1.79	73.01	74.80
201002777-025	874704	7E29	TRACE	0.98	80.91	81.89
201002777-026	874705	7E30	TRACE	1.30	66.65	67.95
201002777-027	874706	7E30X	SMALL	1.54	52.72	54.26
201002777-028	874707	7E31	SMALL	1.28	65.39	66.67
201002777-029	874708	7E32	SMALL	1.18	66.77	67.95
201002777-030	874709	7F27	TRACE	1.92	41.26	43.18
201002777-031	874710	7F28	SMALL	1.93	41.11	43.04
201002777-032	874711	7F29	SMALL	1.66	45.29	46.95
201002777-033	874712	7F30	TRACE	2.04	52.40	54.44
201002777-034	874713	7F31	SMALL	2.36	44.42	46.78

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201002777-035	874714	7F32	SMALL	1.70	38.45	40.15
Team 6 - July 19, 2010 - 6 NORTH						
201002778-001	874715	7B21	SMALL	1.56	51.93	53.49
201002778-002	874716	7B22	SMALL	1.54	52.25	53.79
201002778-003	874717	7B23	SMALL	1.44	48.77	50.21
201002778-004	874718	7B24	TRACE	1.38	55.52	56.90
201002778-005	874719	7C21	SMALL	1.32	56.21	57.53
201002778-006	874720	7C22	SMALL	1.57	52.10	53.67
201002778-007	874721	7C23	TRACE	1.42	58.26	59.68
201002778-008	874722	7C24	TRACE	1.32	72.14	73.46
201002778-009	874723	7D21	SMALL	1.16	67.06	68.22
201002778-010	874724	7D22	SMALL	1.52	60.13	61.65
201002778-011	874725	7D23	TRACE	1.36	60.22	61.58
201002778-012	874726	7D24	TRACE	1.66	56.14	57.80
201002778-013	874727	7E17	TRACE	1.02	75.61	76.63
201002778-014	874728	7E20X	TRACE	1.66	56.03	57.69
201002778-015	874729	7E21	TRACE	1.28	66.35	67.63
201002778-016	874730	7E22	TRACE	1.24	66.13	67.37
201002778-017	874731	7E23	TRACE	1.30	62.86	64.16
201002778-018	874732	7E24	TRACE	1.30	61.50	62.80
201002778-019	874733	7F17	TRACE	1.56	56.35	57.91
201002778-020	874734	7F18	TRACE	1.49	54.54	56.03
201002778-021	874735	7F19	TRACE	1.96	46.28	48.24
201002778-022	874736	7F20	TRACE	1.66	47.93	49.59
201002778-023	874737	7F21	TRACE	2.04	42.02	44.06
201002778-024	874738	7F22	TRACE	2.07	41.99	44.06
201002778-025	874739	7F23	TRACE	1.94	43.53	45.47
Team 7 - July 19, 2010 - SECTION 8						
201002779-001	874740	8F1	SMALL	1.26	60.20	61.46
201002779-002	874741	8F1X	SMALL	1.32	58.13	59.45
201002779-003	874742	8F2	SMALL	1.46	56.47	57.93
201002779-004	874743	8F3	LARGE	1.69	53.00	54.69

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201002779-005	874744	8F4	X LARGE	1.90	54.44	56.34
201002779-006	874745	8G1	SMALL	1.57	54.55	56.12
201002779-007	874746	8G1X	TRACE	0.98	75.03	76.01
201002779-008	874747	8G2	SMALL	1.06	69.99	71.05
201002779-009	874748	8G3	SMALL	1.24	66.69	67.93
201002779-010	874749	8G4	SMALL	1.50	62.28	63.78
201002779-011	874750	8G6	X LARGE	2.68	44.23	46.91
201002779-012	874751	8G6X	X LARGE	1.70	48.47	50.17
201002779-013	874752	8H1	SMALL	1.46	49.97	51.43
201002779-014	874753	8H1X	LARGE	1.62	47.37	48.99
201002779-015	874754	8H2	LARGE	1.64	46.12	47.76
201002779-016	874755	8H3	X LARGE	1.68	44.10	45.78
201002779-017	874756	8H4	LARGE	1.48	55.00	56.48
201002779-018	874757	8H5	X LARGE	1.88	43.74	45.62
201002779-019	874758	8H6	X LARGE	2.63	41.94	44.57
201002779-020	874759	8H6X	X LARGE	2.26	48.48	50.74
201002779-021	874760	8I1	SMALL	1.56	45.37	46.93
201002779-022	874761	8I2	SMALL	2.04	39.50	41.54
201002779-023	874762	8I3	LARGE	1.71	44.09	45.80
201002779-024	874763	8I5	X LARGE	1.88	49.97	51.85
201002779-025	874764	8I6	X LARGE	2.20	46.72	48.92
Team 8 - July 19, 2010 - HG 22 SECTION 11 DEVELOPMENT SECTION						
201002780-001	874765	11A22	LARGE	3.55	38.24	41.79
201002780-002	874766	11A22X	X LARGE	3.17	32.30	35.47
201002780-003	874767	11A23	LARGE	2.59	36.17	38.76
201002780-004	874768	11A24	LARGE	4.29	36.70	40.99
201002780-005	874769	11A25	LARGE	6.80	40.95	47.75
201002780-006	874770	11A26	LARGE	7.02	46.19	53.21
201002780-007	874771	11A27	X LARGE	6.27	44.16	50.43
201002780-008	874772	11A27X	X LARGE	6.35	53.73	60.08
201002780-009	874773	11A28	LARGE	9.66	46.68	56.34
201002780-010	874774	11A29	X LARGE	10.38	43.34	53.72

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002780-011	874775	11B22	SMALL	2.94	41.29	44.23
201002780-012	874776	11B22X	X LARGE	6.98	39.85	46.83
201002780-013	874777	11B23	SMALL	2.54	41.99	44.53
201002780-014	874778	11B24	LARGE	3.16	44.54	47.70
201002780-015	874779	11B25	LARGE	5.42	44.99	50.41
201002780-016	874780	11B26	LARGE	2.60	56.14	58.74
201002780-017	874781	11B27	LARGE	3.16	56.93	60.09
201002780-018	874782	11B27X	X LARGE	10.01	49.88	59.89
201002780-019	874783	11B28	X LARGE	7.88	46.72	54.60
201002780-020	874784	11B29	X LARGE	5.52	46.67	52.19
201002780-021	874785	11C22	SMALL	2.91	40.32	43.23
201002780-022	874786	11C23	LARGE	6.97	43.57	50.54
201002780-023	874787	11C24	LARGE	8.02	36.26	44.28
201002780-024	874788	11C25	LARGE	7.41	41.32	48.73
201002780-025	874789	11C26	SMALL	19.02	32.00	51.02
201002780-026	874790	11C28	LARGE	16.77	43.88	60.65
201002780-027	874791	11C29	X LARGE	8.56	44.36	52.92
Team 10 - July 19, 2010 - TG 1 NORTH						
201002781-001	874792	16A24	X LARGE	1.92	41.59	43.51
201002781-002	874793	16A25	X LARGE	1.93	43.42	45.35
201002781-003	874794	16A26	LARGE	2.18	43.16	45.34
201002781-004	874795	16A26X	X LARGE	2.49	35.82	38.31
201002781-005	874796	16B24	X LARGE	2.00	36.51	38.51
201002781-006	874797	16B25	LARGE	1.62	39.92	41.54
201002781-007	874798	16B26	X LARGE	1.94	30.77	32.71
201002781-008	874799	16B26X	LARGE	1.90	38.25	40.15
201002781-009	874800	16C24	LARGE	1.52	43.67	45.19
201002781-010	874801	16C25	SMALL	1.34	46.78	48.12
201002781-011	874802	16C26	LARGE	1.52	41.79	43.31
201002781-012	874803	16C26X	LARGE	1.74	35.81	37.55
201002781-013	874804	16D24	SMALL	1.48	51.29	52.77
201002781-014	874805	16D25	SMALL	1.28	56.69	57.97

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002781-015	874806	16D26	SMALL	1.58	53.24	54.82
201002781-016	874807	16D26X	LARGE	1.76	42.51	44.27
201002781-017	874808	16E24	SMALL	1.64	38.29	39.93
201002781-018	874809	16E25	SMALL	2.12	37.01	39.13
201002781-019	874810	16E26	SMALL	1.75	38.27	40.02
201002781-020	874811	16E26X	X LARGE	1.96	37.01	38.97
201002781-021	874812	16F24	SMALL	1.90	35.84	37.74
201002781-022	874813	16F25	LARGE	1.81	35.78	37.59
201002781-023	874814	16F26	SMALL	1.84	40.12	41.96
201002781-024	874815	16F26X	X LARGE	2.10	35.99	38.09
201002781-025	874816	16G24	SMALL	2.34	40.64	42.98
201002781-026	874817	16G25	SMALL	2.02	38.90	40.92
201002781-027	874818	16G26	SMALL	1.48	45.71	47.19
201002781-028	874819	16G27	SMALL	1.60	38.53	40.13
201002781-029	874820	16G28	SMALL	1.74	38.58	40.32
Team 1 - July 20, 2010 - SECTION 7						
201002782-001	874821	7B25	SMALL	1.36	54.93	56.29
201002782-002	874822	7B25X	TRACE	1.30	64.24	65.54
201002782-003	874823	7B26	TRACE	1.06	64.07	65.13
201002782-004	874824	7C25X	SMALL	1.30	64.16	65.46
201002782-005	874825	7D25	TRACE	1.40	64.21	65.61
201002782-006	874826	7D25X	SMALL	1.20	62.40	63.60
201002782-007	874827	7D26A	TRACE	1.41	67.24	68.65
201002782-008	874828	7D26B	TRACE	1.74	79.72	81.46
201002782-009	874829	7E25	SMALL	2.46	57.27	59.73
201002782-010	874830	7E25X	TRACE	1.82	56.99	58.81
201002782-011	874831	7E26	TRACE	1.00	74.52	75.52
201002782-012	874832	7F24	TRACE	1.93	41.77	43.70
201002782-013	874833	7F25	TRACE	1.56	45.81	47.37
201002782-014	874834	7F26	TRACE	1.70	43.10	44.80
Team 2 - July 20, 2010 - SECTION 16						
201002787-001	874835	16A27	LARGE	1.90	43.42	45.32

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201002787-002	874836	16A28	LARGE	1.80	43.64	45.44
201002787-003	874837	16A29	LARGE	1.56	44.49	46.05
201002787-004	874838	16A30	LARGE	1.57	49.42	50.99
201002787-005	874839	16A31	LARGE	1.96	42.96	44.92
201002787-006	874840	16B27	LARGE	1.99	36.89	38.88
201002787-007	874841	16B28	LARGE	1.98	36.57	38.55
201002787-008	874842	16B29	LARGE	1.88	34.75	36.63
201002787-009	874843	16B30	LARGE	1.92	37.24	39.16
201002787-010	874844	16B31	X LARGE	1.68	35.52	37.20
201002787-011	874845	16C27	LARGE	1.54	45.79	47.33
201002787-012	874846	16C28	SMALL	1.36	52.62	53.98
201002787-013	874847	16C29	SMALL	1.52	43.72	45.24
201002787-014	874848	16C30	SMALL	1.42	50.89	52.31
201002787-015	874849	16C31	LARGE	1.63	45.85	47.48
201002787-016	874850	16D27	SMALL	1.64	54.14	55.78
201002787-017	874851	16D28	SMALL	1.48	56.56	58.04
201002787-018	874852	16D29	SMALL	1.52	53.26	54.78
201002787-019	874853	16D30	SMALL	1.54	56.08	57.62
201002787-020	874854	16D31	SMALL	1.46	56.51	57.97
201002787-021	874855	16E27	SMALL	1.81	42.71	44.52
201002787-022	874856	16E28	SMALL	1.84	37.23	39.07
201002787-023	874857	16E29	SMALL	1.76	36.70	38.46
201002787-024	874858	16E30	SMALL	1.50	38.82	40.32
201002787-025	874859	16E31	SMALL	1.88	37.00	38.88
201002787-026	874860	16E32	SMALL	1.72	44.26	45.98
201002787-027	874861	16F27	SMALL	1.91	36.43	38.34
201002787-028	874862	16F28	SMALL	1.94	40.27	42.21
201002787-029	874863	16F29	SMALL	1.95	33.69	35.64
201002787-030	874864	16F30	SMALL	1.80	33.85	35.65
201002787-031	874865	16F31	TRACE	1.68	34.70	36.38
201002787-032	874866	16F32	SMALL	1.78	39.37	41.15
201002787-033	874867	16G30	SMALL	1.75	38.28	40.03

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201002787-034	874868	16G31	SMALL	1.56	38.18	39.74
201002787-035	874869	16G32	SMALL	1.70	38.75	40.45
Teams 3 & 6 - July 20, 2010 - AREAS 15 and 16						
201002788-001	874870	15A7	SMALL	1.82	46.65	48.47
201002788-002	874871	15A8	TRACE	2.14	48.96	51.10
201002788-003	874872	15B5	TRACE	1.44	42.62	44.06
201002788-004	874873	15B6	TRACE	1.30	54.65	55.95
201002788-005	874874	15B7	TRACE	1.32	47.84	49.16
201002788-006	874875	15B8	TRACE	1.38	45.34	46.72
201002788-007	874876	15C5	TRACE	1.34	55.20	56.54
201002788-008	874877	15C6	TRACE	1.38	51.21	52.59
201002788-009	874878	15C7	TRACE	1.25	57.01	58.26
201002788-010	874879	15C8	TRACE	1.68	41.31	42.99
201002788-011	874880	15D5	TRACE	1.36	46.05	47.41
201002788-012	874881	15D6	TRACE	1.36	47.86	49.22
201002788-013	874882	15D7	TRACE	1.39	46.98	48.37
201002788-014	874883	15D8	TRACE	1.69	42.07	43.76
201002788-015	874884	15E5	SMALL	1.46	45.94	47.40
201002788-016	874885	15E6	TRACE	1.36	49.59	50.95
201002788-017	874886	15E7	TRACE	1.36	53.56	54.92
201002788-018	874887	15E8	TRACE	1.34	47.39	48.73
201002788-019	874888	16E33	SMALL	1.56	46.70	48.26
201002788-020	874889	16E34	TRACE	1.68	46.90	48.58
201002788-021	874890	16E35	SMALL	1.66	45.64	47.30
201002788-022	874891	16F33	SMALL	1.62	48.79	50.41
201002788-023	874892	16F34	TRACE	1.60	48.87	50.47
201002788-024	874893	16F35	SMALL	1.44	46.02	47.46
201002788-025	874894	16G33	TRACE	1.72	46.46	48.18
201002788-026	874895	16G34	TRACE	1.64	47.37	49.01
201002788-027	874896	16G35	SMALL	1.60	45.48	47.08
Team 4 - July 20, 2010 - Section 17 TG 1 North						
201002789-001	874897	17A1	LARGE	1.83	40.28	42.11

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201002789-002	874898	17A1X	X LARGE	2.10	44.04	46.14
201002789-003	874899	17A2	X LARGE	1.93	38.53	40.46
201002789-004	874900	17A3	X LARGE	2.04	36.59	38.63
201002789-005	874901	17B1	X LARGE	1.88	43.09	44.97
201002789-006	874902	17B1X	X LARGE	2.24	45.94	48.18
201002789-007	874903	17B2	X LARGE	1.96	37.29	39.25
201002789-008	874904	17B3	X LARGE	1.80	35.46	37.26
201002789-009	874905	17C1	LARGE	1.30	58.90	60.20
201002789-010	874906	17C1X	LARGE	1.04	67.11	68.15
201002789-011	874907	17C2	LARGE	1.24	56.42	57.66
201002789-012	874908	17C3	LARGE	0.88	67.10	67.98
201002789-013	874909	17D1	SMALL	1.38	50.57	51.95
201002789-014	874910	17D1X	SMALL	1.73	51.60	53.33
201002789-015	874911	17D2	LARGE	1.44	55.16	56.60
201002789-016	874912	17D3	LARGE	1.52	52.64	54.16
201002789-017	874913	17E1	SMALL	1.54	50.67	52.21
201002789-018	874914	17E1X	LARGE	1.97	48.87	50.84
201002789-019	874915	17E2	X LARGE	1.44	48.24	49.68
201002789-020	874916	17E3	X LARGE	1.54	45.09	46.63
201002789-021	874917	17F1	LARGE	1.30	48.21	49.51
201002789-022	874918	17F1X	X LARGE	1.72	50.39	52.11
201002789-023	874919	17F2	LARGE	1.58	49.54	51.12
201002789-024	874920	17G1	LARGE	1.52	44.00	45.52
201002789-025	874921	17G2	X LARGE	1.47	47.97	49.44
201002789-026	874922	17G3	X LARGE	1.69	44.65	46.34
Team 5 - July 20, 2010 - SECTION 19						
201002791-001	874923	19A2	LARGE	1.80	33.07	34.87
201002791-002	874924	19A2X	LARGE	2.02	38.43	40.45
201002791-003	874925	19B2	SMALL	1.62	41.14	42.76
201002791-004	874926	19B2X	SMALL	1.68	45.16	46.84
201002791-005	874927	19B3	SMALL	1.48	62.79	64.27
201002791-006	874928	19B3X	SMALL	1.41	59.25	60.66

Respectfully Submitted, *Richard L. Wilburn*

STANDARD LABORATORIES, INC.
8451 River King Drive, Freeburg, IL 62243 (618) 539-5836

MINE SAFETY AND HEALTH ADMINISTRATION
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ATTN: MARK WESOLOWSKI

Date: 11/15/2010 8:43:53 AM

Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002791-007	874929	19C2	LARGE	1.42	55.70	57.12
201002791-008	874930	19C2X	SMALL	1.26	57.84	59.10
201002791-009	874931	19C3	SMALL	1.52	63.45	64.97
201002791-010	874932	19C3X	LARGE	1.90	55.63	57.53
201002791-011	874933	19C4	SMALL	1.66	58.98	60.64
201002791-012	874934	19C4X	LARGE	1.75	49.89	51.64
201002791-013	874935	19D2	SMALL	1.54	51.50	53.04
201002791-014	874936	19D2X	SMALL	1.83	44.25	46.08
201002791-015	874937	19D3	SMALL	1.64	55.06	56.70
201002791-016	874938	19D3X	LARGE	1.74	60.03	61.77
201002791-017	874939	19D4	LARGE	1.98	48.78	50.76
201002791-018	874940	19D4X	X LARGE	2.14	42.01	44.15
201002791-019	874941	19E2	SMALL	1.66	47.45	49.11
201002791-020	874942	19E2X	SMALL	2.76	41.15	43.91
201002791-021	874943	19E4	X LARGE	2.17	48.47	50.64
201002791-022	874944	19F2	SMALL	1.82	44.31	46.13
201002791-023	874945	19F2X	SMALL	1.92	42.10	44.02
Team 6 - July 20, 2010 - SECTION 15						
201002792-001	874946	15B1	TRACE	1.36	54.22	55.58
201002792-002	874947	15B2	TRACE	1.34	52.59	53.93
201002792-003	874948	15B3	TRACE	1.42	52.00	53.42
201002792-004	874949	15B3X	SMALL	1.48	48.63	50.11
201002792-005	874950	15B4	TRACE	1.46	47.89	49.35
201002792-006	874951	15C1	TRACE	1.36	52.18	53.54
201002792-007	874952	15C2	TRACE	1.14	60.25	61.39
201002792-008	874953	15C3	TRACE	1.48	51.66	53.14
201002792-009	874954	15C3X	SMALL	1.66	48.37	50.03
201002792-010	874955	15C4	TRACE	1.48	52.91	54.39
201002792-011	874956	15D1	TRACE	1.53	47.56	49.09
201002792-012	874957	15D2	TRACE	1.54	44.34	45.88
201002792-013	874958	15D3	SMALL	1.66	48.65	50.31
201002792-014	874959	15D3X	SMALL	1.79	50.20	51.99

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002792-015	874960	15D4	TRACE	1.42	49.89	51.31
201002792-016	874961	15E1	SMALL	1.71	42.82	44.53
201002792-017	874962	15E2	SMALL	1.79	43.59	45.38
201002792-018	874963	15E3	SMALL	1.60	42.28	43.88
201002792-019	874964	15E4	TRACE	1.46	49.39	50.85
Team 7 - July 20, 2010 - SECTION 8						
201002793-001	874965	8A6	SMALL	2.24	42.19	44.43
201002793-002	874966	8A6X	SMALL	3.00	54.08	57.08
201002793-003	874967	8B4	SMALL	2.13	38.58	40.71
201002793-004	874968	8B5	X LARGE	2.88	39.01	41.89
201002793-005	874969	8B6	TRACE	2.12	51.26	53.38
201002793-006	874970	8B6X	LARGE	2.83	38.71	41.54
201002793-007	874971	8C3	X LARGE	4.39	34.82	39.21
201002793-008	874972	8C4	LARGE	2.12	43.20	45.32
201002793-009	874973	8C5	X LARGE	2.94	41.28	44.22
201002793-010	874974	8C6	LARGE	2.98	40.85	43.83
201002793-011	874975	8C6X	X LARGE	3.29	35.55	38.84
201002793-012	874976	8D5	LARGE	3.05	44.73	47.78
201002793-013	874977	8D6	X LARGE	2.53	41.63	44.16
201002793-014	874978	8D6X	LARGE	1.88	39.60	41.48
201002793-015	874979	8E3	SMALL	2.37	60.96	63.33
201002793-016	874980	8E4	X LARGE	2.10	54.59	56.69
201002793-017	874981	8E5	LARGE	1.58	70.17	71.75
201002793-018	874982	8E6	X LARGE	1.86	56.28	58.14
201002793-019	874983	8E6X	LARGE	2.11	39.19	41.30
201002793-020	874984	8F5	X LARGE	2.16	54.29	56.45
201002793-021	874985	8F6	X LARGE	2.06	51.27	53.33
201002793-022	874986	8F6X	LARGE	2.02	46.56	48.58
Team 8 - July 20, 2010 - SECTION 11 HG 22 DEVELOPMENT SECTION						
201002795-001	874987	11A10	SMALL	3.42	37.71	41.13
201002795-002	874988	11A11	SMALL	6.96	41.10	48.06
201002795-003	874989	11A13	LARGE	4.01	31.46	35.47

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002795-004	874990	11A15	SMALL	4.13	32.35	36.48
201002795-005	874991	11A17	SMALL	2.52	43.37	45.89
201002795-006	874992	11A17X	LARGE	2.40	37.41	39.81
201002795-007	874993	11A19	SMALL	2.19	39.16	41.35
201002795-008	874994	11A21	SMALL	4.34	39.98	44.32
201002795-009	874995	11B14	SMALL	2.14	33.43	35.57
201002795-010	874996	11B15	SMALL	2.19	34.78	36.97
201002795-011	874997	11B16	SMALL	1.93	45.44	47.37
201002795-012	874998	11B17	SMALL	2.23	39.65	41.88
201002795-013	874999	11B17X	X LARGE	2.56	47.57	50.13
201002795-014	875000	11B18	LARGE	2.34	40.11	42.45
201002795-015	875001	11B19	LARGE	2.28	43.55	45.83
201002795-016	875002	11B20	LARGE	2.35	44.77	47.12
201002795-017	875003	11B21	LARGE	2.36	41.77	44.13
201002795-018	875004	11C14	SMALL	2.60	45.98	48.58
201002795-019	875005	11C15	SMALL	3.53	42.83	46.36
201002795-020	875006	11C16	TRACE	2.88	39.92	42.80
201002795-021	875007	11C17	SMALL	4.03	41.17	45.20
201002795-022	875008	11C18	SMALL	3.29	46.23	49.52
201002795-023	875009	11C19	SMALL	5.89	38.37	44.26
201002795-024	875010	11C20	SMALL	4.68	42.38	47.06
201002795-025	875011	11C21	SMALL	3.04	36.48	39.52
Team 9 - July 20, 2010 - SECTION 11 HG 22						
201002796-001	875012	11A12	SMALL	7.83	31.75	39.58
201002796-002	875013	11A12X	SMALL	2.56	41.48	44.04
201002796-003	875014	11A14	SMALL	2.06	32.21	34.27
201002796-004	875015	11A16	SMALL	1.80	40.91	42.71
201002796-005	875016	11A18	LARGE	2.08	32.34	34.42
201002796-006	875017	11A20	LARGE	2.10	40.68	42.78
201002796-007	875018	11A7X	LARGE	2.00	47.99	49.99
201002796-008	875019	11B10	SMALL	2.55	44.53	47.08
201002796-009	875020	11B3	SMALL	2.04	45.16	47.20

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002796-010	875021	11B6	SMALL	2.12	48.18	50.30
201002796-011	875022	11B7	SMALL	1.32	57.64	58.96
201002796-012	875023	11B7X	SMALL	1.92	49.79	51.71
201002796-013	875024	11B8	SMALL	1.48	48.15	49.63
201002796-014	875025	11B9	SMALL	1.70	50.17	51.87
201002796-015	875026	11C6	TRACE	1.86	47.41	49.27
201002796-016	875027	11C7	TRACE	2.08	50.11	52.19
201002796-017	875028	11C8	TRACE	1.66	45.48	47.14
201002796-018	875029	11C9	TRACE	2.19	44.89	47.08
Team 10 - July 20, 2010 - TG 1 NORTH						
201002797-001	875030	16A32	LARGE	1.52	48.55	50.07
201002797-002	875031	16A33	LARGE	1.64	45.87	47.51
201002797-003	875032	16A34	X LARGE	1.83	45.84	47.67
201002797-004	875033	16A35	LARGE	1.76	42.60	44.36
201002797-005	875034	16B32	LARGE	2.02	44.63	46.65
201002797-006	875035	16B33	SMALL	1.68	47.92	49.60
201002797-007	875036	16B34	LARGE	1.56	46.11	47.67
201002797-008	875037	16B35	LARGE	2.02	44.21	46.23
201002797-009	875038	16C32	SMALL	1.48	49.12	50.60
201002797-010	875039	16C33	TRACE	1.28	52.14	53.42
201002797-011	875040	16C34	SMALL	1.38	51.35	52.73
201002797-012	875041	16C35	SMALL	1.48	50.30	51.78
201002797-013	875042	16D32	SMALL	1.47	45.42	46.89
201002797-014	875043	16D33	SMALL	1.40	52.58	53.98
201002797-015	875044	16D34	SMALL	1.64	52.77	54.41
201002797-016	875045	16D35	LARGE	1.54	49.44	50.98
Team 1 - July 21, 2010 - 4 NORTH SECTION 4						
201002798-001	875046	4A2	NONE	1.16	66.17	67.33
201002798-002	875047	4A3	NONE	0.90	80.10	81.00
201002798-003	875048	4A3X	NONE	0.76	74.69	75.45
201002798-004	875049	4B2	NONE	0.40	91.97	92.37
201002798-005	875050	4B3X	NONE	0.88	73.29	74.17

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002798-006	875051	4C3	NONE	0.74	78.30	79.04
Team 2 - July 21, 2010 - SECTION 2						
201002799-001	875052	2A3X	NONE	2.02	56.01	58.03
201002799-002	875053	2B3	NONE	2.67	68.40	71.07
201002799-003	875054	2B3X	NONE	1.64	58.72	60.36
201002799-004	875055	2C3	NONE	2.55	71.00	73.55
Team 3 - July 21, 2010 - ELLIS PORTAL MAINS AREA 3						
201002800-001	875056	3A1X	NONE	1.65	67.30	68.95
201002800-002	875057	3A2	NONE	1.06	84.06	85.12
201002800-003	875058	3B1	NONE	0.52	95.73	96.25
201002800-004	875059	3B1X	NONE	1.00	69.71	70.71
201002800-005	875060	3B2	NONE	2.22	88.54	90.76
201002800-006	875061	3B3	NONE	3.62	88.41	92.03
201002800-007	875062	3C1	NONE	3.24	52.41	55.65
Team 4 - July 21, 2010 - 4 NORTH						
201002801-001	875063	4B3	NONE	0.86	81.48	82.34
201002801-002	875064	4D3	NONE	1.22	71.60	72.82
Team 5 - July 21, 2010 - SECTION 19						
201002802-001	875065	19A1	LARGE	1.62	47.19	48.81
201002802-002	875066	19A1X	X LARGE	2.16	44.23	46.39
201002802-003	875067	19B1	LARGE	1.94	41.28	43.22
201002802-004	875068	19B1X	X LARGE	1.76	43.86	45.62
201002802-005	875069	19C1	LARGE	1.36	60.69	62.05
201002802-006	875070	19C1X	X LARGE	1.59	50.78	52.37
201002802-007	875071	19D1	X LARGE	1.56	47.23	48.79
201002802-008	875072	19D1X	LARGE	1.82	37.27	39.09
201002802-009	875073	19E1	X LARGE	1.42	51.63	53.05
201002802-010	875074	19E1X	X LARGE	1.96	41.11	43.07
201002802-011	875075	19F1	LARGE	1.65	43.08	44.73
201002802-012	875076	19F1X	X LARGE	2.42	35.48	37.90
Team 6 - July 21, 2010 - SECTION 2						

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Lab No.	Customer ID#1	Customer ID#2	Alcohol Coking	Percent Moisture	Percent Residue	Percent Incombustible
201002803-001	875077	2B2	NONE	4.72	63.63	68.35
201002803-002	875078	2C1X	NONE	3.81	74.99	78.80
201002803-003	875079	2D1X	NONE	5.39	54.83	60.22
201002803-004	875080	2E1	NONE	2.88	62.04	64.92
Team 8 - July 21, 2010 - HG 22 SECTION 11 DEVELOPMENT SECTION						
201002804-001	875081	11A5	SMALL	5.45	33.34	38.79
201002804-002	875082	11A6	SMALL	3.87	43.99	47.86
201002804-003	875083	11A7	SMALL	2.82	32.06	34.88
201002804-004	875084	11A8	SMALL	3.03	34.93	37.96
201002804-005	875085	11A9	SMALL	3.56	35.73	39.29
201002804-006	875086	11B11	SMALL	2.99	39.04	42.03
201002804-007	875087	11B12	SMALL	2.54	44.22	46.76
201002804-008	875088	11B12X	LARGE	3.20	40.14	43.34
201002804-009	875089	11B13	LARGE	2.74	37.82	40.56
201002804-010	875090	11C11	TRACE	3.42	45.21	48.63
201002804-011	875091	11C12	TRACE	2.28	48.34	50.62
201002804-012	875092	11C13	TRACE	3.31	50.07	53.38
Team 9 - July 21, 2010 - SECTION 3 ELLIS PORTAL MAINS						
201002805-001	875093	3A4	NONE	0.88	75.33	76.21
201002805-002	875094	3A5	NONE	1.32	54.60	55.92
201002805-003	875095	3A5X	NONE	1.46	35.79	37.25
201002805-004	875096	3B4	NONE	1.20	91.77	92.97
201002805-005	875097	3B5	NONE	0.58	90.45	91.03
201002805-006	875098	3B5X	NONE	1.64	58.22	59.86
201002805-007	875099	3C4	NONE	1.48	50.34	51.82
201002805-008	875100	3C5	NONE	2.77	53.02	55.79

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11/15/2010

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UBB DUST SAMPLES

	Replicates			QAR RM-4			CaCO3		
Count N			94			94			94
Average	1.55	1.56		5.79	5.87		0.20	0.19	
Average Difference			0.0346			0.1226			0.0272
Max Difference			0.17			0.32			0.08
Min Difference			0.00			0.00			0.00
Repeatabilty STD DEV			0.0303			0.1020			0.0232
Estimated Within Lab REPEATABILTY (Based on first 30)			0.10			0.21			0.06
Within Lab REPEATABILITY (Based on Total Population)			0.08			0.29			0.06

Parameter:
Moisture

			Replicates						QAR RM-4						$CaCO_3$				
N	Sample	Date	Replicate 1	Replicate 2	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared
			A	B	diff.	s	s^2		A	B	diff.	s	s^2		A	B	diff.	s	s^2
1	201002333-002	10/05/2010	1.44	1.50	0.06	0.0424	0.0018	10/05/2010	5.79	5.95	0.16	0.1131	0.0128	10/05/2010	0.20	0.18	0.02	0.0141	0.0002
2	201002333-026	10/05/2010	1.30	1.30	0.00	0.0000	0.0000	10/05/2010	5.79	5.93	0.14	0.0990	0.0098	10/05/2010	0.20	0.22	0.02	0.0141	0.0002
3	201002434-001	10/06/2010	1.12	1.14	0.02	0.0141	0.0002	10/06/2010	5.79	5.85	0.06	0.0424	0.0018	10/06/2010	0.20	0.16	0.04	0.0283	0.0008
4	201002434-015	10/06/2010	1.26	1.24	0.02	0.0141	0.0002	10/06/2010	5.79	5.93	0.14	0.0990	0.0098	10/06/2010	0.20	0.22	0.02	0.0141	0.0002
5	201002438-005	10/07/2010	1.62	1.63	0.01	0.0071	0.0000	10/07/2010	5.79	5.79	0.00	0.0000	0.0000	10/07/2010	0.20	0.22	0.02	0.0141	0.0002
6	201002438-021	10/07/2010	1.65	1.64	0.01	0.0071	0.0001	10/07/2010	5.79	5.82	0.03	0.0212	0.0005	10/07/2010	0.20	0.22	0.02	0.0141	0.0002
7	201002474-005	10/11/2010	2.00	2.17	0.17	0.1202	0.0145	10/11/2010	5.79	5.75	0.04	0.0283	0.0008	10/11/2010	0.20	0.20	0.00	0.0000	0.0000
8	201002475-001	10/11/2010	1.86	1.92	0.06	0.0424	0.0018	10/11/2010	5.79	5.79	0.00	0.0000	0.0000	10/11/2010	0.20	0.20	0.00	0.0000	0.0000
9	201002474-010	10/11/2010	1.16	1.18	0.02	0.0141	0.0002	10/11/2010	5.79	5.75	0.04	0.0283	0.0008	10/11/2010	0.20	0.20	0.00	0.0000	0.0000
10	201002478-009	10/11/2010	1.30	1.26	0.04	0.0283	0.0008	10/11/2010	5.79	5.71	0.08	0.0566	0.0032	10/11/2010	0.20	0.16	0.04	0.0283	0.0008
11	201002479-016	10/12/2010	1.85	1.84	0.01	0.0071	0.0001	10/12/2010	5.79	5.56	0.23	0.1626	0.0264	10/12/2010	0.20	0.18	0.02	0.0141	0.0002
12	201002480-004	10/12/2010	1.88	1.84	0.04	0.0283	0.0008	10/12/2010	5.79	5.78	0.01	0.0071	0.0000	10/12/2010	0.20	0.14	0.06	0.0424	0.0018
13	201002480-018	10/12/2010	1.94	1.92	0.02	0.0141	0.0002	10/12/2010	5.79	5.81	0.02	0.0141	0.0002	10/12/2010	0.20	0.16	0.04	0.0283	0.0008
14	201002481-001	10/12/2010	1.52	1.50	0.02	0.0141	0.0002	10/12/2010	5.79	5.75	0.04	0.0283	0.0008	10/12/2010	0.20	0.20	0.00	0.0000	0.0000
15	201002481-028	10/13/2010	0.96	0.94	0.02	0.0141	0.0002	10/13/2010	5.79	5.79	0.00	0.0000	0.0000	10/13/2010	0.20	0.24	0.04	0.0283	0.0008
16	201002529-003	10/13/2010	1.92	1.90	0.02	0.0141	0.0002	10/13/2010	5.79	5.80	0.01	0.0071	0.0000	10/13/2010	0.20	0.18	0.02	0.0141	0.0002
17	201002529-023	10/13/2010	1.10	1.16	0.06	0.0424	0.0018	10/13/2010	5.79	5.67	0.12	0.0849	0.0072	10/13/2010	0.20	0.20	0.00	0.0000	0.0000
18	201002530-017	10/13/2010	1.40	1.34	0.06	0.0424	0.0018	10/13/2010	5.79	5.68	0.11	0.0778	0.0061	10/13/2010	0.20	0.14	0.06	0.0424	0.0018
19	201002530-039	10/14/2010	1.12	1.16	0.04	0.0283	0.0008	10/14/2010	5.79	5.96	0.17	0.1202	0.0144	10/14/2010	0.20	0.16	0.04	0.0283	0.0008
20	201002531-014	10/14/2010	0.72	0.70	0.02	0.0141	0.0002	10/14/2010	5.79	5.98	0.19	0.1344	0.0181	10/14/2010	0.20	0.18	0.02	0.0141	0.0002
21	201002532-003	10/14/2010	1.52	1.50	0.02	0.0141	0.0002	10/14/2010	5.79	5.66	0.13	0.0919	0.0084	10/14/2010	0.20	0.18	0.02	0.0141	0.0002
22	201002532-035	10/14/2010	1.93	1.88	0.05	0.0354	0.0013	10/14/2010	5.79	5.96	0.17	0.1202	0.0144	10/14/2010	0.20	0.18	0.02	0.0141	0.0002
23	201002566-014	10/15/2010	1.08	1.10	0.02	0.0141	0.0002	10/15/2010	5.79	5.86	0.07	0.0495	0.0025	10/15/2010	0.20	0.24	0.04	0.0283	0.0008
24	201002567-010	10/15/2010	1.40	1.40	0.00	0.0000	0.0000	10/15/2010	5.79	5.87	0.08	0.0566	0.0032	10/15/2010	0.20	0.20	0.00	0.0000	0.0000
25	201002567-021	10/15/2010	1.14	1.12	0.02	0.0141	0.0002	10/15/2010	5.79	5.87	0.08	0.0566	0.0032	10/15/2010	0.20	0.20	0.00	0.0000	0.0000
26	201002568-017	10/15/2010	0.82	0.86	0.04	0.0283	0.0008	10/15/2010	5.79	5.80	0.01	0.0071	0.0000	10/15/2010	0.20	0.22	0.02	0.0141	0.0002
27	201002569-027	10/18/2010	1.82	1.88	0.06	0.0424	0.0018	10/18/2010	5.79	5.61	0.18	0.1273	0.0162	10/18/2010	0.20	0.14	0.06	0.0424	0.0018
28	201002570-018	10/18/2010	1.70	1.80	0.10	0.0707	0.0050	10/18/2010	5.79	5.86	0.07	0.0495	0.0025	10/18/2010	0.20	0.16	0.04	0.0283	0.0008
29	201002570-025	10/18/2010	1.62	1.66	0.04	0.0283	0.0008	10/18/2010	5.79	5.70	0.09	0.0636	0.0040	10/18/2010	0.20	0.14	0.06	0.0424	0.0018
30	201002588-001	10/18/2010	2.60	2.59	0.01	0.0071	0.0001	10/18/2010	5.79	5.87	0.08	0.0566	0.0032	10/18/2010	0.20	0.20	0.00	0.0000	0.0000
31	201002589-014	10/19/2010	1.22	1.24	0.02	0.0141	0.0002	10/19/2010	5.79	5.89	0.10	0.0707	0.0050	10/09/2010	0.20	0.24	0.04	0.0283	0.0008
32	201002590-007	10/19/2010	0.90	0.92	0.02	0.0141	0.0002	10/19/2010	5.79	5.88	0.09	0.0636	0.0040	10/09/2010	0.20	0.22	0.02	0.0141	0.0002
33	201002590-014	10/19/2010	0.68	0.60	0.08	0.0566	0.0032	10/19/2010	5.79	5.84	0.05	0.0354	0.0012	10/09/2010	0.20	0.16	0.04	0.0283	0.0008
34	201002604-003	10/19/2010	1.08	1.10	0.02	0.0141	0.0002	10/19/2010	5.79	5.91	0.12	0.0849	0.0072	10/09/2010	0.20	0.22	0.02	0.0141	0.0002
35	201002609-012	10/20/2010	1.34	1.36	0.02	0.0141	0.0002	10/20/2010	5.79	5.81	0.02	0.0141	0.0002	10/20/2010	0.20	0.22	0.02	0.0141	0.0002
36	201002611-011	10/20/2010	1.53	1.56	0.03	0.0212	0.0005	10/20/2010	5.79	5.86	0.07	0.0495	0.0025	10/20/2010	0.20	0.18	0.02	0.0141	0.0002
37	201002612-012	10/20/2010	1.56	1.58	0.02	0.0141	0.0002	10/20/2010	5.79	5.94	0.15	0.1061	0.0113	10/20/2010	0.20	0.18	0.02	0.0141	0.0002
38	201002613-001	10/20/2010	1.66	1.68	0.02	0.0141	0.0002	10/20/2010	5.79	5.87	0.08	0.0566	0.0032	10/20/2010	0.20	0.20	0.00	0.0000	0.0000
39	201002614-005	10/21/2010	1.82	1.78	0.04	0.0283	0.0008	10/21/2010	5.79	5.81	0.02	0.0141	0.0002	10/21/2010	0.20	0.22	0.02	0.0141	0.0002
40	201002615--006	10/21/2010	2.76	2.81	0.05	0.0354	0.0013	10/21/2010	5.79	5.94	0.15	0.1061	0.0113	10/21/2010	0.20	0.16	0.04	0.0283	0.0008
41	201002615-015	10/21/2010	2.17	2.23	0.06	0.0424	0.0018	10/21/2010	5.79	5.88	0.09	0.0636	0.0040	10/21/2010	0.20	0.16	0.04	0.0283	0.0008
42	201002616-011	10/21/2010	0.98	1.04	0.06	0.0424	0.0018	10/21/2010	5.79	5.80	0.01	0.0071	0.0000	10/21/2010	0.20	0.18	0.02	0.0141	0.0002
43	201002617-015	10/22/2010	1.14	1.16	0.02	0.0141	0.0002	10/22/2010	5.79	5.76	0.03	0.0212	0.0005	10/22/2010	0.20	0.18	0.02	0.0141	0.0002
44	201002620-012	10/22/2010	1.18	1.14	0.04	0.0283	0.0008	10/22/2010	5.79	5.85	0.06	0.0424	0.0018	10/22/2010	0.20	0.18	0.02	0.0141	0.0002
45	201002657-001	10/22/2010	1.54	1.51	0.03	0.0212	0.0005	10/22/2010	5.79	5.90	0.11	0.0778	0.0060	10/22/2010	0.20	0.22	0.02	0.0141	0.0002
46	201002657-015	10/22/2010	0.42	0.38	0.04	0.0283	0.0008	10/22/2010	5.79	5.95	0.16	0.1131	0.0128	10/22/2010	0.20	0.18	0.02	0.0141	0.0002
47	201002658-015	10/25/2010	2.45	2.39	0.06	0.0424	0.0018	10/25/2010	5.79	5.69	0.10	0.0707	0.0050	10/25/2010	0.20	0.22	0.02	0.0141	0.0002
48	201002659-011	10/25/2010	1.60	1.58	0.02	0.0141	0.0002	10/25/2010	5.79	5.59	0.20	0.1414	0.0200	10/25/2010	0.20	0.22	0.02	0.0141	0.0002
49	201002660-004	10/25/2010	1.67	1.72	0.05	0.0354	0.0013	10/25/2010	5.79	5.59	0.20	0.1414	0.0200	10/25/2010	0.20	0.16	0.04	0.0283	0.0008
50	201002660-021	10/25/2010	1.56	1.54	0.02	0.0141	0.0002	10/25/2010	5.79	5.66	0.13	0.0919	0.0084	10/25/2010	0.20	0.18	0.02	0.0141	0.0002
51	201002680-007	10/26/2010	1.06	1.02	0.04	0.0283	0.0008	10/26/2010	5.79	5.72	0.07	0.0495	0.0025	10/26/2010	0.20	0.24	0.04	0.0283	0.0008
52	201002681-022	10/26/2010	1.78	1.82	0.04	0.0283	0.0008	10/26/2010	5.79	5.89	0.10	0.0707	0.0050	10/26/2010	0.20	0.24	0.04	0.0283	0.0008
53	201002682-015	10/26/2010	2.28	2.36	0.08	0.0566	0.0032	10/26/2010	5.79	5.95	0.16	0.1131	0.0128	10/26/2010	0.20	0.18	0.02	0.0141	0.0002
54	201002683-001	10/26/2010	1.84	1.88	0.04	0.0283	0.0008	10/26/2010	5.79	5.98	0.19	0.1344	0.0181	10/26/2010	0.20	0.18	0.02	0.0141	0.0002
55	201002684-010	10/29/2010	1.50	1.55	0.05	0.0354	0.0013	10/29/2010	5.79	6.04	0.25	0.1768	0.0312	10/29/2010	0.20	0.24	0.04	0.0283	0.0008
56	201002684-018	10/29/2010	1.60	1.68	0.08	0.0566	0.0032	10/29/2010	5.79	6.08	0.29	0.2051	0.0420	10/29/2010	0.20	0.24	0.04	0.0283	0.0008
57	201002685-009	10/29/2010	1.50	1.48	0.02	0.0141	0.0002	10/29/2010	5.79	5.95	0.16	0.1131	0.0128	10/29/2010	0.20	0.12	0.08	0.0566	0.0032
58	201002686-010	10/29/2010	1.20	1.20	0.00	0.0000	0.0000	10/29/2010	5.79	5.96	0.17	0.1202	0.0144	10/29/2010	0.20	0.18	0.02	0.0141	0.0002
59	201002686-023	11/01/2010	0.48	0.46	0.02	0.0141	0.0002	11/01/2010	5.79	5.91	0.12	0.0849	0.0072	11/01/2010	0.20	0.16	0.04	0.0283	0.0008
60	201002741-001	11/01/2010	2.00	2.02	0.02	0.0141	0.0002	11/01/2010	5.79	6.00	0.21	0.1485	0.0221	11/01/2010	0.20	0.24	0.04	0.0283	0.0008
61	201002741-016	11/01/2010	1.71	1.70	0.01	0.0071	0.0001	11/01/2010	5.79	6.00	0.21	0.1485	0.0221	11/01/2010	0.20	0.14	0.06	0.0424	0.0018
62	201002742-017	11/01/2010	0.98	0.96	0.02	0.0141	0.0002	11/01/2010	5.79	6.11	0.32	0.2263	0.0512	11/01/2010	0.20	0.24	0.04	0.0283	0.0008
63	201002743-005	11/02/2010	1.34	1.36	0.02	0.0141	0.0002	11/02/2010	5.79	5.95	0.16	0.1131	0.0128	11/02/2010	0.20	0.26	0.06	0.0424	0.0018
64	201002744-001	11/02/2010	1.88	1.89	0.01	0.0071	0.0001	11/02/2010	5.79	5.96	0.17	0.1202	0.0144	11/02/2010	0.20	0.22	0.02	0.0141	0.0002
65	201002745-018	11/02/2010	1.12	1.18	0.06	0.0424	0.0018	11/02/2010	5.79	5.96	0.17	0.1202	0.0144	11/02/2010	0.20	0.22	0.02	0.0141	0.0002
66	201002746-004	11/02/2010	1.00	0.96	0.04	0.0283	0.0008	11/02/2010	5.79	6.03	0.24	0.1697	0.0288	11/02/2010	0.20	0.24	0.04	0.0283	0.0008
67	201002747-013	11/03/2010	1.16	1.18	0.02	0.0141	0.0002	11/03/2010	5.79	5.91	0.12	0.0849	0.0072	11/03/2010	0.20	0.16	0.04	0.0283	0.0008
68	201002759-006	11/03/2010	0.50	0.46	0.04	0.0283	0.0008	11/03/2010	5.79	6.04	0.25	0.1768	0.0312	11/03/2010	0.20	0.18	0.02	0.0141	0.0002
69	201002760-008	11/03/2010	1.76	1.77	0.01	0.0071	0.0001	11/03/2010	5.79	6.00	0.21	0.1485	0.0221	11/03/2010	0.20	0.16	0.04	0.0283	0.0008
70	201002761-002	11/03/2010	2.30	2.25	0.05	0.0354	0.0012	11/03/2010	5.79	6.02	0.23	0.1626	0.0265	11/03/2010	0.20	0.16	0.04	0.0283	0.0008
71	201002762-011	11/04/2010	2.32	2.31	0.01	0.0071	0.0000	11/04/2010	5.79	6.01	0.22	0.1556	0.0242	11/04/2010	0.20	0.22	0.02	0.0141	0.0002
72	201002764-011	11/04/2010	1.28	1.30	0.02	0.0141	0.0002	11/04/2010	5.79	6.01	0.22	0.1556	0.0242	11/04/2010	0.20	0.14	0.06	0.0424	0.0018
73	201002777-004	11/04/2010	1.28	1.30	0.02	0.0141	0.0002	11/04/2010	5.79	5.97	0.18	0.1273	0.0162	11/04/2010	0.20	0.20	0.00	0.0000	0.0000
74	201002777-015	11/04/2010	1.60	1.66	0.06	0.0424	0.0018	11/04/2010	5.79	5.92	0.13	0.0919	0.0084	11/04/2010	0.20	0.16	0.04	0.0283	0.0008
75	201002778-008	11/05/2010	1.32	1.30	0.02	0.0141	0.0002	11/05/2010	5.79	5.90	0.11	0.0778	0.0060	11/05/2010	0.20	0.16	0.04	0.0283	0.0008

11/15/2010

STANDARD LABORATORIES, INC.
8451 River King Drive, Freeburg, Illinois 62243 (618) 539-5836

UBB DUST SAMPLES

	Replicates			QAR RM-4			CaCO3
Count N			94			94	94
Average	1.55	1.56		5.79	5.87		0.20 0.19
Average Difference			0.0346			0.1226	0.0272
Max Difference			0.17			0.32	0.08
Min Difference			0.00			0.00	0.00
Repeatabilty STD DEV			0.0303			0.1020	0.0232
Estimated Within Lab REPEATABILTY (Based on first 30)			0.10			0.21	0.06
Within Lab REPEATABILITY (Based on Total Population)			0.08			0.29	0.06

Parameter:
Moisture

			Replicates						QAR RM-4						$CaCO_3$				
N	Sample	Date	Replicate 1	Replicate 2	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared
			A	B	diff.	s	s^2		A	B	diff.	s	s^2		A	B	diff.	s	s^2
76	201002779-001	11/05/2010	1.26	1.26	0.00	0.0000	0.0000	11/05/2010	5.79	6.01	0.22	0.1556	0.0242	11/05/2010	0.20	0.18	0.02	0.0141	0.0002
77	201002779-013	11/05/2010	1.46	1.42	0.04	0.0283	0.0008	11/05/2010	5.79	6.07	0.28	0.1980	0.0392	11/05/2010	0.20	0.20	0.00	0.0000	0.0000
78	201002780-008	11/05/2010	6.35	6.41	0.06	0.0424	0.0018	11/05/2010	5.79	6.06	0.27	0.1909	0.0365	11/05/2010	0.20	0.24	0.04	0.0283	0.0008
79	201002781-003	11/08/2010	2.18	2.20	0.02	0.0141	0.0002	11/08/2010	5.79	5.93	0.14	0.0990	0.0098	11/08/2010	0.20	0.22	0.02	0.0141	0.0002
80	201002782-002	11/08/2010	1.30	1.30	0.00	0.0000	0.0000	11/08/2010	5.79	5.98	0.19	0.1344	0.0181	11/08/2010	0.20	0.24	0.04	0.0283	0.0008
81	201002787-003	11/08/2010	1.56	1.58	0.02	0.0141	0.0002	11/08/2010	5.79	5.89	0.10	0.0707	0.0050	11/08/2010	0.20	0.20	0.00	0.0000	0.0000
82	201002787-020	11/08/2010	1.46	1.42	0.04	0.0283	0.0008	11/08/2010	5.79	5.90	0.11	0.0778	0.0060	11/08/2010	0.20	0.20	0.00	0.0000	0.0000
83	201002788-008	11/09/2010	1.38	1.38	0.00	0.0000	0.0000	11/09/2010	5.79	5.77	0.02	0.0141	0.0002	11/09/2010	0.20	0.16	0.04	0.0283	0.0008
84	201002789-002	11/09/2010	2.10	2.13	0.03	0.0212	0.0004	11/09/2010	5.79	5.92	0.13	0.0919	0.0084	11/09/2010	0.20	0.20	0.00	0.0000	0.0000
85	201002789-012	11/09/2010	0.83	0.86	0.03	0.0212	0.0005	11/09/2010	5.79	5.83	0.04	0.0283	0.0008	11/09/2010	0.20	0.18	0.02	0.0141	0.0002
86	201002791-006	11/09/2010	1.41	1.48	0.07	0.0495	0.0025	11/09/2010	5.79	5.94	0.15	0.1061	0.0113	11/09/2010	0.20	0.14	0.06	0.0424	0.0018
87	201002792-006	11/10/2010	1.36	1.40	0.04	0.0283	0.0008	11/10/2010	5.79	5.99	0.20	0.1414	0.0200	11/10/2010	0.20	0.22	0.02	0.0141	0.0002
88	201002793-006	11/10/2010	2.83	2.88	0.05	0.0354	0.0012	11/10/2010	5.79	5.96	0.17	0.1202	0.0144	11/10/2010	0.20	0.18	0.02	0.0141	0.0002
89	201002795-007	11/10/2010	2.19	2.20	0.01	0.0071	0.0001	11/10/2010	5.79	5.81	0.02	0.0141	0.0002	11/10/2010	0.20	0.18	0.02	0.0141	0.0002
90	201002796-002	11/10/2010	2.56	2.50	0.06	0.0424	0.0018	11/10/2010	5.79	5.73	0.06	0.0424	0.0018	11/10/2010	0.20	0.14	0.06	0.0424	0.0018
91	201002797-009	11/11/2010	1.48	1.52	0.04	0.0283	0.0008	11/11/2010	5.79	5.69	0.10	0.0707	0.0050	11/11/2010	0.20	0.16	0.04	0.0283	0.0008
92	201002798-006	11/11/2010	0.74	0.70	0.04	0.0283	0.0008	11/11/2010	5.79	5.85	0.06	0.0424	0.0018	11/11/2010	0.20	0.20	0.00	0.0000	0.0000
93	201002802-005	11/11/2010	1.36	1.42	0.06	0.0424	0.0018	11/11/2010	5.79	5.85	0.06	0.0424	0.0018	11/11/2010	0.20	0.18	0.02	0.0141	0.0002
94	201002805-004	11/11/2010	1.20	1.16	0.04	0.0283	0.0008	11/11/2010	5.79	5.84	0.05	0.0354	0.0012	11/11/2010	0.20	0.20	0.00	0.0000	0.0000
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STANDARD LABORATORIES, INC.
8451 River King Drive, Freeburg, Illinois 62243 (618) 539-5836

UBB DUST SAMPLES

	Replicates			QAR RM-4			CaCO3		
Count N			94			94			94
Average	57.92	57.92		12.68	12.72		99.88	99.98	
Average Difference			0.5979			0.0696			0.1036
Max Difference			3.98			0.23			0.22
Min Difference			0.01			0.00			0.00
Repeatabilty STD DEV			0.5937			0.0624			0.0825
Estimated Within Lab REPEATABILTY (Based on first 30)			2.27			0.19			0.23
Within Lab REPEATABILITY (Based on Total Population)			1.66			0.17			0.23

Parameter:
Residue

			Replicates						QAR RM-4						$CaCO_3$				
N	Sample	Date	Replicate 1	Replicate 2	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared
			A	B	diff.	s	s^2		A	B	diff.	s	s^2		A	B	diff.	s	s^2
1	201002333-002	10/05/2010	68.52	69.05	0.53	0.3748	0.1404	10/05/2010	12.68	12.60	0.08	0.0566	0.0032	10/05/2010	99.88	99.84	0.04	0.0283	0.0008
2	201002333-026	10/05/2010	59.59	59.30	0.29	0.2051	0.0421	10/05/2010	12.68	12.71	0.03	0.0212	0.0005	10/05/2010	99.88	99.92	0.04	0.0283	0.0008
3	201002434-001	10/06/2010	73.95	73.76	0.19	0.1344	0.0180	10/06/2010	12.68	12.61	0.07	0.0495	0.0025	10/06/2010	99.88	99.88	0.00	0.0000	0.0000
4	201002434-015	10/06/2010	60.83	60.03	0.80	0.5657	0.3200	10/06/2010	12.68	12.72	0.04	0.0283	0.0008	10/06/2010	99.88	99.88	0.00	0.0000	0.0000
5	201002438-005	10/07/2010	48.75	48.97	0.22	0.1556	0.0242	10/07/2010	12.68	12.59	0.09	0.0636	0.0040	10/07/2010	99.88	99.94	0.06	0.0424	0.0018
6	201002438-021	10/07/2010	51.08	51.60	0.52	0.3677	0.1352	10/07/2010	12.68	12.64	0.04	0.0283	0.0008	10/07/2010	99.88	99.92	0.04	0.0283	0.0008
7	201002474-005	10/11/2010	52.72	53.77	1.05	0.7425	0.5512	10/11/2010	12.68	12.63	0.05	0.0354	0.0012	10/11/2010	99.88	99.98	0.10	0.0707	0.0050
8	201002475-001	10/11/2010	40.55	39.19	1.36	0.9617	0.9248	10/11/2010	12.68	12.81	0.13	0.0919	0.0085	10/11/2010	99.88	100.02	0.14	0.0990	0.0098
9	201002474-010	10/11/2010	61.41	61.50	0.09	0.0636	0.0041	10/11/2010	12.68	12.69	0.01	0.0071	0.0000	10/11/2010	99.88	99.98	0.10	0.0707	0.0050
10	201002478-009	10/11/2010	63.31	63.20	0.11	0.0778	0.0060	10/11/2010	12.68	12.77	0.09	0.0636	0.0040	10/11/2010	99.88	99.98	0.10	0.0707	0.0050
11	201002479-016	10/13/2010	55.20	56.27	1.07	0.7566	0.5725	10/13/2010	12.68	12.64	0.04	0.0283	0.0008	10/13/2010	99.88	100.00	0.12	0.0849	0.0072
12	201002480-004	10/13/2010	40.23	41.22	0.99	0.7000	0.4901	10/13/2010	12.68	12.67	0.01	0.0071	0.0000	10/13/2010	99.88	100.08	0.20	0.1414	0.0200
13	201002480-018	10/13/2010	46.16	46.80	0.64	0.4525	0.2048	10/13/2010	12.68	12.69	0.01	0.0071	0.0000	10/13/2010	99.88	100.02	0.14	0.0990	0.0098
14	201002481-01	10/13/2010	46.32	47.11	0.79	0.5586	0.3120	10/13/2010	12.68	12.71	0.03	0.0212	0.0005	10/13/2010	99.88	99.94	0.06	0.0424	0.0018
15	201002481-028	10/14/2010	60.79	61.19	0.40	0.2828	0.0800	10/14/2010	12.68	12.69	0.01	0.0071	0.0000	10/14/2010	99.88	99.94	0.06	0.0424	0.0018
16	20102529-003	10/14/2010	49.30	50.00	0.70	0.4950	0.2450	10/14/2010	12.68	12.80	0.12	0.0849	0.0072	10/14/2010	99.88	100.02	0.14	0.0990	0.0098
17	201002529-023	10/14/2010	68.65	68.84	0.19	0.1344	0.0180	10/14/2010	12.68	12.72	0.04	0.0283	0.0008	10/14/2010	99.88	99.98	0.10	0.0707	0.0050
18	201002530-017	10/14/2010	61.88	62.90	1.02	0.7212	0.5202	10/14/2010	12.68	12.78	0.10	0.0707	0.0050	10/14/2010	99.88	100.04	0.16	0.1131	0.0128
19	201002530-039	10/15/2010	68.16	67.46	0.70	0.4950	0.2450	10/15/2010	12.68	12.71	0.03	0.0212	0.0005	10/15/2010	99.88	99.96	0.08	0.0566	0.0032
20	201002531-014	10/15/2010	86.13	86.24	0.11	0.0778	0.0060	10/15/2010	12.68	12.81	0.13	0.0919	0.0085	10/15/2010	99.88	100.02	0.14	0.0990	0.0098
21	201002532-003	10/14/2010	58.89	61.44	2.55	1.8031	3.2512	10/15/2010	12.68	12.67	0.01	0.0071	0.0000	10/15/2010	99.88	100.10	0.22	0.1556	0.0242
22	201002532-035	10/14/2010	38.56	39.36	0.80	0.5657	0.3200	10/15/2010	12.68	12.90	0.22	0.1556	0.0242	10/15/2010	99.88	100.02	0.14	0.0990	0.0098
23	201002566-014	10/18/2010	72.46	72.50	0.04	0.0283	0.0008	10/18/2010	12.68	12.57	0.11	0.0778	0.0060	10/18/2010	99.88	100.00	0.12	0.0849	0.0072
24	201002567-010	10/18/2010	49.53	48.32	1.21	0.8556	0.7321	10/18/2010	12.68	12.84	0.16	0.1131	0.0128	10/18/2010	99.88	100.02	0.14	0.0990	0.0098
25	201002567-021	10/18/2010	59.88	60.27	0.39	0.2758	0.0761	10/18/2010	12.68	12.76	0.08	0.0566	0.0032	10/18/2010	99.88	100.00	0.12	0.0849	0.0072
26	201002568-017	10/18/2010	76.74	76.60	0.14	0.0990	0.0098	10/18/2010	12.68	12.79	0.11	0.0778	0.0060	10/18/2010	99.88	99.96	0.08	0.0566	0.0032
27	201002569-027	10/19/2010	45.89	41.91	3.98	2.8143	7.9202	10/19/2010	12.68	12.65	0.03	0.0212	0.0004	10/19/2010	99.88	100.00	0.12	0.0849	0.0072
28	201002570-018	10/19/2010	42.77	43.62	0.85	0.6010	0.3612	10/19/2010	12.68	12.91	0.23	0.1626	0.0265	10/19/2010	99.88	99.98	0.10	0.0707	0.0050
29	201002570-025	10/19/2010	52.86	52.70	0.16	0.1131	0.0128	10/19/2010	12.68	12.66	0.02	0.0141	0.0002	10/19/2010	99.88	100.00	0.12	0.0849	0.0072
30	201002588-001	10/19/2010	43.84	45.89	2.05	1.4496	2.1012	10/19/2010	12.68	12.81	0.13	0.0919	0.0085	10/19/2010	99.88	99.98	0.10	0.0707	0.0050
31	201002589-014	10/20/2010	69.82	70.32	0.50	0.3536	0.1250	10/20/2010	12.68	12.60	0.08	0.0566	0.0032	10/20/2010	99.88	99.98	0.10	0.0707	0.0050
32	201002590-007	10/20/2010	78.37	79.10	0.73	0.5162	0.2665	10/20/2010	12.68	12.80	0.12	0.0849	0.0072	10/20/2010	99.88	99.94	0.06	0.0424	0.0018
33	201002590-014	10/20/2010	84.46	85.25	0.79	0.5586	0.3121	10/20/2010	12.68	12.78	0.10	0.0707	0.0050	10/20/2010	99.88	99.98	0.10	0.0707	0.0050
34	201002604-003	10/20/2010	74.08	73.36	0.72	0.5091	0.2592	10/20/2010	12.68	12.87	0.19	0.1344	0.0181	10/20/2010	99.88	100.04	0.16	0.1131	0.0128
35	201002609-012	10/21/2010	53.47	53.18	0.29	0.2051	0.0420	10/21/2010	12.68	12.64	0.04	0.0283	0.0008	10/21/2010	99.88	99.92	0.04	0.0283	0.0008
36	201002611-011	10/21/2010	52.93	53.51	0.58	0.4101	0.1682	10/21/2010	12.68	12.82	0.14	0.0990	0.0098	10/21/2010	99.88	99.96	0.08	0.0566	0.0032
37	201002612-012	10/21/2010	39.30	37.31	1.99	1.4071	1.9801	10/21/2010	12.68	12.70	0.02	0.0141	0.0002	10/21/2010	99.88	100.06	0.18	0.1273	0.0162
38	201002613-001	10/21/2010	50.87	50.31	0.56	0.3960	0.1568	10/21/2010	12.68	12.73	0.05	0.0354	0.0013	10/21/2010	99.88	100.02	0.14	0.0990	0.0098
39	201002614-005	10/22/2010	43.87	43.82	0.05	0.0354	0.0012	10/22/2010	12.68	12.71	0.03	0.0212	0.0005	10/22/2010	99.88	99.92	0.04	0.0283	0.0008
40	201002615--006	10/22/2010	43.61	43.56	0.05	0.0354	0.0012	10/22/2010	12.68	12.69	0.01	0.0071	0.0000	10/22/2010	99.88	100.00	0.12	0.0849	0.0072
41	201002615-015	10/22/2010	45.98	46.27	0.29	0.2051	0.0421	10/22/2010	12.68	12.72	0.04	0.0283	0.0008	10/22/2010	99.88	100.00	0.12	0.0849	0.0072
42	201002616-011	10/22/2010	65.53	65.36	0.17	0.1202	0.0145	10/22/2010	12.68	12.85	0.17	0.1202	0.0144	10/22/2010	99.88	100.06	0.18	0.1273	0.0162
43	201002617-015	10/25/2010	66.46	66.94	0.48	0.3394	0.1152	10/25/2010	12.68	12.77	0.09	0.0636	0.0040	10/25/2010	99.88	100.00	0.12	0.0849	0.0072
44	201002620-012	10/25/2010	69.55	68.14	1.41	0.9970	0.9940	10/25/2010	12.68	12.89	0.21	0.1485	0.0220	10/25/2010	99.88	100.02	0.14	0.0990	0.0098
45	201002657-001	10/25/2010	65.71	65.36	0.35	0.2475	0.0612	10/25/2010	12.68	12.81	0.13	0.0919	0.0085	10/25/2010	99.88	100.00	0.12	0.0849	0.0072
46	201002657-015	10/25/2010	96.45	96.53	0.08	0.0566	0.0032	10/25/2010	12.68	12.86	0.18	0.1273	0.0162	10/25/2010	99.88	100.08	0.20	0.1414	0.0200
47	201002658-015	10/26/2010	37.22	37.95	0.73	0.5162	0.2665	10/26/2010	12.68	12.73	0.05	0.0354	0.0013	10/26/2010	99.88	99.96	0.08	0.0566	0.0032
48	201002659-011	10/26/2010	43.65	44.24	0.59	0.4172	0.1741	10/26/2010	12.68	12.84	0.16	0.1131	0.0128	10/26/2010	99.88	99.98	0.10	0.0707	0.0050
49	201002660-004	10/26/2010	37.15	37.07	0.08	0.0566	0.0032	10/26/2010	12.68	12.76	0.08	0.0566	0.0032	10/26/2010	99.88	100.10	0.22	0.1556	0.0242
50	201002660-021	10/26/2010	45.10	45.53	0.43	0.3041	0.0925	10/26/2010	12.68	12.74	0.06	0.0424	0.0018	10/26/2010	99.88	100.06	0.18	0.1273	0.0162
51	201002680-007	10/29/2010	70.63	70.54	0.09	0.0636	0.0040	10/29/2010	12.68	12.61	0.07	0.0495	0.0025	10/29/2010	99.88	99.84	0.04	0.0283	0.0008
52	201002681-022	10/29/2010	48.13	47.63	0.50	0.3536	0.1250	10/29/2010	12.68	12.61	0.07	0.0495	0.0025	10/29/2010	99.88	99.94	0.06	0.0424	0.0018
53	201002682-015	10/29/2010	43.17	42.18	0.99	0.7000	0.4901	10/29/2010	12.68	12.60	0.08	0.0566	0.0032	10/29/2010	99.88	99.92	0.04	0.0283	0.0008
54	201002683-001	10/29/2010	44.41	44.74	0.33	0.2333	0.0544	10/29/2010	12.68	12.69	0.01	0.0071	0.0000	10/29/2010	99.88	99.88	0.00	0.0000	0.0000
55	201002684-010	11/01/2010	50.95	50.10	0.85	0.6010	0.3612	11/01/2010	12.68	12.60	0.08	0.0566	0.0032	11/01/2010	99.88	99.92	0.04	0.0283	0.0008
56	201002684-018	11/01/2010	45.51	44.40	1.11	0.7849	0.6161	11/01/2010	12.68	12.66	0.02	0.0141	0.0002	11/01/2010	99.88	100.00	0.12	0.0849	0.0072
57	201002685-009	11/01/2010	59.55	59.10	0.45	0.3182	0.1012	11/01/2010	12.68	12.70	0.02	0.0141	0.0002	11/01/2010	99.88	100.10	0.22	0.1556	0.0242
58	201002686-010	11/01/2010	69.87	69.03	0.84	0.5940	0.3528	11/01/2010	12.68	12.74	0.06	0.0424	0.0018	11/01/2010	99.88	100.02	0.14	0.0990	0.0098
59	201002686-023	11/02/2010	92.15	92.92	0.77	0.5445	0.2965	11/02/2010	12.68	12.59	0.09	0.0636	0.0040	11/02/2010	99.88	99.94	0.06	0.0424	0.0018
60	201002741-001	11/02/2010	37.95	38.64	0.69	0.4879	0.2381	11/02/2010	12.68	12.74	0.06	0.0424	0.0018	11/02/2010	99.88	99.94	0.06	0.0424	0.0018
61	201002741-016	11/02/2010	42.64	42.54	0.10	0.0707	0.0050	11/02/2010	12.68	12.68	0.00	0.0000	0.0000	11/02/2010	99.88	100.00	0.12	0.0849	0.0072
62	201002742-017	11/02/2010	73.30	73.40	0.10	0.0707	0.0050	11/02/2010	12.68	12.73	0.05	0.0354	0.0013	11/02/2010	99.88	100.02	0.14	0.0990	0.0098
63	201002743-005	11/03/2010	59.27	57.78	1.49	1.0536	1.1100	11/03/2010	12.68	12.68	0.00	0.0000	0.0000	11/03/2010	99.88	99.96	0.08	0.0566	0.0032
64	201002744-001	11/03/2010	48.18	47.59	0.59	0.4172	0.1740	11/03/2010	12.68	12.73	0.05	0.0354	0.0013	11/03/2010	99.88	99.96	0.08	0.0566	0.0032
65	201002745-018	11/03/2010	68.05	67.28	0.77	0.5445	0.2965	11/03/2010	12.68	12.68	0.00	0.0000	0.0000	11/03/2010	99.88	100.02	0.14	0.0990	0.0098
66	201002746-004	11/03/2010	71.26	71.43	0.17	0.1202	0.0145	11/03/2010	12.68	12.84	0.16	0.1131	0.0128	11/03/2010	99.88	100.06	0.18	0.1273	0.0162
67	201002747-013	11/04/2010	62.19	62.38	0.19	0.1344	0.0181	11/04/2010	12.68	12.60	0.08	0.0566	0.0032	11/04/2010	99.88	99.96	0.08	0.0566	0.0032
68	201002759-006	11/04/2010	92.93	93.14	0.21	0.1485	0.0220	11/04/2010	12.68	12.77	0.09	0.0636	0.0040	11/04/2010	99.88	100.02	0.14	0.0990	0.0098
69	201002760-008	11/04/2010	77.62	77.68	0.06	0.0424	0.0018	11/04/2010	12.68	12.72	0.04	0.0283	0.0008	11/04/2010	99.88	100.06	0.18	0.1273	0.0162
70	201002761-002	11/04/2010	95.37	95.54	0.17	0.1202	0.0145	11/04/2010	12.68	12.75	0.07	0.0495	0.0025	11/04/2010	99.88	99.96	0.08	0.0566	0.0032
71	201002762-011	11/05/2010	42.57	42.25	0.32	0.2263	0.0512	11/05/2010	12.68	12.65	0.03	0.0212	0.0004	11/05/2010	99.88	99.90	0.02	0.0141	0.0002
72	201002764-011	11/05/2010	57.84	57.91	0.07	0.0495	0.0024	11/05/2010	12.68	12.70	0.02	0.0141	0.0002	11/05/2010	99.88	100.00	0.12	0.0849	0.0072
73	201002777-004	11/05/2010	62.44	61.75	0.69	0.4879	0.2380	11/05/2010	12.68	12.65	0.03	0.0212	0.0004	11/05/2010	99.88	99.98	0.10	0.0707	0.0050
74	201002777-015	11/05/2010	42.08	43.58	1.50	1.0607	1.1250	11/05/2010	12.68	12.69	0.01	0.0071	0.0000	11/05/2010	99.88	100.04	0.16	0.1131	0.0128
75	201002778-006	11/08/2010	72.14	72.85	0.71	0.5020	0.2520	11/08/2010	12.68	12.66	0.02	0.0141	0.0002	11/08/2010	99.88	99.92	0.04	0.0283	0.0008

STANDARD LABORATORIES, INC.
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UBB DUST SAMPLES

Count N			94			94			94
Average	57.92	57.92		12.68	12.72		99.88	99.98	
Average Difference			0.5979			0.0696			0.1036
Max Difference			3.98			0.23			0.22
Min Difference			0.01			0.00			0.00
Repeatablity STD DEV			0.5937			0.0624			0.0825
Estimated Within Lab REPEATABILTY (Based on first 30)			2.27			0.19			0.23
Within Lab REPEATABILITY (Based on Total Population)			1.66			0.17			0.23

Parameter:

Residue

			Replicates						QAR RM-4						$CaCO_3$				
N	Sample	Date	Replicate 1	Replicate 2	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared
			A	B	diff.	s	s^2		A	B	diff.	s	s^2		A	B	diff.	s	s^2
76	201002779-001	11/08/2010	60.20	60.47	0.27	0.1909	0.0364	11/08/2010	12.68	12.74	0.06	0.0424	0.0018	11/08/2010	99.88	100.00	0.12	0.0849	0.0072
77	201002779-013	11/08/2010	49.97	50.00	0.03	0.0212	0.0005	11/08/2010	12.68	12.74	0.06	0.0424	0.0018	11/08/2010	99.88	100.04	0.16	0.1131	0.0128
78	201002780-008	11/08/2010	53.73	52.62	1.11	0.7849	0.6161	11/08/2010	12.68	12.78	0.10	0.0707	0.0050	11/08/2010	99.88	100.00	0.12	0.0849	0.0072
79	201002781-003	11/09/2010	43.16	43.32	0.16	0.1131	0.0128	11/09/2010	12.68	12.60	0.08	0.0566	0.0032	11/09/2010	99.88	99.96	0.08	0.0566	0.0032
80	201002782-002	11/09/2010	64.24	64.23	0.01	0.0071	0.0000	11/09/2010	12.68	12.65	0.03	0.0212	0.0004	11/09/2010	99.88	99.94	0.06	0.0424	0.0018
81	201002787-003	11/09/2010	44.49	43.65	0.84	0.5940	0.3528	11/09/2010	12.68	12.71	0.03	0.0212	0.0005	11/09/2010	99.88	99.88	0.00	0.0000	0.0000
82	201002787-020	11/09/2010	56.51	56.73	0.22	0.1556	0.0242	11/09/2010	12.68	12.72	0.04	0.0283	0.0008	11/09/2010	99.88	99.98	0.10	0.0707	0.0050
83	201002788-008	11/10/2010	51.21	51.66	0.45	0.3182	0.1012	11/10/2010	12.68	12.67	0.01	0.0071	0.0000	11/10/2010	99.88	99.92	0.04	0.0283	0.0008
84	201002789-002	11/10/2010	44.04	44.28	0.24	0.1697	0.0288	11/10/2010	12.68	12.73	0.05	0.0354	0.0013	11/10/2010	99.88	99.94	0.06	0.0424	0.0018
85	201002789-012	11/10/2010	67.10	67.83	0.73	0.5162	0.2664	11/10/2010	12.68	12.73	0.05	0.0354	0.0013	11/10/2010	99.88	99.92	0.04	0.0283	0.0008
86	201002791-006	11/10/2010	59.25	59.85	0.60	0.4243	0.1800	11/10/2010	12.68	12.70	0.02	0.0141	0.0002	11/10/2010	99.88	100.00	0.12	0.0849	0.0072
87	201002792-006	11/11/2010	52.18	51.56	0.62	0.4384	0.1922	11/11/2010	12.68	12.64	0.04	0.0283	0.0008	11/11/2010	99.88	99.88	0.00	0.0000	0.0000
88	201002793-006	11/11/2010	38.71	38.77	0.06	0.0424	0.0018	11/11/2010	12.68	12.73	0.05	0.0354	0.0013	11/11/2010	99.88	100.02	0.14	0.0990	0.0098
89	201002795-007	11/11/2010	39.16	38.50	0.66	0.4667	0.2178	11/11/2010	12.68	12.74	0.06	0.0424	0.0018	11/11/2010	99.88	100.04	0.16	0.1131	0.0128
90	201002796-002	11/11/2010	41.48	42.06	0.58	0.4101	0.1682	11/11/2010	12.68	12.89	0.21	0.1485	0.0220	11/11/2010	99.88	100.06	0.18	0.1273	0.0162
91	201002797-009	11/12/2010	49.12	49.15	0.03	0.0212	0.0005	11/12/2010	12.68	12.64	0.04	0.0283	0.0008	11/12/2010	99.88	99.92	0.04	0.0283	0.0008
92	201002798-006	11/12/2010	78.30	78.25	0.05	0.0354	0.0012	11/12/2010	12.68	12.75	0.07	0.0495	0.0025	11/12/2010	99.88	99.92	0.04	0.0283	0.0008
93	201002802-005	11/12/2010	60.69	60.13	0.56	0.3960	0.1568	11/12/2010	12.68	12.70	0.02	0.0141	0.0002	11/12/2010	99.88	100.02	0.14	0.0990	0.0098
94	201002805-004	11/12/2010	91.77	91.36	0.41	0.2899	0.0840	11/12/2010	12.68	12.79	0.11	0.0778	0.0060	11/12/2010	99.88	100.02	0.14	0.0990	0.0098
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UBB DUST SAMPLES

	Replicates			QAR RM-4			CaCO3		
Count N			94			94			94
Average	59.37	59.41		18.47	18.59		100.10	100.17	
Average Difference			0.5628			0.1553			0.0794
Max Difference			3.92			0.41			0.20
Min Difference			0.00			0.01			0.00
Repeatabilty STD DEV			0.5791			0.1307			0.0646
Estimated Within Lab REPEATABILTY (Based on first 30)			2.25			0.32			0.17
Within Lab REPEATABILITY (Based on Total Population)			1.62			0.37			0.18

Parameter:

Incombustible

			Replicates						QAR RM-4						CaCO$_3$				
N	Sample	Date	Replicate 1	Replicate 2	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared
			A	B	diff.	s	s^2		A	B	diff.	s	s^2		A	B	diff.	s	s^2
1	201002333-002	10/05/2010	69.96	70.55	0.59	0.4172	0.1740	10/05/2010	18.47	18.55	0.08	0.0566	0.0032	10/05/2010	100.10	100.02	0.08	0.0566	0.0032
2	201002333-026	10/05/2010	60.89	60.60	0.29	0.2051	0.0420	10/05/2010	18.47	18.64	0.17	0.1202	0.0145	10/05/2010	100.10	100.14	0.04	0.0283	0.0008
3	201002434-001	10/06/2010	75.07	74.90	0.17	0.1202	0.0144	10/06/2010	18.47	18.46	0.01	0.0071	0.0000	10/06/2010	100.10	100.04	0.06	0.0424	0.0018
4	201002434-015	10/06/2010	62.09	61.27	0.82	0.5798	0.3362	10/06/2010	18.47	18.65	0.18	0.1273	0.0162	10/06/2010	100.10	100.10	0.00	0.0000	0.0000
5	201002438-005	10/07/2010	50.37	50.60	0.23	0.1626	0.0265	10/06/2010	18.47	18.38	0.09	0.0636	0.0040	10/06/2010	100.10	100.16	0.06	0.0424	0.0018
6	201002438-021	10/07/2010	52.73	53.24	0.51	0.3606	0.1300	10/06/2010	18.47	18.46	0.01	0.0071	0.0000	10/06/2010	100.10	100.14	0.04	0.0283	0.0008
7	201002474-005	10/11/2010	54.72	55.94	1.22	0.8627	0.7442	10/11/2010	18.47	18.38	0.09	0.0636	0.0040	10/11/2010	100.10	100.18	0.08	0.0566	0.0032
8	201002475-001	10/11/2010	42.41	41.11	1.30	0.9192	0.8450	10/11/2010	18.47	18.60	0.13	0.0919	0.0085	10/11/2010	100.10	100.22	0.12	0.0849	0.0072
9	201002474-010	10/11/2010	62.57	62.68	0.11	0.0778	0.0060	10/11/2010	18.47	18.44	0.03	0.0212	0.0004	10/11/2010	100.10	100.18	0.08	0.0566	0.0032
10	201002478-009	10/11/2010	64.61	64.46	0.15	0.1061	0.0113	10/11/2010	18.47	18.48	0.01	0.0071	0.0001	10/11/2010	100.10	100.14	0.04	0.0283	0.0008
11	201002479-016	10/12/2010	57.05	58.11	1.06	0.7495	0.5618	10/12/2010	18.47	18.20	0.27	0.1909	0.0364	10/12/2010	100.10	100.18	0.08	0.0566	0.0032
12	201002480-004	10/12/2010	42.11	43.06	0.95	0.6718	0.4513	10/12/2010	18.47	18.45	0.02	0.0141	0.0002	10/12/2010	100.10	100.22	0.12	0.0849	0.0072
13	201002480-018	10/12/2010	48.10	48.72	0.62	0.4384	0.1922	10/12/2010	18.47	18.50	0.03	0.0212	0.0005	10/12/2010	100.10	100.18	0.08	0.0566	0.0032
14	201002481-001	10/12/2010	47.84	48.61	0.77	0.5445	0.2964	10/12/2010	18.47	18.46	0.01	0.0071	0.0000	10/12/2010	100.10	100.14	0.04	0.0283	0.0008
15	201002481-028	10/14/2010	61.75	62.13	0.38	0.2687	0.0722	10/14/2010	18.47	18.48	0.01	0.0071	0.0001	10/14/2010	100.10	100.18	0.08	0.0566	0.0032
16	201002529-003	10/14/2010	51.22	51.90	0.68	0.4808	0.2312	10/14/2010	18.47	18.60	0.13	0.0919	0.0085	10/14/2010	100.10	100.20	0.10	0.0707	0.0050
17	201002529-023	10/14/2010	69.75	70.00	0.25	0.1768	0.0313	10/14/2010	18.47	18.39	0.08	0.0566	0.0032	10/14/2010	100.10	100.18	0.08	0.0566	0.0032
18	201002530-017	10/14/2010	63.08	64.24	1.16	0.8202	0.6728	10/14/2010	18.47	18.46	0.01	0.0071	0.0000	10/14/2010	100.10	100.18	0.08	0.0566	0.0032
19	201002530-039	10/15/2010	69.28	68.62	0.66	0.4667	0.2178	10/15/2010	18.47	18.37	0.10	0.0707	0.0050	10/15/2010	100.10	100.14	0.04	0.0283	0.0008
20	201002531-014	10/15/2010	86.85	86.96	0.11	0.0778	0.0060	10/15/2010	18.47	18.77	0.30	0.2121	0.0450	10/15/2010	100.10	100.20	0.10	0.0707	0.0050
21	201002532-003	10/15/2010	60.51	62.94	2.43	1.7183	2.9525	10/15/2010	18.47	18.63	0.16	0.1131	0.0128	10/15/2010	100.10	100.26	0.16	0.1131	0.0128
22	201002532-035	10/15/2010	40.49	41.24	0.75	0.5303	0.2813	10/15/2010	18.47	18.88	0.41	0.2899	0.0841	10/15/2010	100.10	100.20	0.10	0.0707	0.0050
23	201002566-014	10/18/2010	73.54	73.60	0.06	0.0424	0.0018	10/18/2010	18.47	18.43	0.04	0.0283	0.0008	10/18/2010	100.10	100.24	0.14	0.0990	0.0098
24	201002567-010	10/18/2010	50.93	49.72	1.21	0.8556	0.7320	10/18/2010	18.47	18.71	0.24	0.1697	0.0288	10/18/2010	100.10	100.22	0.12	0.0849	0.0072
25	201002567-021	10/18/2010	61.02	61.39	0.37	0.2616	0.0685	10/18/2010	18.47	18.63	0.16	0.1131	0.0128	10/18/2010	100.10	100.20	0.10	0.0707	0.0050
26	201002568-017	10/18/2010	77.56	77.46	0.10	0.0707	0.0050	10/18/2010	18.47	18.59	0.12	0.0849	0.0072	10/18/2010	100.10	100.18	0.08	0.0566	0.0032
27	201002569-027	10/19/2010	47.71	43.79	3.92	2.7719	7.6832	10/19/2010	18.47	18.26	0.21	0.1485	0.0220	10/19/2010	100.10	100.14	0.04	0.0283	0.0008
28	201002570-018	10/19/2010	44.47	45.42	0.95	0.6718	0.4513	10/19/2010	18.47	18.77	0.30	0.2121	0.0450	10/19/2010	100.10	100.14	0.04	0.0283	0.0008
29	201002570-025	10/19/2010	52.86	52.70	0.16	0.1131	0.0128	10/19/2010	18.47	18.36	0.11	0.0778	0.0060	10/19/2010	100.10	100.14	0.04	0.0283	0.0008
30	201002588-001	10/19/2010	43.84	45.89	2.05	1.4496	2.1012	10/19/2010	18.47	18.68	0.21	0.1485	0.0220	10/19/2010	100.10	100.18	0.08	0.0566	0.0032
31	201002589-014	10/20/2010	71.04	71.56	0.52	0.3677	0.1352	10/20/2010	18.47	18.49	0.02	0.0141	0.0002	10/20/2010	100.10	100.22	0.12	0.0849	0.0072
32	201002590-007	10/20/2010	79.27	80.02	0.75	0.5303	0.2813	10/20/2010	18.47	18.68	0.21	0.1485	0.0220	10/20/2010	100.10	100.16	0.06	0.0424	0.0018
33	201002590-014	10/20/2010	85.14	85.85	0.71	0.5020	0.2520	10/20/2010	18.47	18.62	0.15	0.1061	0.0113	10/20/2010	100.10	100.14	0.04	0.0283	0.0008
34	201002604-003	10/20/2010	75.16	74.46	0.70	0.4950	0.2450	10/20/2010	18.47	18.78	0.31	0.2192	0.0480	10/20/2010	100.10	100.26	0.16	0.1131	0.0128
35	201002609-012	10/21/2010	54.81	54.54	0.27	0.1909	0.0365	10/21/2010	18.47	18.45	0.02	0.0141	0.0002	10/21/2010	100.10	100.14	0.04	0.0283	0.0008
36	201002611-011	10/21/2010	54.46	55.07	0.61	0.4313	0.1860	10/21/2010	18.47	18.68	0.21	0.1485	0.0220	10/21/2010	100.10	100.14	0.04	0.0283	0.0008
37	201002612-012	10/21/2010	40.86	38.89	1.97	1.3930	1.9405	10/21/2010	18.47	18.64	0.17	0.1202	0.0145	10/21/2010	100.10	100.24	0.14	0.0990	0.0098
38	201002613-001	10/21/2010	52.53	51.99	0.54	0.3818	0.1458	10/21/2010	18.47	18.60	0.13	0.0919	0.0085	10/21/2010	100.10	100.22	0.12	0.0849	0.0072
39	201002614-005	10/22/2010	45.69	45.60	0.09	0.0636	0.0040	10/22/2010	18.47	18.52	0.05	0.0354	0.0013	10/22/2010	100.10	100.14	0.04	0.0283	0.0008
40	201002615–006	10/22/2010	46.37	46.37	0.00	0.0000	0.0000	10/22/2010	18.47	18.63	0.16	0.1131	0.0128	10/22/2010	100.10	100.16	0.06	0.0424	0.0018
41	201002615-015	10/22/2010	48.15	48.50	0.35	0.2475	0.0612	10/22/2010	18.47	18.60	0.13	0.0919	0.0085	10/22/2010	100.10	100.16	0.06	0.0424	0.0018
42	201002616-011	10/22/2010	66.51	66.40	0.11	0.0778	0.0060	10/22/2010	18.47	18.65	0.18	0.1273	0.0162	10/22/2010	100.10	100.24	0.14	0.0990	0.0098
43	201002617-015	10/25/2010	67.60	68.10	0.50	0.3536	0.1250	10/25/2010	18.47	18.53	0.06	0.0424	0.0018	10/25/2010	100.10	100.18	0.08	0.0566	0.0032
44	201002620-012	10/25/2010	70.73	69.28	1.45	1.0253	1.0513	10/25/2010	18.47	18.74	0.27	0.1909	0.0365	10/25/2010	100.10	100.20	0.10	0.0707	0.0050
45	201002657-001	10/25/2010	67.25	66.87	0.38	0.2687	0.0722	10/25/2010	18.47	18.71	0.24	0.1697	0.0288	10/25/2010	100.10	100.22	0.12	0.0849	0.0072
46	201002657-015	10/25/2010	96.87	96.91	0.04	0.0283	0.0008	10/25/2010	18.47	18.81	0.34	0.2404	0.0578	10/25/2010	100.10	100.26	0.16	0.1131	0.0128
47	201002658-015	10/26/2010	39.67	40.34	0.67	0.4738	0.2245	10/26/2010	18.47	18.42	0.05	0.0354	0.0012	10/26/2010	100.10	100.18	0.08	0.0566	0.0032
48	201002659-011	10/26/2010	45.25	45.82	0.57	0.4031	0.1625	10/26/2010	18.47	18.43	0.04	0.0283	0.0008	10/26/2010	100.10	100.20	0.10	0.0707	0.0050
49	201002660-004	10/26/2010	38.82	38.79	0.03	0.0212	0.0005	10/26/2010	18.47	18.35	0.12	0.0849	0.0072	10/26/2010	100.10	100.26	0.16	0.1131	0.0128
50	201002660-021	10/26/2010	46.66	47.07	0.41	0.2899	0.0841	10/26/2010	18.47	18.40	0.07	0.0495	0.0025	10/26/2010	100.10	100.24	0.14	0.0990	0.0098
51	201002680-007	10/29/2010	71.69	71.56	0.13	0.0919	0.0084	10/29/2010	18.47	18.33	0.14	0.0990	0.0098	10/29/2010	100.10	100.08	0.02	0.0141	0.0002
52	201002681-022	10/29/2010	49.91	49.45	0.46	0.3253	0.1058	10/29/2010	18.47	18.50	0.03	0.0212	0.0005	10/29/2010	100.10	100.18	0.08	0.0566	0.0032
53	201002682-015	10/29/2010	45.45	44.54	0.91	0.6435	0.4140	10/29/2010	18.47	18.55	0.08	0.0566	0.0032	10/29/2010	100.10	100.10	0.00	0.0000	0.0000
54	201002683-001	10/29/2010	46.25	46.62	0.37	0.2616	0.0684	10/29/2010	18.47	18.67	0.20	0.1414	0.0200	10/29/2010	100.10	100.06	0.04	0.0283	0.0008
55	201002684-010	11/01/2010	52.45	51.65	0.80	0.5657	0.3200	11/01/2010	18.47	18.64	0.17	0.1202	0.0145	11/01/2010	100.10	100.16	0.06	0.0424	0.0018
56	201002684-018	11/01/2010	47.11	46.08	1.03	0.7283	0.5305	11/01/2010	18.47	18.74	0.27	0.1909	0.0365	11/01/2010	100.10	100.24	0.14	0.0990	0.0098
57	201002685-009	11/01/2010	61.05	60.58	0.47	0.3323	0.1105	11/01/2010	18.47	18.65	0.18	0.1273	0.0162	11/01/2010	100.10	100.22	0.12	0.0849	0.0072
58	201002686-010	11/01/2010	71.07	70.23	0.84	0.5940	0.3528	11/01/2010	18.47	18.70	0.23	0.1626	0.0264	11/01/2010	100.10	100.20	0.10	0.0707	0.0050
59	201002686-023	11/02/2010	92.63	93.38	0.75	0.5303	0.2813	11/02/2010	18.47	18.50	0.03	0.0212	0.0005	11/02/2010	100.10	100.10	0.00	0.0000	0.0000
60	201002741-001	11/02/2010	39.95	40.66	0.71	0.5020	0.2521	11/02/2010	18.47	18.74	0.27	0.1909	0.0365	11/02/2010	100.10	100.18	0.08	0.0566	0.0032
61	201002741-016	11/02/2010	44.35	44.24	0.11	0.0778	0.0060	11/02/2010	18.47	18.68	0.21	0.1485	0.0220	11/02/2010	100.10	100.14	0.04	0.0283	0.0008
62	201002742-017	11/02/2010	74.28	74.36	0.08	0.0566	0.0032	11/02/2010	18.47	18.84	0.37	0.2616	0.0684	11/02/2010	100.10	100.26	0.16	0.1131	0.0128
63	201002743-005	11/03/2010	60.61	61.14	0.53	0.3748	0.1404	11/03/2010	18.47	18.63	0.16	0.1131	0.0128	11/03/2010	100.10	100.22	0.12	0.0849	0.0072
64	201002744-001	11/03/2010	50.06	49.48	0.58	0.4101	0.1682	11/03/2010	18.47	18.69	0.22	0.1556	0.0242	11/03/2010	100.10	100.18	0.08	0.0566	0.0032
65	201002745-018	11/03/2010	69.17	68.46	0.71	0.5020	0.2521	11/03/2010	18.47	18.64	0.17	0.1202	0.0145	11/03/2010	100.10	100.24	0.14	0.0990	0.0098
66	201002746-004	11/03/2010	72.26	72.39	0.13	0.0919	0.0084	11/03/2010	18.47	18.87	0.40	0.2828	0.0800	11/03/2010	100.10	100.30	0.20	0.1414	0.0200
67	201002747-013	11/04/2010	63.35	63.56	0.21	0.1485	0.0221	11/04/2010	18.47	18.51	0.04	0.0283	0.0008	11/04/2010	100.10	100.12	0.02	0.0141	0.0002
68	201002759-006	11/04/2010	93.43	93.60	0.17	0.1202	0.0144	11/04/2010	18.47	18.81	0.34	0.2404	0.0578	11/04/2010	100.10	100.20	0.10	0.0707	0.0050
69	201002760-008	11/04/2010	79.38	79.45	0.07	0.0495	0.0025	11/04/2010	18.47	18.72	0.25	0.1768	0.0313	11/04/2010	100.10	100.22	0.12	0.0849	0.0072
70	201002761-002	11/04/2010	97.67	97.79	0.12	0.0849	0.0072	11/04/2010	18.47	18.77	0.30	0.2121	0.0450	11/05/2010	100.10	100.12	0.02	0.0141	0.0002
71	201002762-011	11/05/2010	44.89	44.56	0.33	0.2333	0.0545	11/05/2010	18.47	18.66	0.19	0.1344	0.0181	11/05/2010	100.10	100.12	0.02	0.0141	0.0002
72	201002764-011	11/05/2010	59.12	59.21	0.09	0.0636	0.0041	11/05/2010	18.47	18.71	0.24	0.1697	0.0288	11/05/2010	100.10	100.14	0.04	0.0283	0.0008
73	201002777-004	11/05/2010	63.72	63.05	0.67	0.4738	0.2245	11/05/2010	18.47	18.62	0.15	0.1061	0.0113	11/05/2010	100.10	100.18	0.08	0.0566	0.0032
74	201002777-015	11/05/2010	43.68	45.24	1.56	1.1031	1.2168	11/05/2010	18.47	18.61	0.14	0.0990	0.0098	11/05/2010	100.10	100.20	0.10	0.0707	0.0050
75	201002778-008	11/08/2010	73.46	74.15	0.69	0.4879	0.2380	11/08/2010	18.47	18.56	0.09	0.0636	0.0040	11/08/2010	100.10	100.08	0.02	0.0141	0.0002

STANDARD LABORATORIES, INC.
8451 River King Drive, Freeburg, Illinois 62243 (618) 539-5836

UBB DUST SAMPLES

	Replicates	QAR RM-4	CaCO3
Count N	94	94	94
Average	59.37 59.41	18.47 18.59	100.10 100.17
Average Difference	0.5626	0.1553	0.0794
Max Difference	3.92	0.41	0.20
Min Difference	0.00	0.01	0.00
Repeatabilty STD DEV	0.5791	0.1307	0.0646
Estimated Within Lab REPEATABILTY (Based on first 30)	2.25	0.32	0.17
Within Lab REPEATABILITY (Based on Total Population)	1.62	0.37	0.18

Parameter:
Incombustible

			Replicates						QAR RM-4						$CaCO_3$				
N	Sample	Date	Replicate 1	Replicate 2	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared	Date	Reference	System	|A-B| =	Replic. STD Dev.	Replic. STD Dev. Squared
			A	B	diff.	s	s^2		A	B	diff.	s	s^2		A	B	diff.	s	s^2
76	201002779-001	11/08/2010	61.46	61.73	0.27	0.1909	0.0364	11/08/2010	18.47	18.75	0.28	0.1980	0.0392	11/08/2010	100.10	100.18	0.08	0.0566	0.0032
77	201002779-013	11/08/2010	51.43	51.42	0.01	0.0071	0.0000	11/08/2010	18.47	18.81	0.34	0.2404	0.0578	11/08/2010	100.10	100.24	0.14	0.0990	0.0098
78	201002780-008	11/08/2010	60.08	59.03	1.05	0.7425	0.5512	11/08/2010	18.47	18.84	0.37	0.2616	0.0684	11/08/2010	100.10	100.24	0.14	0.0990	0.0098
79	201002781-003	11/09/2010	45.34	45.42	0.08	0.0566	0.0032	11/09/2010	18.47	18.53	0.06	0.0424	0.0018	11/09/2010	100.10	100.18	0.08	0.0566	0.0032
80	201002782-002	11/09/2010	65.54	65.53	0.01	0.0071	0.0001	11/09/2010	18.47	18.63	0.16	0.1131	0.0128	11/09/2010	100.10	100.18	0.08	0.0566	0.0032
81	201002787-003	11/09/2010	46.05	45.23	0.82	0.5798	0.3362	11/09/2010	18.47	18.60	0.13	0.0919	0.0085	11/09/2010	100.10	100.08	0.02	0.0141	0.0002
82	201002787-020	11/09/2010	57.97	58.15	0.18	0.1273	0.0162	11/09/2010	18.47	18.62	0.15	0.1061	0.0113	11/09/2010	100.10	100.18	0.08	0.0566	0.0032
83	201002788-008	11/10/2010	52.59	53.04	0.45	0.3182	0.1013	11/10/2010	18.47	18.44	0.03	0.0212	0.0004	11/10/2010	100.10	100.08	0.02	0.0141	0.0002
84	201002789-002	11/10/2010	46.14	46.41	0.27	0.1909	0.0364	11/10/2010	18.47	18.65	0.18	0.1273	0.0162	11/10/2010	100.10	100.14	0.04	0.0283	0.0008
85	201002789-012	11/10/2010	67.98	68.69	0.71	0.5020	0.2520	11/10/2010	18.47	18.56	0.09	0.0636	0.0040	11/10/2010	100.10	100.10	0.00	0.0000	0.0000
86	201002791-006	11/10/2010	60.66	61.33	0.67	0.4738	0.2244	11/10/2010	18.47	18.64	0.17	0.1202	0.0145	11/10/2010	100.10	100.14	0.04	0.0283	0.0008
87	201002792-006	11/11/2010	53.54	52.96	0.58	0.4101	0.1682	11/11/2010	18.47	18.63	0.16	0.1131	0.0128	11/11/2010	100.10	100.10	0.00	0.0000	0.0000
88	201002793-006	11/11/2010	41.54	41.65	0.11	0.0778	0.0060	11/11/2010	18.47	18.69	0.22	0.1556	0.0242	11/11/2010	100.10	100.20	0.10	0.0707	0.0050
89	201002795-007	11/11/2010	39.16	38.50	0.66	0.4667	0.2178	11/11/2010	18.47	18.55	0.08	0.0566	0.0032	11/11/2010	100.10	100.22	0.12	0.0849	0.0072
90	201002796-002	11/11/2010	41.48	42.06	0.58	0.4101	0.1682	11/11/2010	18.47	18.62	0.15	0.1061	0.0113	11/11/2010	100.10	100.20	0.10	0.0707	0.0050
91	201002797-009	11/12/2010	50.60	50.67	0.07	0.0495	0.0025	11/12/2010	18.47	18.33	0.14	0.0990	0.0098	11/12/2010	100.10	100.08	0.02	0.0141	0.0002
92	201002798-006	11/12/2010	79.04	78.95	0.09	0.0636	0.0041	11/12/2010	18.47	18.60	0.13	0.0919	0.0085	11/12/2010	100.10	100.12	0.02	0.0141	0.0002
93	201002802-005	11/12/2010	62.05	61.55	0.50	0.3536	0.1250	11/12/2010	18.47	18.55	0.08	0.0566	0.0032	11/12/2010	100.10	100.20	0.10	0.0707	0.0050
94	201002805-004	11/12/2010	92.97	92.52	0.45	0.3182	0.1012	11/12/2010	18.47	18.63	0.16	0.1131	0.0128	11/12/2010	100.10	100.22	0.12	0.0849	0.0072
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APPENDIX K

INSPECTION HISTORY

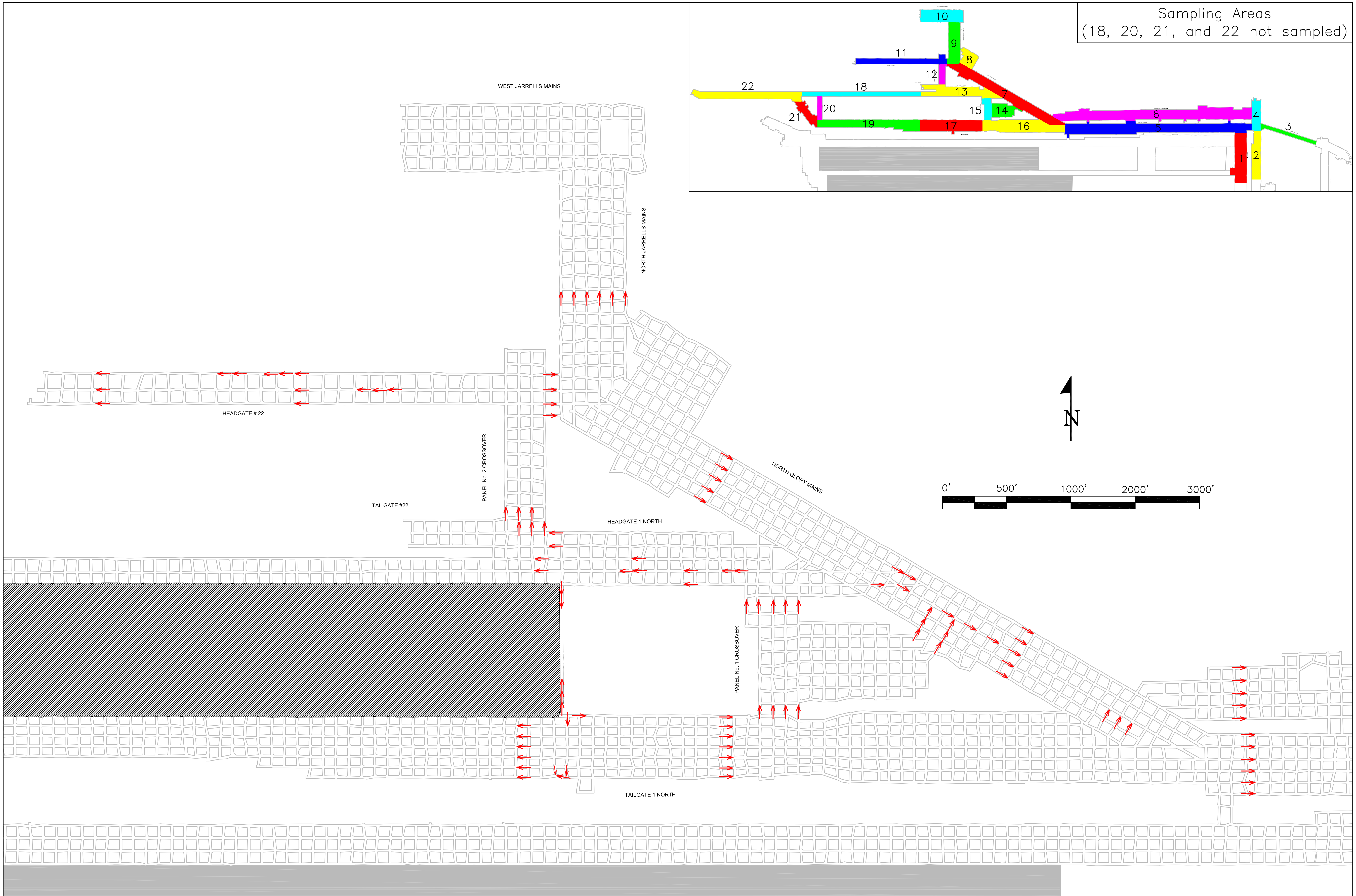
Appendix K

Table K-1. Types and Number of Enforcement Actions for All UBB Inspection Events, Calendar Year 2009

Type of Enforcement Action	No. Issued
104(a) non-S&S citation	284
104(a) S&S citation	176
104(d)(1) citation	1
104(d)(1) order	1
104(d)(2) order	48
104(b) order	4
107(a) order	1
104(g)(1) order	1
103(k) order	1
Total	517

Table K-2. Types and Number of Enforcement Actions for All UBB Inspection Events, Calendar Year 2010 through April 5, 2010 (Prior to the Explosion)

Type of Enforcement Action	No. Issued
104(a) non-S&S citation	87
104(a) S&S citation	30
104(b) order	1
104(d)(2) order	6
103(k) order	1
103(j) order	1
Total	126



DIRECTION OF PRIMARY FORCES

LEGEND
Scale 1"=500'

MAPPING NOTES

DIRECTION OF PRIMARY EXPLOSION FORCES.

APPENDIX L

Mine Map Showing Direction of Primary Forces and Mine Dust Sampling Areas

Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

APPENDIX M

SEISMIC EVENTS IN SOUTHERN WEST VIRGINIA

Appendix M
Seismic Events in Southern West Virginia

Data from the U.S. Geological Survey indicate that two rare seismic events occurred in southern West Virginia in the weeks preceding the explosion at UBB. The first was a 2.9 Magnitude event that occurred on March 27, 2010 in Logan County, approximately 27 miles away from UBB. The shallow depth and location in a historically bump-prone area of West Virginia suggests that the seismic event represents a coal pillar bump rather than an earthquake. Review of old mine maps, downloaded from the West Virginia Geologic and Economic Survey (WVGES), identified an old mine with extensive pillared works within one mile of the plotted location of the seismic event. The extensive pillared works in the abandoned mine surrounded large, square barrier-style pillars that may have experienced rapid failure after decades of degradation to reach a critical size.

The second seismic event occurred on April 4, 2010 in Braxton County, approximately 60 miles from the face of the 1 North Panel, UBB (Figure M-1). Despite the seemingly close temporal relation between the April 4 seismic event (05:19:14), and the April 5 explosion (15:02), the 60 mile interval and 34-hour time difference does not support any recognizable relationship between the two events. After the April 5, 2010 explosion, seismic events continued to be recorded in the Upshur/Randolph County area. A 2.5 magnitude seismic event was reported on August 21, 2010, with the hypocenter exactly coinciding with a gas well that is exploiting the Devonian-aged Marcellus Shale (API # 47-09703326), with a neighboring well also reported as developed to the Marcellus Shale (API # 47-09703622) (Figure M-2). Following the April 5, 2010 explosion, several seismic events were recorded in central West Virginia. A search of seismic events within 200 km of UBB indicated that six seismic events were recorded in 2010 along the crest of the Gassaway Anticline (Figure M-3). Because several of those events were reported as occurring at 0 km depth, the localized seismic activity is interpreted to be associated in some fashion with the recent increase in gas drilling in the state, and does not appear to have any recognizable association with UBB.

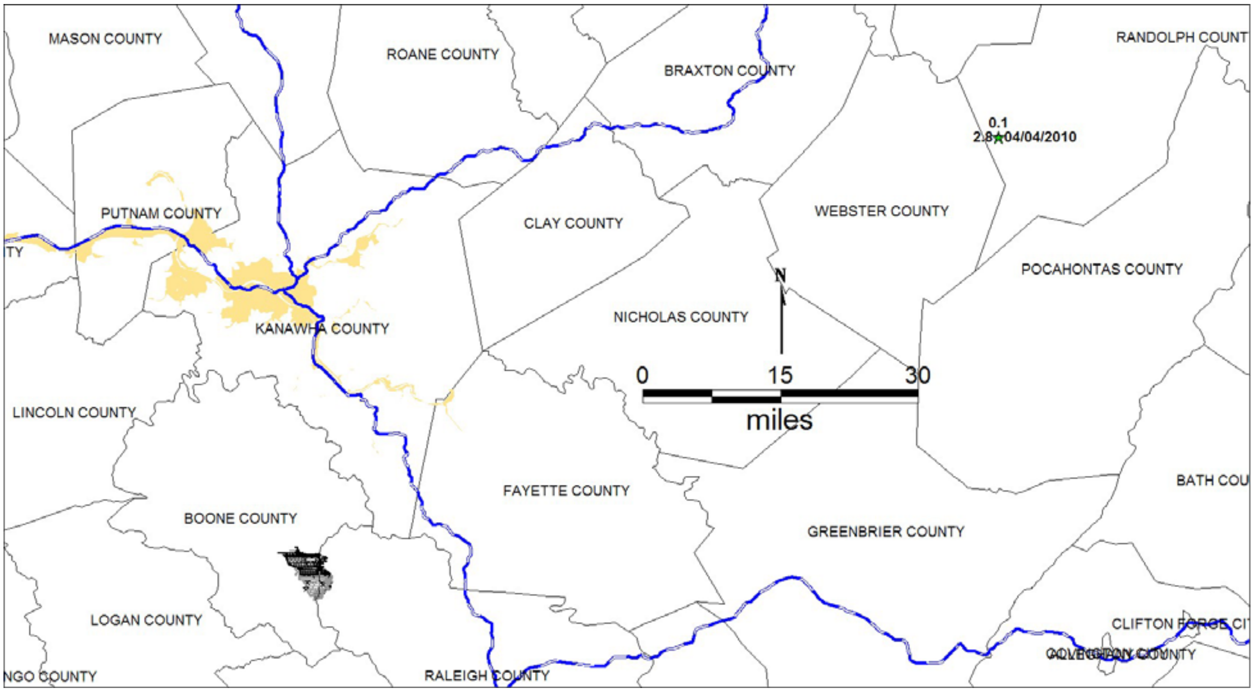


Figure M-1. Location of Randolph County 2.8 M "seismic event," in relation to UBB, that occurred on April 4, 2010. The event was essentially at the surface, only 0.1 km deep and located over 60 miles away.

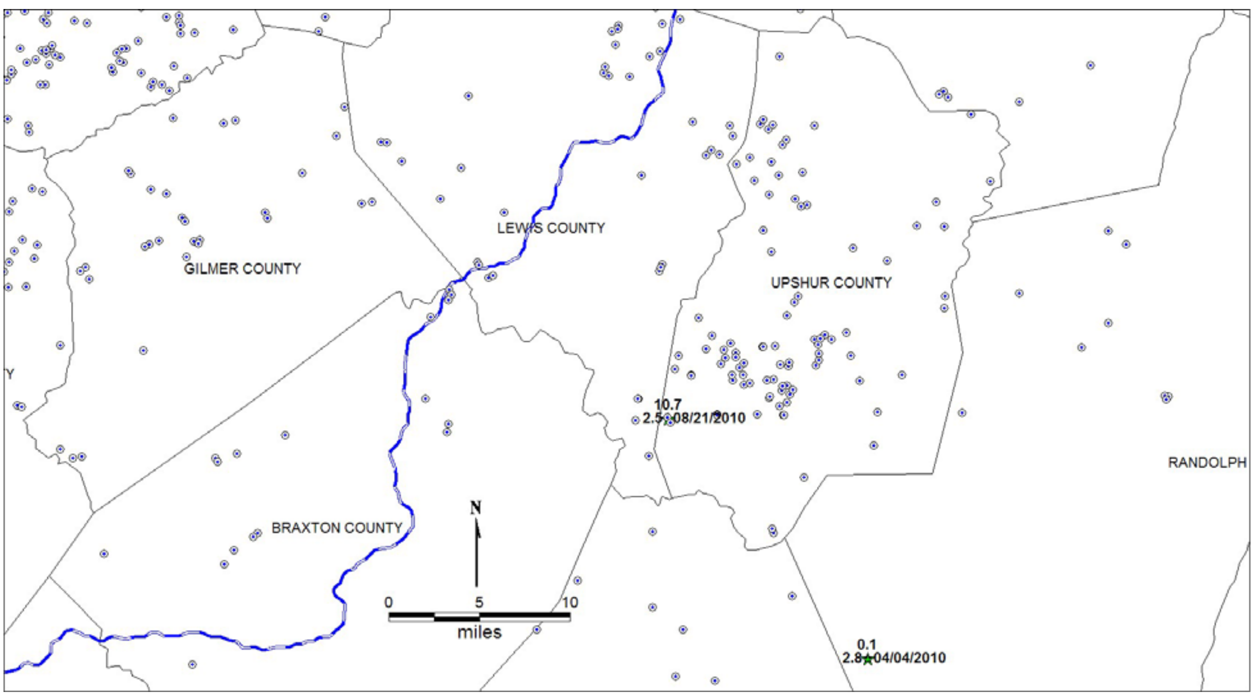


Figure M-2. Locations of seismic events in the vicinity of Upshur County shown in relation to the locations of gas wells developed to the Marcellus Shale. Event on August 21, 2010 plots directly on top of a gas well location, suggesting that increased drilling activity, possibly associated with fluid injection, is related to the increase in recorded seismic events.

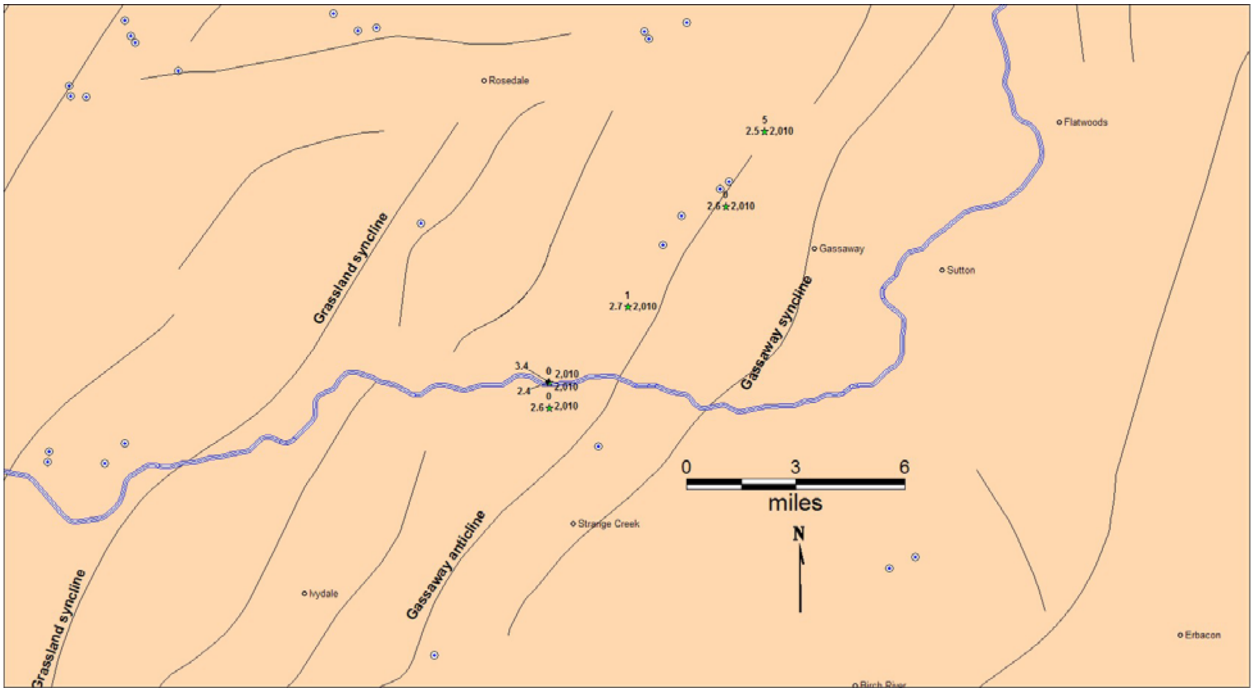


Figure M-3. Map of seismic events recorded by the USGS in 2010 in West Virginia are located along the axis of the Gassaway Anticline, dominantly occurring essentially at the ground surface. Location along anticline axis is suggestive of gas drilling-related activity. Blue circles represent the locations of gas wells drilled to the Marcellus Shale.

APPENDIX N

WVDEP SURFACE BLASTING

APPENDIX N

WVDEP SURFACE BLASTING

Appendix N
Surface Blasting on April 5, 2010

Although the US Geological Survey does not report events that are less than 1.0 Magnitude, the possibility of an association with surface blasting was assessed by portraying UBB workings in relation to surface mines on georeferenced air photos. The nearest surface operation is located nearly two miles from the vicinity of HG 22 and/or the 1 North Panel face. Surface shots conducted on April 5, 2010, the day of the explosion, were recorded by seismographs monitored by the West Virginia Department of Environmental Protection's (WVDEP) Office of Explosives and Blasting. The locations of surface blasts were plotted in a Geographic Information System (GIS) using coordinates provided by the WVDEP Office of Explosives and Blasting, along with the times of surface blasting. Four surface blasts were recorded approximately 2 ½ miles from the face of the 1 North Panel, but the earliest was over one hour after the 3:02 p.m. time of the explosion. The WVDEP was requested to provide the locations and times of all surface blasts for the week prior to the explosion, within a five mile radius of the 1 North Panel face. Discussions with David Vande Linde (Office of Explosives and Blasting) conducted on April 29-30, 2010, revealed that seismographs were located at Lindytown and Synergy, and agreed with the time data provided by the company, although located 1,500-2,000 feet away from the blast (Figure N-1). Mr. Vande Linde indicated that at that distance, the seismic magnitudes resulting from the surface shots were 0.01-0.06 Magnitude, representing very small events.

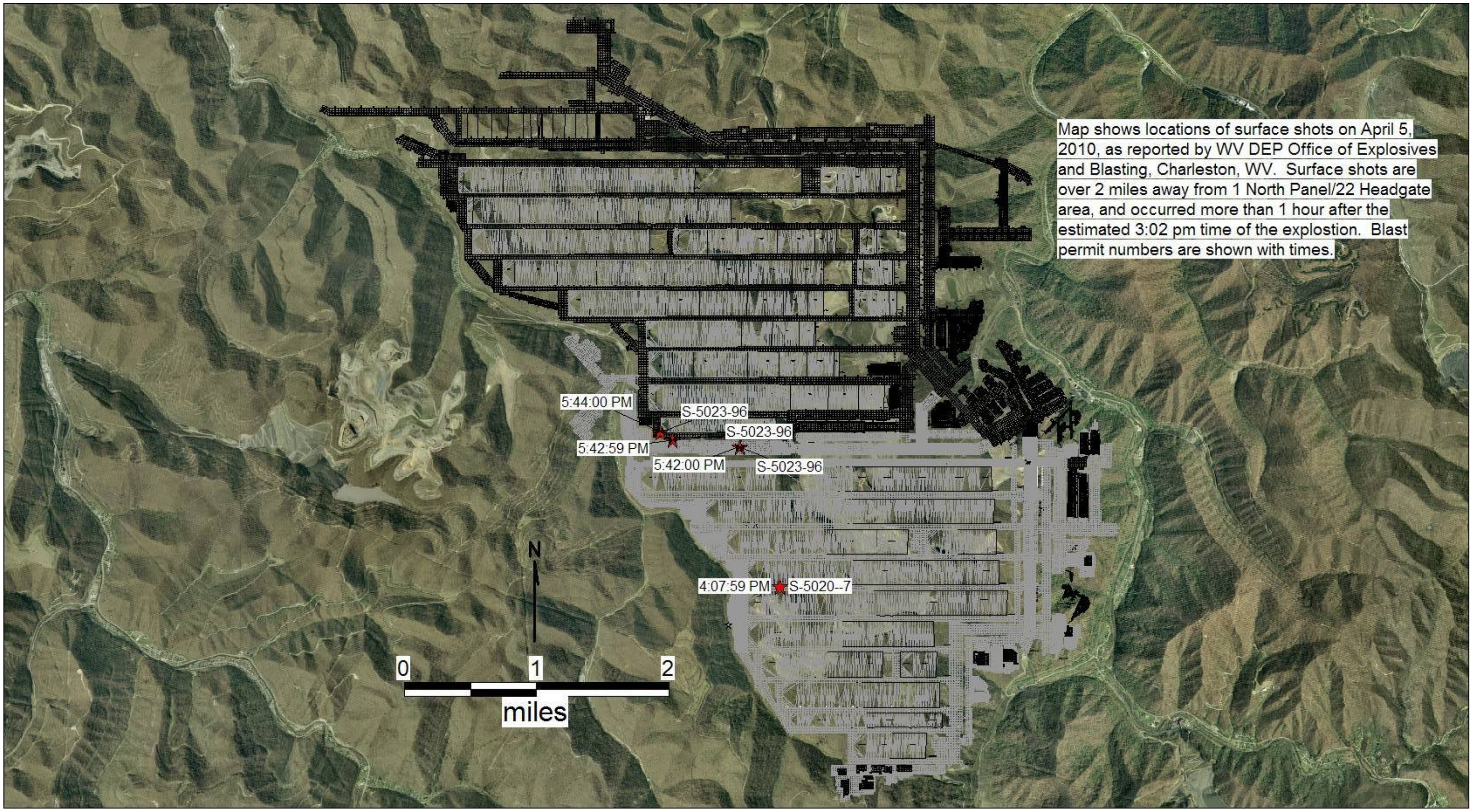


Figure N-1. UBB in relation to surface blasting events on April 5, 2010. Surface shots all occurred at least one hour after the 3:02 p.m. time of the explosion, and were located more than two miles south of the 1 North panel.

APPENDIX O

GEOCHEMISTRY OF NATURAL GAS AND COALBED METHANE

Appendix O
Geochemistry of Natural Gas and Coalbed Methane

Primary gases originate from bacterial respiration (biogenic) and thermal alteration of liquid or solid organic precursors (thermogenic) (Schoell, 1983). Four values are found useful in describing variability in natural gases and deducing their origin and processes involved with their origin, including the concentration of C_2 through C_5 hydrocarbons (i.e. ethane, propane, butane, and pentane) relative to C_1(i.e. methane), the carbon and hydrogen isotopic composition of methane, and the carbon isotopic composition of ethane (Schoell, 1983). Additionally, the hydrogen isotope composition of methane and ethane has been found useful for distinguishing between gas sources (Whiticar, 1996).

Coalification involves a series of biochemical and geochemical reactions that transform plant material into a combustible, carbonaceous solid (Kim, 1973). Most coalbed gases are generated during the progressive burial and maturation of the coal (Scott, 1993). Samples of coal collected from various seams by Kim (1973) contained gas that was characterized by generally greater than 90% methane and 1.0-1.5% ethane, with negligible amounts of heavier gaseous hydrocarbons. Similarly, experiments conducted by Kim (1974) involving the collection of gas desorbed from coal samples revealed domination (99.5%) by methane and ethane, with only trace amounts of higher hydrocarbons. Scott (1993) reports that an average coalbed gas will contain 93.2% methane, 3.1% carbon dioxide, 2.6% wet gases (i.e. hydrocarbons $>C_1$) and 1.1% nitrogen.

Isotopes are atoms with the same number of protons but different numbers of neutrons, which results in differing atomic mass for the same element. The difference in properties between two isotopes that may lead to a slight separation in distribution (fractionation) is largely a result of the different vibrational frequencies of heavy and light atoms in a molecular or crystal structure (Krauskopf and Bird, 1995). Atoms of a light isotope vibrate with higher frequencies, hence in general are less strongly bonded to other atoms than atoms of a heavy isotope. It is assumed that migration of gases in most situations does not appreciably change the isotopic composition of the hydrocarbons (Schoell, 1983). The element Carbon includes two stable isotopes, ^{12}C and ^{13}C, as well as the radioactive ^{14}C. The element Hydrogen includes two stable isotopes, ^{1}H and ^{2}H, the latter being known as Deuterium and referred to with a capital "D." Hydrogen has a third, radioactive isotope, Tritium (^{3}H) with a short half-life of 12.26 years. Three mechanisms of isotope separation can be distinguished, including those depending on physical properties (such as evaporation and precipitation), exchange reactions resulting in equilibrium between two or more substances, and separation depending on reaction rates. The extent of separation between two phases is expressed by a ratio called the fractionation factor, which compares the ratio of concentrations of heavy to light isotope in one phase to the same ratio in another phase. The comparison ratio is reported in concentrations of per mil, or parts per thousand, relative to the heavier isotope. Carbon isotope ratios are expressed as $\delta^{13}C$ in parts per thousand (per mil or ‰) deviations from the Pee Dee Belemnite marine carbonate standard, for which the internationally accepted standard for the ratio of $^{13}C/^{12}C$ is equal to 0.0112372. A positive value of the fractionation ratio indicates relative enrichment of the heavier isotope, whereas a negative value represents a relative depletion of the heavier isotope compared to the lighter isotope. In practice, the Peedee Belemnite has a very high ^{13}C content, so virtually all terrestrial samples will exhibit a negative value of $\delta^{13}C$‰ in comparison such that a relative enrichment will be expressed.

Natural gas is generated from organic matter throughout the burial history of sedimentary rocks. Three principal episodes of gas generation are recognized: 1) biogenic gas is formed during the early, low temperature (<60-100° C) phase of sediment burial history at shallow (< 3 km) depths, by anaerobic bacteria, characterized by isotopically light methane of $\delta^{13}C$< -60‰; 2) early thermogenic gas is produced along with liquid hydrocarbons during the intermediate phase of burial history; 3) late thermogenic gas is produced during the high temperature phase of burial history, which is destructive to earlier formed liquid hydrocarbons. Jenden et al. (1993) state that at greater depths and temperatures, thermal degradation of kerogen yields thermogenic gases, in addition to hydrocarbon liquids, and that although geochemistry is strongly dependent on source rock and maturity, they are generally characterized by ethane contents greater than 1% and $\delta^{13}C$ values for methane of greater than -50‰. In general the amount of natural gas formed increases as a sedimentary unit progresses through the various stages of gas generation (Claypool et al., 1978; Jenden et al., 1993). The gas formed during each of these stages has a characteristic chemical composition and stable carbon isotope ratio for methane. Biogenic gas is predominantly methane that is isotopically light ($\delta^{13}C$ = -90 to -55‰). Methane originating during the thermal generation of petroleum is always accompanied by ethane and heavier hydrocarbons, and is isotopically heavier ($\delta^{13}C$ = -55 to -35‰). Data from samples compiled by Scott (1993) for the San Juan, Piceance, and Black Warrior Basins, for coal classified as high-volatile C bituminous rank, indicates $\delta^{13}C$ values for methane of -49.3 to -60.2‰, δD values for methane of -223 to -256‰, and $\delta^{13}C$ values for ethane of -29.2 to -30.8‰. Data for samples compiled by Laughrey and Baldassare (1998) for coalbed methane in the central Appalachian Basin indicate $\delta^{13}C$ values for methane of -39.9to -55.1‰ and values of δD for methane of -194 to -219‰.

The accident investigation team collected gas samples from UBB, another longwall mine in the Eagle seam located 14 miles away, and from separate gas wells producing from the Greenbrier Formation and Marcellus Shale within seven miles of the 1 North Panel. The hydrocarbon contents and stable isotope ratios were compared and plotted on discrimination diagrams to determine the sources of gas entering the mine, and to understand the role of gas in the geologic model. Samples from the other Eagle seam longwall mine were collected from gas feeders that were discovered on June 7, and October 25, 2010. The gas content (by mole) of the June 7 event contained 90.141% methane, 4.188% ethane, 1.496% propane, 0.838% combined butanes, 0.458% combined pentanes, 0.264% hexanes, 0.127% heptanes, and 0.203% hydrogen. The gas content from the October 25 event contained 98.27% methane, 1.23% ethane, 0.3% propane, 0.11% combined butanes, 0.03% combined pentanes, and 0.01% C_{6+} hydrocarbons. Therefore, the relatively high ethane content (>4%), and presence of propane, butane, pentane, hexane, and heptane (i.e. a "wet" composition) is an indication that the floor gas represents natural gas derived from a source other than a coal seam. Plots of stable isotope values indicate that the gas was derived from a Type II kerogen, such as expected for organic-rich shale. This suggests a source in the Devonian-aged black shale such as the Marcellus/Millboro/Lower Huron. Plots of stable isotope values on discrimination diagrams developed by Jenden et al. (1993) indicate a vitrinite reflectance value of approximately 0.7-0.8% for the source rock, which is at the lower range of vitrinite reflectance reported for the Lower Huron of western West Virginia, a source of Type II kerogen.

Several samples of gas were collected at different times by MSHA, WVOMHST, and company investigators from floor feeders located behind the shield pontoons on the longwall face at shield 160 and shield 170. The immediate vicinity of the floor feeders were characterized by a distinctive smell similar to that noted at the other Eagle seam longwall mine, and registered high values of methane and CO. The samples were characterized by gas contents of 40.61% (90.15% normalized to 100% hydrocarbons) methane, 2.7% (5.99%) ethane and 1.21% (2.68%) propane, as well as 0.135% (0.3%) and 0.188% (0.41%) iso-butane and n-butane, respectively; 0.04% (0.08%) and 0.0202% (0.04%) iso-pentane and n-pentane, respectively, and; 0.018% (0.04%) hydrocarbons including or heavier than hexane. The sample also contained 0.279% hydrogen, and no CO, despite a hand-held methane detector indicating several hundred parts per million CO. These samples are chemically and isotopically very similar to those collected from the other Eagle seam longwall mine, and are representative of organic shale-derived thermogenic gas, rather than biogenic gas derived from humic coal.

Numerous samples were collected by MSHA and company investigators from small feeders emanating from the floor throughout the HG 22 and 'new' TG 22 sections. Analysis results indicate a different kind of gas than that sampled at shield 160-170 or the other Eagle seam longwall mine. In contrast to those samples, which contained significant ethane and other heavier hydrocarbons, the HG 22 and TG 22 samples were characterized by methane content of 75-78%, with only 0.01-0.02% ethane and insignificant or nondetectable contents of C_{2+} hydrocarbons. Furthermore, the samples contained no hydrogen, and during the sampling process the hand-held gas detector indicated no CO. Although subsequent analyses indicated that no CO is actually present in any of the samples, a CO reading of several hundred parts per million is simply a proxy for hydrogen, which the hand-held detector is incapable of registering. These samples were also subjected to determination of stable isotope contents, and plotted on discrimination diagrams for comparison with other collected samples, where they represent a distinct and separate sample population The source of coalbed methane bubblers may be the Lower (Little) Eagle seam, based on an absence of hydrocarbons higher than methane, although isotopes suggest some mixing with a deeper thermogenic source.

A sample of Eagle seam coal was collected from the longwall face on August 31, 2010 in an aluminum desorption canister for determination of hydrocarbon content. After a prolonged period of desorption, five 15-cc test tubes of gas were obtained from the sample, and sent for analysis. Because the desorbed samples were highly diluted with air, chemical analysis indicated only 0.580% (mole) methane but failed to detect any C_{2+} hydrocarbons in the sample. This is an indication that the gas is typical of coalbed methane, but may also represent that last residual gas to desorb from the coal. Nitrogen and oxygen contents were similar to expected for ambient air, at 77.55% and 20.85%, respectively. Because of the very low sample volume and high dilution, the results may not be conclusive, since ethane occurs at such a small ratio to methane even in samples of natural gas. However, stable isotope contents for methane indicated a $\delta^{13}C$ value of -61.68‰ and a δD value of -247‰, which is indicative of microbial gas. Thus, it appears that gas derived from the Eagle seam itself is different from the coalbed methane gas emanating from floor bubblers, as well as the natural gas emanating from floor fractures.

A chemical analysis was obtained from Equitable Resources for well no. 7645 (API 005-00810) developed to the Greenbrier Formation, indicating over 89% methane, 4.8% ethane, 1.7% propane, 0.3% iso-butane, 0.6% n-butane, 0.2% iso-pentane, 0.2% n-pentane, and 0.4% content of hexane and longer hydrocarbons. This composition is very similar, in terms of the presence of longer-chain hydrocarbons, to the samples collected from the floor feeders at the other Eagle seam longwall mine, and from the floor fractures at Shields 160-170.

Chemical analyses were obtained from samples of gas from two EXCO Resources wells producing from the Devonian-aged Marcellus Shale, located 6.25-7 miles ESE of the 1 North Panel face (API No.'s 4708101435 and 4708101436). Data from these samples were plotted on discrimination diagrams together with other samples collected from the mine, and are considered the basis for comparison with natural gas (Figures O-1 to O-4). The samples plot very close to those collected from the other Eagle seam longwall mine and from shields 160-170, confirming previous interpretations that those samples represent natural gas rather than coalbed methane.

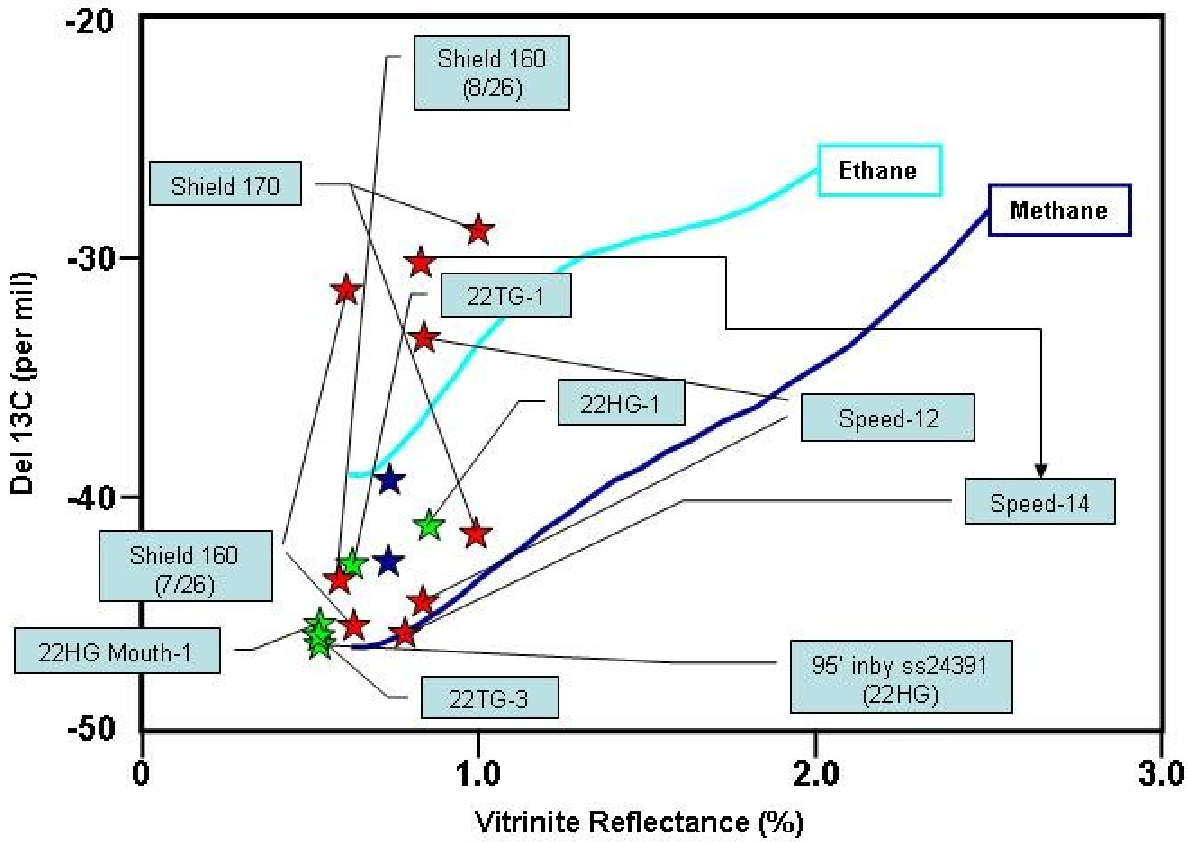


Figure O-1. Plot of collected gas samples for δ ^{13}C for methane (‰) and ethane versus vitrinite reflectance, after Berner and Faber (1996), indicating derivation from Type II kerogen, such as expected for organic shale. Vitrinite reflectance is unknown for Marcellus Shale beneath UBB, but values of 0.8% and 0.6% for samples collected from the American Eagle Mine and UBB, respectively, are based on Figure 46. Published data for area coal seams in the southern Appalachian Basin suggest that vitrinite reflectance may be as high as 0.9%. For both samples, values lie along the curve defined for methane, but diverge significantly from the curve defined for ethane. Red stars indicate samples that contain C_{2+} hydrocarbons; green stars indicate samples with little or no C_{2+} hydrocarbons. Blue stars indicate composition of natural gas produced from the Marcellus Shale.

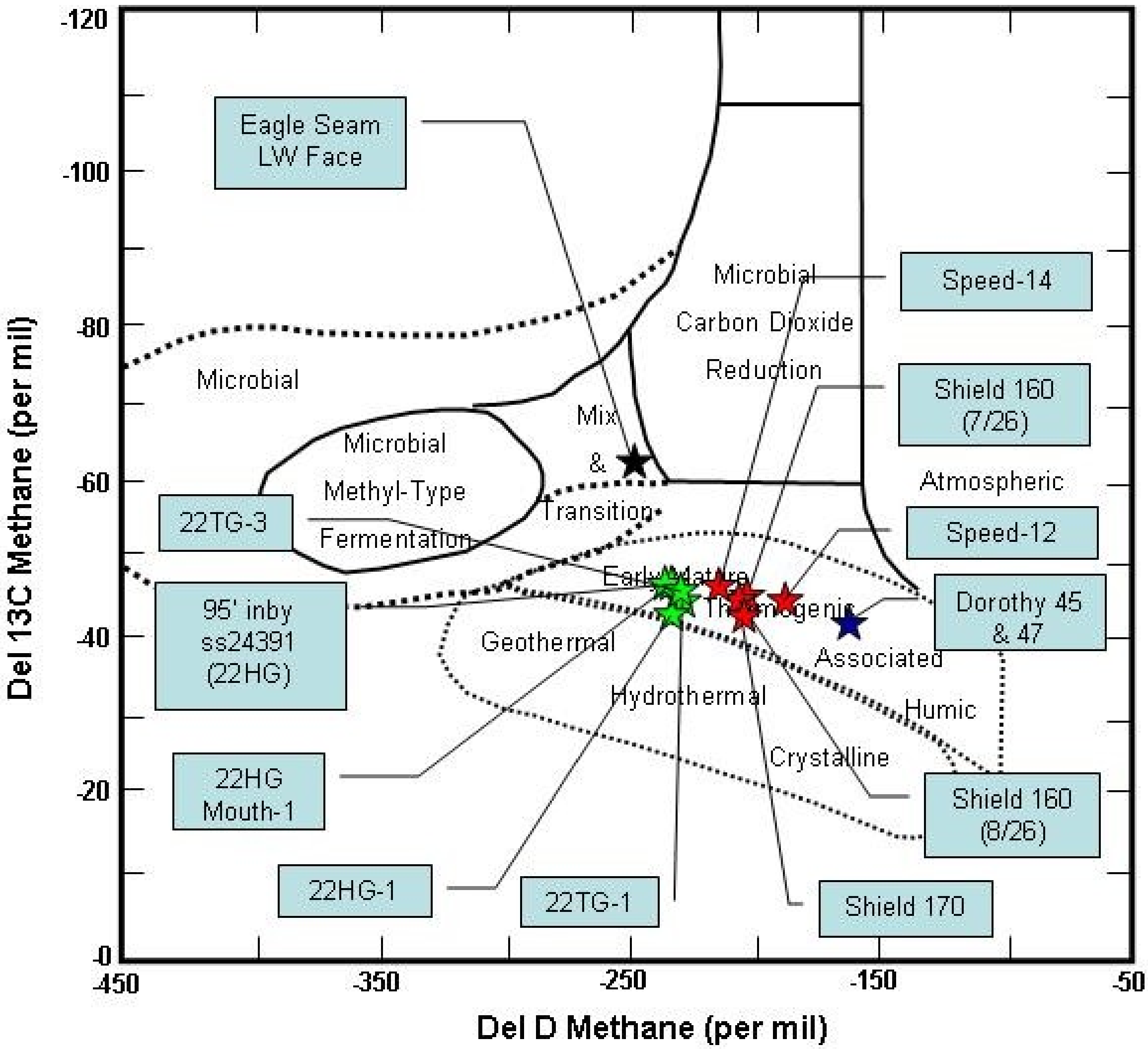


Figure O-2. Discrimination diagram from Whiticar (1996) showing gas fields based on plotting δ ^{13}C for methane (‰) versus δ D for methane (‰). Red stars indicate samples that contain C_{2+} hydrocarbons; green stars indicate samples with little or no C_{2+} hydrocarbons. Blue star indicates samples that were obtained from the Dorothy 45 and Dorothy 47 wells, which produce natural gas from the Marcellus Shale.

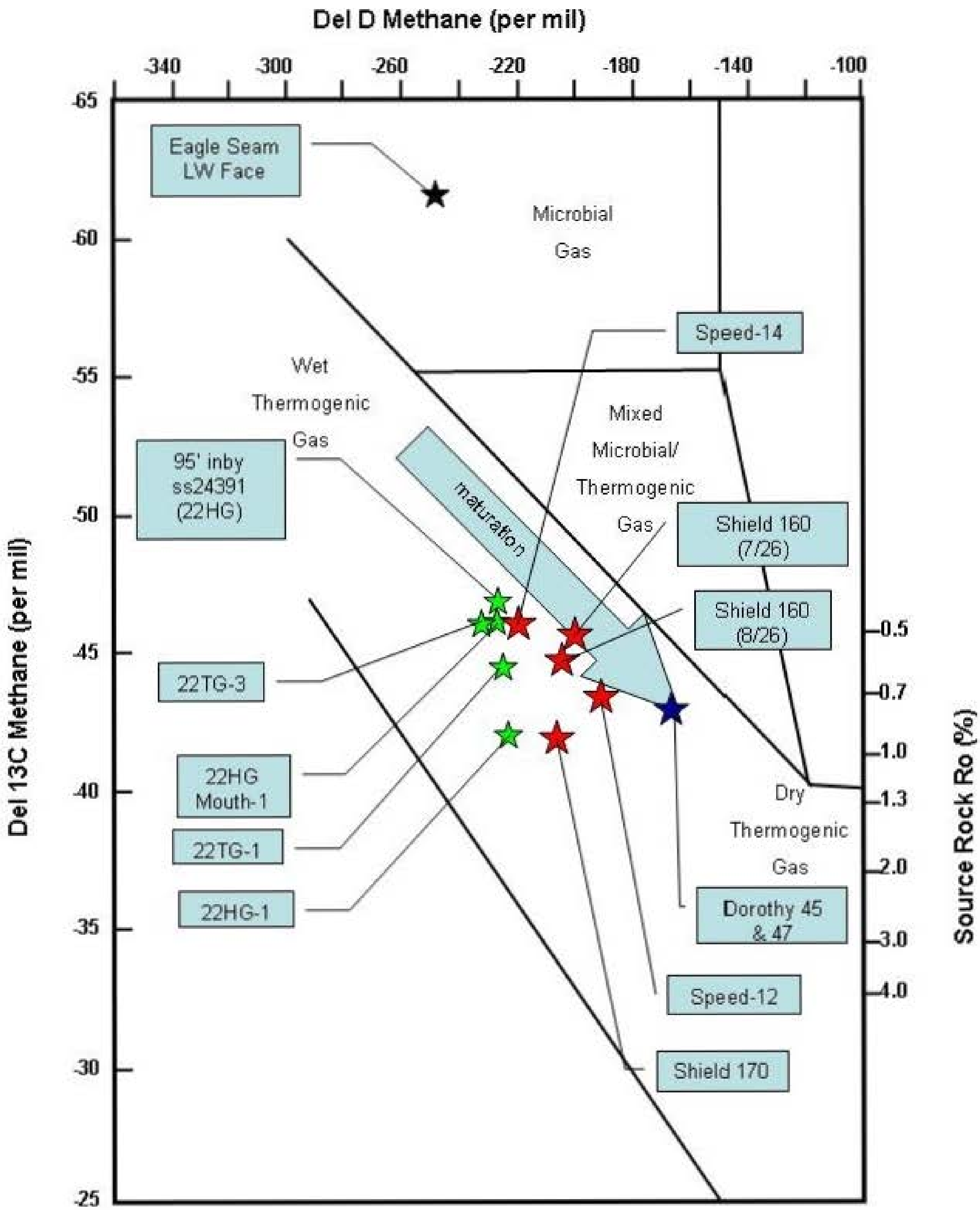


Figure O-3. Discrimination diagram after Jenden et al. (1993) showing fields of microbial and thermogenic gas based on plotting values of δ ^{13}C for methane (‰) and δ D for methane (‰). Values for vitrinite reflectance are shown for comparison. Red stars indicate samples that contain C_{2+} hydrocarbons; green stars indicate samples with little or no C_{2+} hydrocarbons. Blue star indicates samples that were obtained from the Dorothy 45 and Dorothy 47 wells, which produce natural gas from the Marcellus Shale.

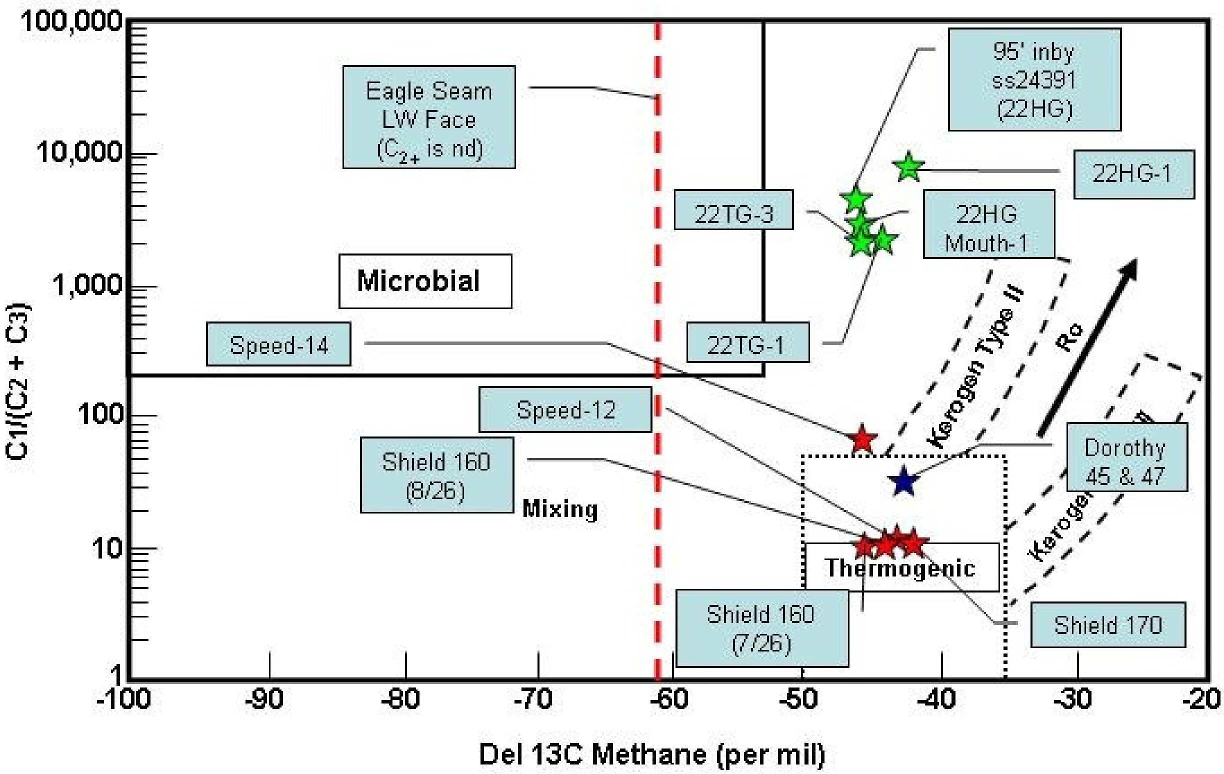


Figure O-4. Discrimination diagram showing fields of gas from microbial and thermogenic sources, based on comparison of C_1, C_2, and C_3 hydrocarbons (ratio of methane to combined ethane and propane), compared to $\delta^{13}C$ for methane (‰). Diagram modified from Whiticar, 1996). Red stars indicate samples that contain C_{2+} hydrocarbons; green stars indicate samples with little or no C_{2+} hydrocarbons. Blue star represents samples obtained from the Dorothy 45 and Dorothy 47 wells, which produce natural gas from the Marcellus Shale.

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APPENDIX P

RECONSTRUCTION OF VENTILATION MAP

CAN BE FOUND IN THE BACK OF THE BINDER

WEST JARRELLS MAINS
NORTH JARRELLS MAINS
HEADGATE # 22
MMU-029-0
No. 2 COMPRESSED AIR LINE SHAFT
POWER BOREHOLE
BANDYTOWN FAN
PANEL No. 2 CROSSOVER
TAILGATE #22
MMU-040-0
NORTH GLORY MAINS
HEADGATE 1 NORTH
MMU-050-0
#1 BOREHOLE VERTICAL TURBINE PUMP
#2 BOREHOLE VERTICAL TURBINE PUMP
No. 1 COMPRESSED AIR LINE SHAFT
N
0'
500'
1000'
1500'
2000'
TAILGATE 1 NORTH
PANEL No. 1 CROSSOVER
STOPPING
STOPPING WITH HOLE
STOPPING WITH MANDOOR
STOPPING WITH MANDOOR AND HOLE
BELT CHECK
CURTAIN
FLYPAD
EQUIPMENT DOOR
EQUIPMENT DOOR WITH HOLE
REGULATOR
OVERCAST
OVERCAST WITH HOLE
OVERCAST WITH MANDOOR
OVERCAST WITH MANDOOR AND HOLE
TRACK
CONVEYOR BELT
EVALUATION POINT
MEASURING POINT
BELT HEAD
INTAKE AIR COURSE
BELT AIR COURSE
RETURN AIR COURSE
BELT AIR CONTAMINATED WITH RETURN AIR
ROOF FALL
FAN
CROSSCUT NUMBER
SEAL
LEGEND
Scale 1"=300'
MAPPING NOTES
VERIFICATION OF VENTILATION CONTROLS ONLY COMPLETED IN ACCESSIBLE AREAS
APPENDIX P
Ventilation Map
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

APPENDIX Q

PETROGRAPHIC ANALYSES

Appendix Q
Petrographic Analysis of Roof and Floor, 1 North Panel Face

Samples of the roof and floor were collected from the tailgate side of the 1 North Panel face so that petrographic analyses could be conducted. Results of mineral content were plotted on a diagram to assess the incendive potential of the rock encountered by the shearing drums. Underground observations indicated that the tailside drum was cutting sandstone in the roof and floor, while the headside drum was cutting sandstone in the floor.

A sample of rock from the face, directly in contact with the top of the coal seam, had been ejected outward onto the tail drive. The sample contains two rock types, coarse-grained micaceous quartzo-feldspathic siltstone interbedded with medium-grained feldspathic wacke (arkose). The siltstone layers are characterized by gradational laminations in color, highlighted by changes in the relative proportions of biotite and quartz + feldspar. Alternating bands of brown coloration are due to the proportion of biotite in bands that are less than 1 mm thick. Angular, commonly jagged grains of quartz (7% content, 0.03-0.2 mm diameter) are sporadically distributed throughout the rock, with individual grains commonly isolated by a matrix of biotite and muscovite lathes (Figure Q-1). Less commonly, quartz grains touch along tangential boundaries. Quartz grains also commonly touch plagioclase grains along tangential boundaries. Angular, jagged-edged grains of plagioclase (25% content, 0.04-0.2 mm diameter) touch along tangential boundaries and commonly show moderate to heavy sericite alteration. Thin, ragged flakes of biotite (15% content, 0.04-0.2 mm diameter) are abundantly distributed, with individual flakes isolated or concentrated in clusters between quartz and plagioclase. Flakes are oriented parallel and their abundance defines color banding in alternating layers (Figure Q-2). Biotite flakes are compacted around angular corners of quartz and plagioclase grains. Rarely, some flakes are completely altered to chlorite. Thin lathes and ragged flakes of muscovite (5% lathe content, 48% content including matrix sericite, 0.01-0.1 mm diameter) are sporadically distributed with individual lathes or flakes abundantly intermixed with quartz and plagioclase. Fine-grained flakes represent a matrix that generally surrounds individual grains of quartz and plagioclase and occupies angular interstices. In other layers, individual lathes are isolated between angular grains of sericitized plagioclase.

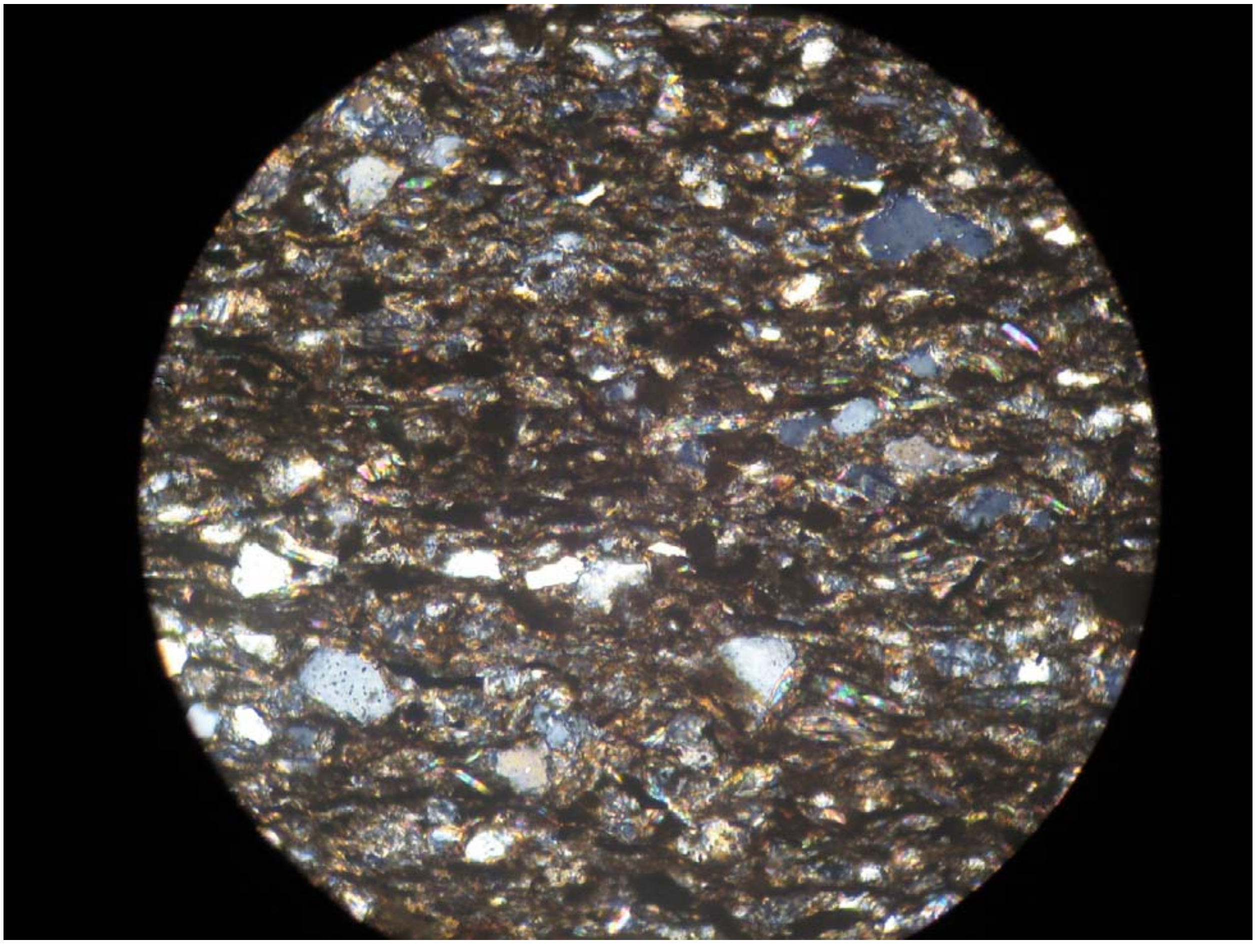

Figure Q-1. Angular grains of quartz (white, yellow) and plagioclase (gray, with dusty sericite alteration) are generally surrounded by a matrix of biotite (dark brown), muscovite (brightly speckled), and illite or very fine-grained muscovite in this sample of coarse siltstone from the 1 North Panel face roof. Field of view 1 mm at 100X.

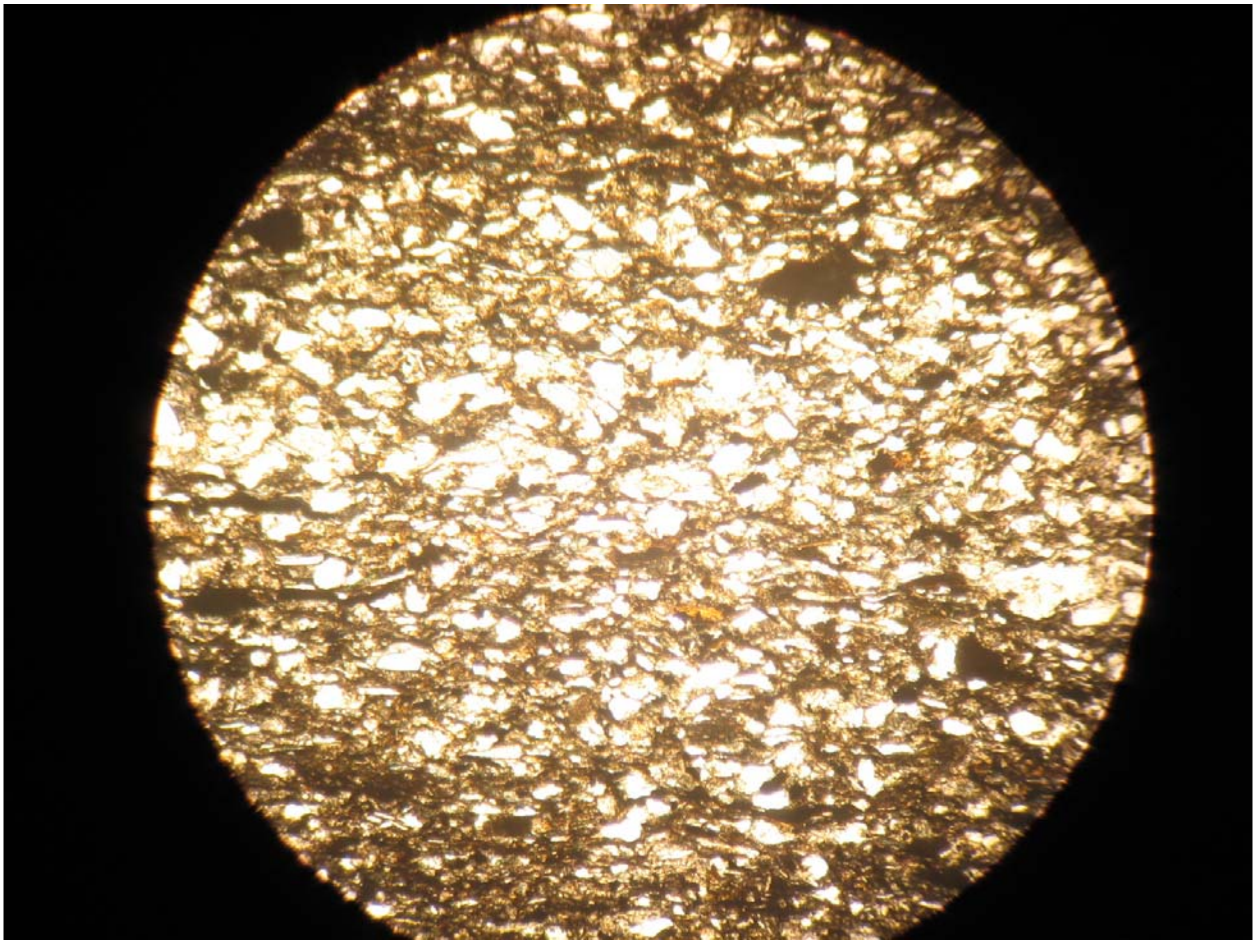

Figure Q-2. The roof rock, viewed in plane polarized light, reveals how changes in the concentration of biotite mica impart the effect of color banding in the coarse siltstone collected from the 1 North Panel face roof. Field of view 1 mm at 100X.

The sandstone, characterized as feldspathic arenite/wacke or arkose, is comprised of angular grains of quartz, plagioclase, and minor microcline that touch along tangential or concavo-convex boundaries, with individual grains or clusters of grains surrounded by a matrix of illite or very fine-grained muscovite (Figure Q-3). Angular, commonly jagged grains of quartz, ranging in size from 0.07-0.6 mm in diameter and constituting 43% of the rock, touch along tangential or concavo-convex boundaries. Angular grains of plagioclase, ranging in size from 0.07-0.4 mm in diameter and constituting 34% of the rock, touch along tangential and concavo-convex boundaries, and are commonly intermixed between larger quartz grains, and exhibit light to moderate sericite alteration. Angular grains of microcline, ranging in size from 0.2-0.3 mm in diameter and constituting 6% of the rock, are sparsely distributed, surrounded by angular grains of quartz and plagioclase. Ragged lathes of muscovite (5% lathe content, 17% including sericite, 0.04-1.1 mm diameter) are sporadically distributed, with individual lathes isolated by surrounding quartz and feldspars (Figure Q-4).

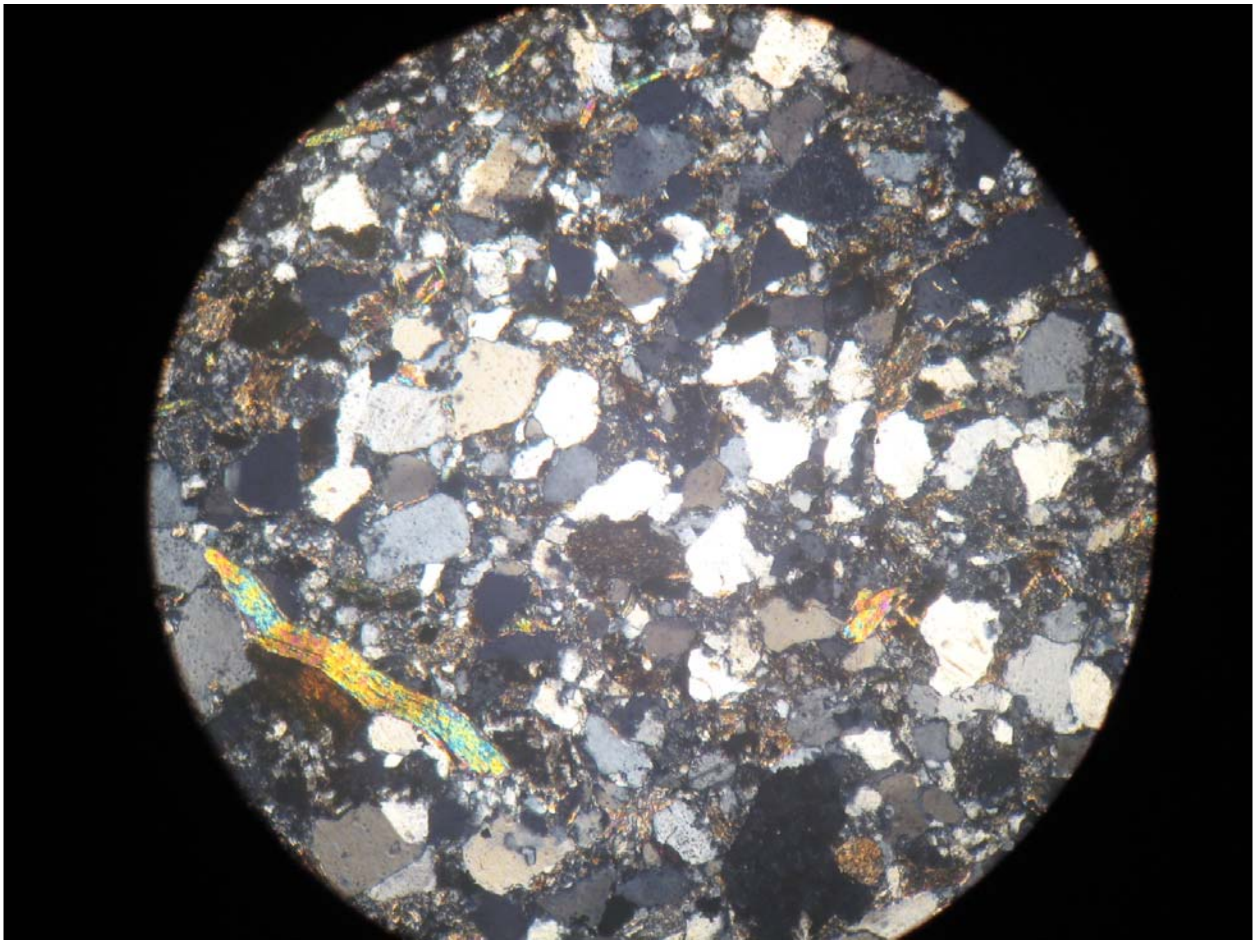

Figure Q-3. Layer of feldspathic arenite interbedded with coarse siltstone from the roof of 1 North Panel face is characterized by angular grains of quartz (white), plagioclase (gray, with dusty sericite alteration), and rare microcline (plaid black and gray) that touch along tangential and concavo-convex boundaries that leave few interstices for illite/muscovite matrix material. Field of view 2.4 mm at 40X.

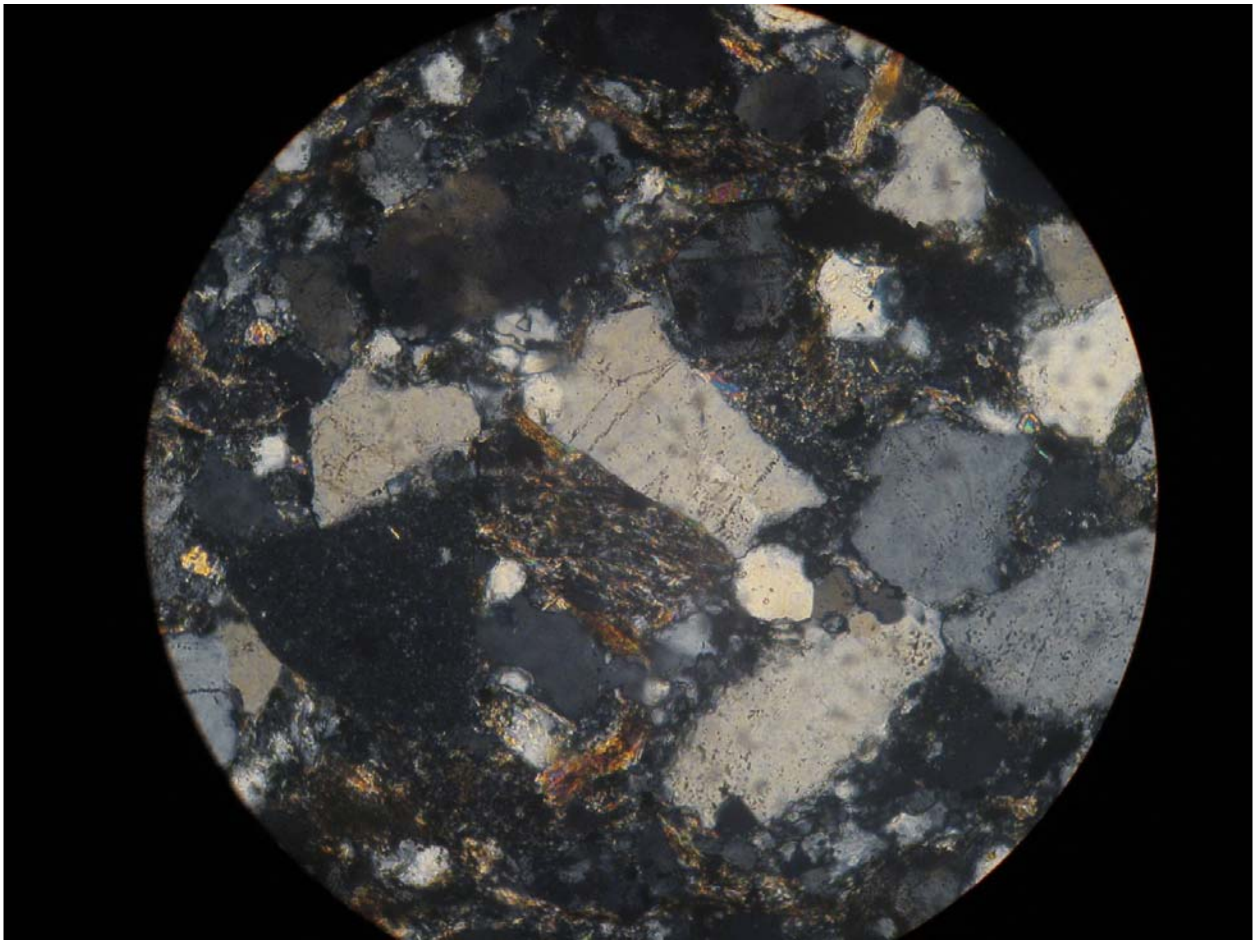

Figure Q-4. Angular grains of quartz (white, shadowed) and plagioclase (gray, with dusty sericite alteration) touch along straight, tangential, and concavo-convex boundaries that leave few interstices for illite/muscovite matrix. Field of view 1 mm at 100X.

A sample of the floor (LWTG ss22582) was collected for petrographic study from the 1 North Panel tailgate entry, from a layer of heaved up sandstone 36 feet outby the longwall face, beneath survey station 22582 (Figure Q-5). Extraction of sandstone from the floor heave slab's brow fully exposed the crack and confirmed earlier observations that the fracture was rootless, and did not extend farther than 12 inches into the floor (Figure Q-6). Based on petrographic study, the rock is classified as fine-grained feldspathic arenite/subarkose sandstone. In general, angular grains of quartz, plagioclase, and minor microcline interlock along straight, concavo-convex, and sutured boundaries with small flakes of muscovite sporadically scattered throughout the rock. Small, angular interstices between quartz and plagioclase are filled with sericite, and plagioclase grains commonly exhibit light to moderate sericite alteration. Angular quartz grains, ranging in size from 0.03-0.2 mm in diameter and constituting 74% of the rock, interlock with each other and plagioclase along straight, concavo-convex, and less commonly, sutured boundaries, especially between quartz grains. Small patches of quartz grains exhibit sutured boundaries that meet at 120° angles. In layers with more sericite in larger interstices, grain to grain contacts may become tangential. Interstitial material and open spaces are rare, with mostly grain to grain contacts. Angular plagioclase grains, ranging in size from 0.07-0.1 mm in diameter and constituting 11% of the rock, interlock with surrounding quartz grains along concavo-convex and straight boundaries. Grains are commonly lightly to moderately altered to sericite (Figure Q-7). Less commonly, grains interlock with quartz along complexly intergrown, sutured boundaries. Angular microcline grains, ranging in size from 0.1-0.2 mm in diameter and constituting 2% of the rock, are roughly rectangular and distributed sparsely throughout the rock, with individual grains surrounded by quartz and plagioclase, with which they interlock along straight and concavo-convex boundaries. Flakes of biotite, ranging in size from 0.07-0.2 mm in diameter and constituting 5% of the rock, are sporadically distributed uniformly throughout the rock, with individual flakes isolated by surrounding grains of quartz, plagioclase, and microcline. Areas of locally higher biotite content represent discontinuous mica-rich interbeds within the sandstone matrix. The long axes of flakes are aligned roughly parallel, reflecting indistinct bedding. Some flakes have been extensively altered to chlorite. Flakes of muscovite, ranging in size from 0.01-0.4 mm in diameter and constituting 8% of the rock if illite and "sericite" is included, are sparsely distributed throughout the rock, with individual flakes isolated between surrounding grains of quartz and feldspar. Muscovite flakes represent only 3% of the rock, with interstitial illite or sericite representing 5%. Angular grains of accessory apatite are sparsely distributed throughout the rock, with individual grains isolated by surrounding quartz and feldspars.

Figure Q-5. Sample of sandstone was collected from floor heave brow beneath survey station 22582 in 1 North Panel longwall tailgate, 36 feet outby the face. Brow of heaved sandstone slab reveals rootless crack.

Figure Q-6. View of exposed floor heave crack looking straight down, with hammer and tape measure for scale. The crack is rootless and dies out approximately 12 inches into the floor at a layer of shale.

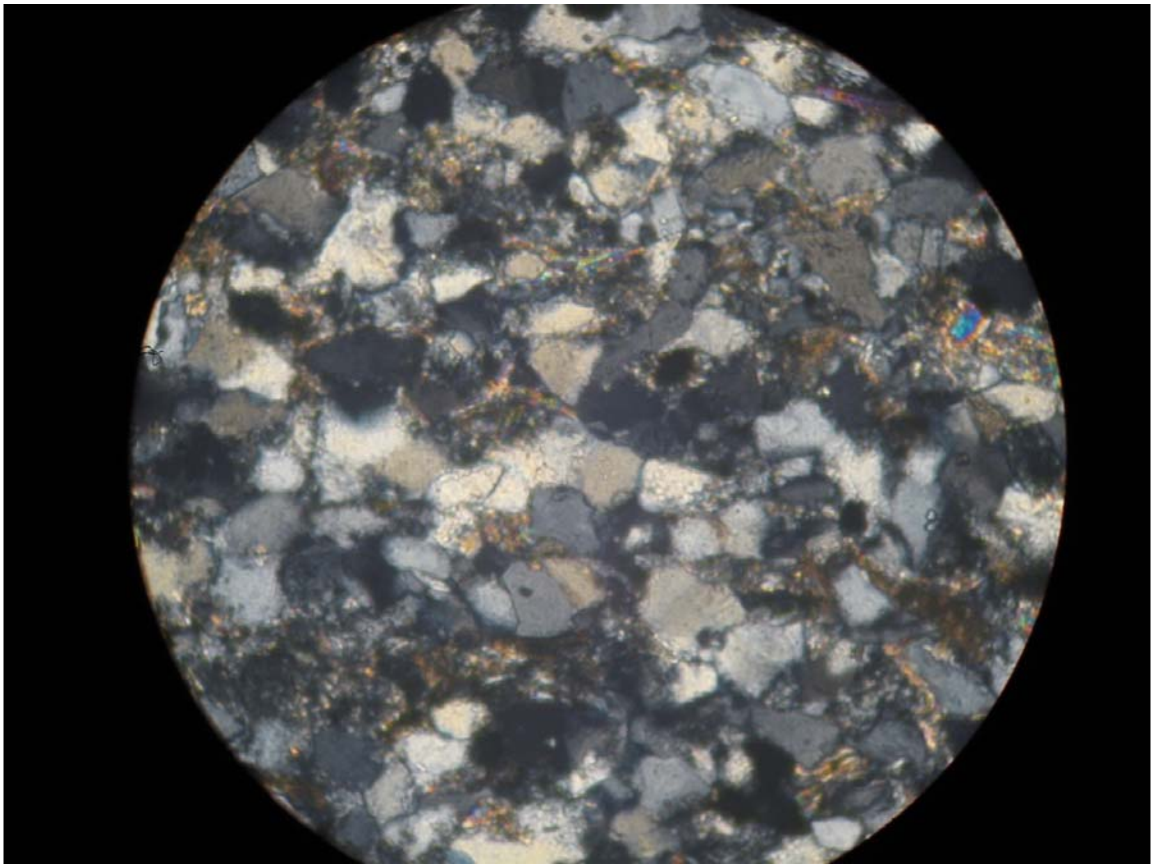

Figure Q-7. In fine-grained feldspathic arenite/subarkose sandstone from floor, angular grains of quartz (yellow, gray) and plagioclase (wavy shades of gray) interlock along straight, concavo-convex, and sutured boundaries, with only minor amounts of mica or sericite in small, rare interstices. Cluster of quartz grains at center of view interlock along sutured boundaries that meet at roughly 120° angles, indicating compaction recrystallization. Field of view 1 mm at 100X.

Compared to the sample collected from the roof, the floor sample contains a much greater quartz content, and is characterized by a much greater degree of grain interlocking, with a significant number of concavo-convex and sutured boundaries. Several areas exhibit sutured boundaries along quartz grains that meet at 120° angles, indicating a degree of diagenetic compaction recrystallization. Similarly, mica flakes are wrapped around obdurate quartz grains due to intense compaction. Due to the higher quartz content in the floor sandstone, it has a higher average Mohs Hardness value of 6.31, compared to a value of 5.83 for the sandstone in the roof, or 3.64 for the dark gray siltstone in the roof. Furthermore, the floor sandstone appears to be more fine-grained, with maximum grains sizes of 0.2 mm compared to grains sizes of 0.4-0.6 mm in the roof sandstone. The grain size distribution also seems more uniform in the floor sandstone.

Based on the mineral contents determined by thin section petrography, the samples were plotted on the ternary diagram developed by Ward et al. (2001) for comparison with the incendivity index developed for rocks in Australian coal mines (Figure Q-8). The layers of coarse siltstone, which contain a high mica content, plot in Category 1, indicating a low potential for frictional ignition. In contrast, the sandstone plots in Category 4, indicating a high potential for frictional ignition. The floor sandstone very nearly plots in the Category 5 zone, due to its high quartz content. It should be noted that the incendivity index applies to rock-on-rock and metal-on-rock ignitions. Thus, sandstone falling in the gob behind the shields, or sandstone being struck by bits on the shearer would both represent potential ignition sources.

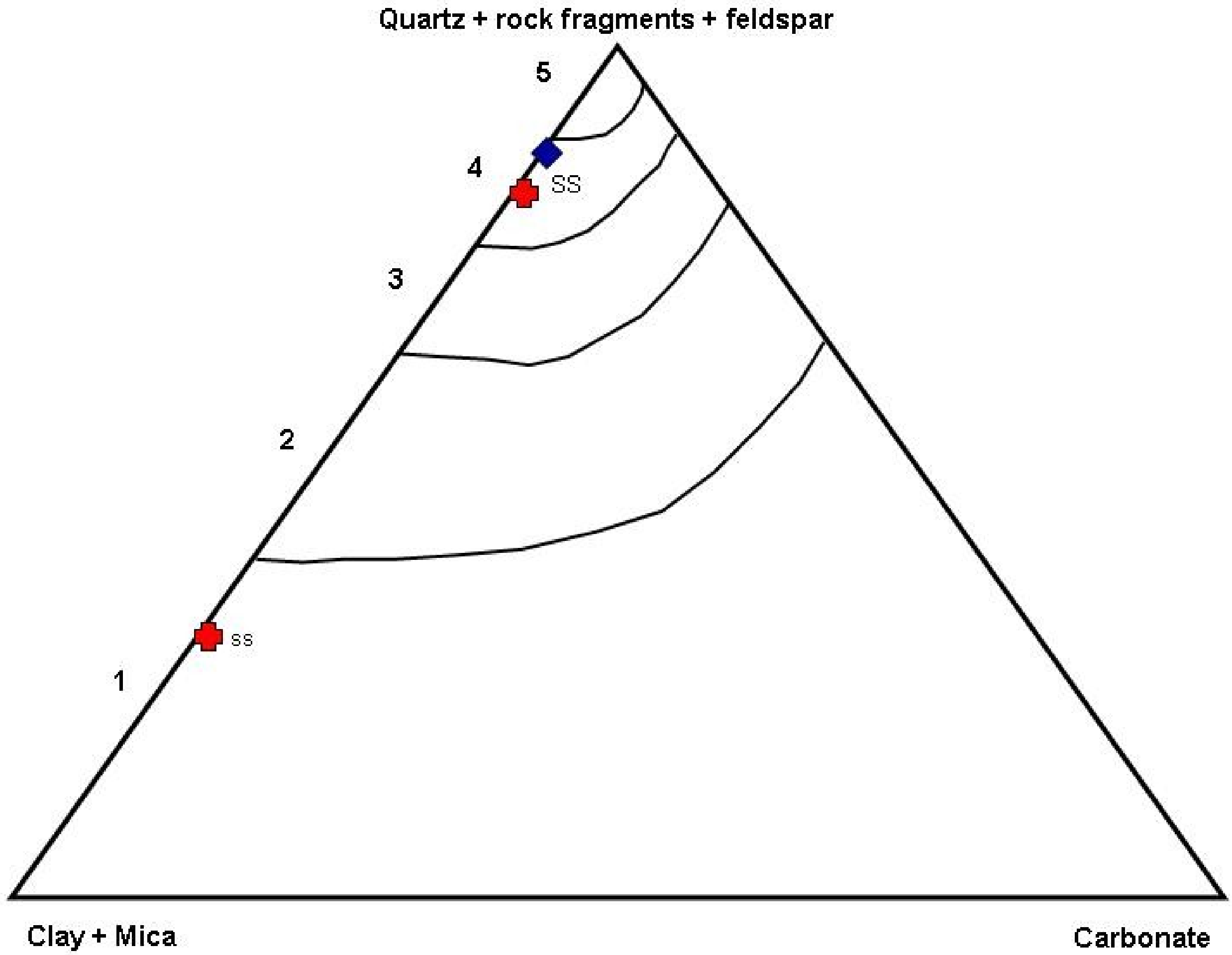

Figure Q-8. Ternary diagram after Ward et al. (2001) showing relation of Upper Big Branch roof (red crosses) and floor (blue diamond) sandstone (SS) and siltstone (ss) to contour lines of incendivity index. Rocks with an incendivity index of 4-5 were shown in tests to have a high potential for frictional ignition. Although sandstone from roof and floor have similar incendivity indices, the floor sample is composed dominantly of quartz.

APPENDIX R

WATER SUPPLY SYSTEM TO THE LONGWALL SHEARER DUST SPRAYS

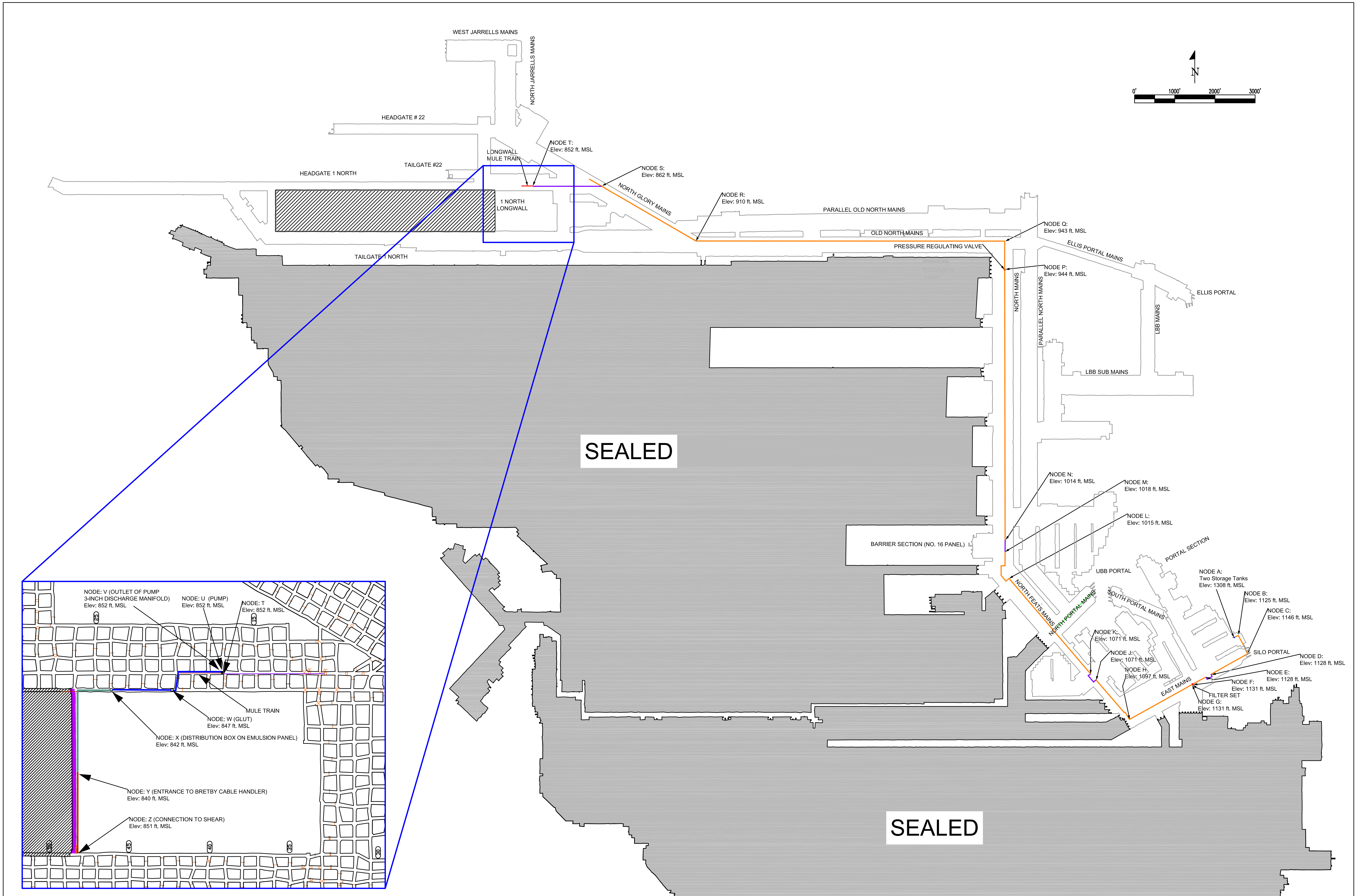

FIGURE R–1

Location of Waterline Supplying the Mule Train

Upper Big Branch Mine – South

Performance Coal Company

MSHA ID No. 46–08436

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
TECHNICAL SUPPORT

Appendix R: HYDRAULIC ANALYSIS REPORT

Water Supply System to the Longwall Shearer Dust Sprays

Upper Big Branch Mine-South (MSHA ID 46-08436)
Montcoal (Raleigh County), WV

April 5, 2010

PAR 98947

Prepared By:

Derrick M. Tjernlund, PE
Sr. Fire Protection Engineer

November 26, 2011

-Originating Office-
Approval and Certification Center
Mechanical and Engineering Safety Division
Dennis Ferlich, Chief
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Triadelphia, West Virginia 26059

Executive Summary

This report identifies the methods and conclusions of an analysis conducted to determine the capability of the mine water system to adequately supply water to the Shearer dust sprays on the Longwall mining machine at the No. 1 Longwall Panel. This analysis was requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page. The analysis is based upon conditions believed to be existing just prior to the mine explosion of April 5, 2010.

The methodology herein was a four step process:

Step 1: Determine the rate of water flow needed for various equipment, along with the pressures at the equipment. In this case, the equipment in question was the dust control sprays on the longwall Shearer and related longwall equipment (longwall Shields and Stage Loader).

Step 2: Evaluate the water supply to determine the available pressure for the needed flow at a strategic location in the water distribution system. For this analysis, the strategic location chosen was the discharge side of the booster pump on the longwall mule train (Node U on the corresponding mine map, Appendix R, Figure R-1).

Step 3: Starting at the Shearer sprays and using the flows determined in Step 1, calculate hydraulic pressure losses traveling upstream to the same strategic location referenced in Step 2 (Node U). This provides the pressure required to maintain the needed flow determined in Step 1.

Step 4: Compare the pressure required in Step 3 to the available pressure determined in Step 2. If the required pressure exceeds the available pressure, the water system is deemed inadequate. For the analysis conducted herein, the required pressure exceeded the available pressure for all the flow scenarios that were considered.

The following assumptions and conditions apply to the analysis.

1. Because the fluid is water and all piping and hoses are assumed to have smooth internal linings, hydraulic pressure losses due to friction in the piping or hoses can be determined accurately using the Hazen-Williams formula. This accuracy is generally considered adequate for water up to velocities of approximately 25 feet per second. The Hazen-Williams formula is normally expressed as:

$$P_{loss} = \frac{4.52Q^{1.85}}{C^{1.85}D^{4.87}}L \qquad \text{(R-1)}$$

Where:

P_{loss} = pressure loss in pounds per square inch (psi) end to end in the pipe or hose
Q = flow through the pipe in gallons per minute (gpm)
D = internal diameter of the pipe or hose (inches)
L = length of the pipe or hose (feet)
C = Hazen-Williams factor representing the internal smoothness of the pipe

2. A Hazen-Williams C value (pipe smoothness factor) of 150 was used for all calculations. The lower the C value, the rougher the pipe or hose lining and the greater will be the pressure losses for a given flow. A C value of 150 represents very smooth pipe or hoses in a typically brand new condition. This value is being used since the actual internal conditions of the hoses and piping is unknown. One method of determining the actual C values for piping would be to conduct a detail hydraulic profile flow test of the system. However, the water system was damaged by the explosion and out of service, thus eliminating any opportunity to flow test it.

3. Velocity pressure differences between any reference point and related locations were not considered where such differences were less than 4 psi, which was the case in all analyzed situations. Furthermore, flow velocities were well below the upper limit of about 25 feet per second.

4. The flow characteristics of the Shearer are based upon both flow testing conducted underground on the Shearer on December 20, 2010, and upon flow estimates based upon nozzle data received from the MSHA UBB accident investigation team. Four scenarios for various combinations of flows were considered in the analysis.

5. For large diameter piping and hoses, and for long runs of smaller hoses, minor losses for fittings were considered negligible and have been excluded from the analysis. Where minor losses were deemed important, details were included in the Node by Node description of the water system. Additionally, the main water line contained a number of in-line control valves to isolate sections of the water line for the purpose of maintenance. It is assumed all of theses valves were in the fully open position and any losses across these valves are negligible.

6. Elevations of important or useful locations in the mine were estimated using a mine map showing "bottom" elevations. These elevations are listed in feet above mean sea level (MSL)[1]. All elevations, pressure sources, pressure losses, and net pump discharge pressure have been converted to equivalent feet of head for inclusion on the hydraulic profiles (Figures R-2 through R-5). Before plotting the data on a hydraulic profile, each pressure head value must be added to the elevation at the location in question. The equivalent feet of head for a pressure value can be determined by multiplying the pressure in psi by 2.31. The equivalent pressure value in psi for a given feet of head can be found by dividing the head by 2.31.

7. For the analysis, calculated pressures were rounded down to the nearest whole psi for required pressures, and rounded up to the nearest whole psi for available pressures, except where the decimal value was within about 0.2 psi of a whole psi. For those cases, the pressure was rounded to the nearest whole psi.

General Description of the Mine Water System

The Upper Big Branch mine water supply was a gravity fed system supplemented with underground booster pumps placed at strategic locations. For the long wall section at the 1 North Panel, two booster pumps, arranged in parallel, were located on the most outby car of the longwall mule train.

Water for the system was stored in two steel cone roof surface tanks located on the hilltop above the southeast corner of the mine near the Silo Portal where the No. 1 South Belt exits the mine. The bottom elevation of the tanks was reported to be 1308 feet above MSL.

The main water line between the tanks and the various parts of the mine consisted primarily of PVC plastic piping known as "Yelomine" pipe, a trademark of the Certainteed Corporation. The wall thicknesses and pressure ratings for this type of pipe are based upon SDR (standard dimensional ratio number) specifications. The main water line is primarily 8-inch piping but there were some sections consisting of 6-inch piping, including a long run in the No. 1 Headgate North Mains. Yelomine piping sections visually examined had an SDR number of 13.5, giving it a pressure rating of 315 psig.

The water system had two locations where filter canisters removed sediment or debris from the water. The first bank of filters consisted of ten filters in parallel located approximately midway in the East Mains. The second bank consisted of

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[1] "feet above mean sea level" is hereafter abbreviated "ft MSL".

four filters in parallel located on the longwall mule train booster pump car. The filter media were metal baskets consisting of No. 60 sieve material[2]. Several weeks before the explosion, the mine operator had stopped using cloth bags, commonly referred to as socks, typically sized to filter either at the 10 micron or 100 micron particle size.

The layout of the water system is shown on two mine views presented in Appendix R, Figure R-1. One view shows the overall water line routing from the tanks to the longwall mule train connection; the second view shows the routing from the mule train connection to the Shearer connection. In both views, important locations are identified with individually lettered node labels. Certain letters, specifically I and O, were not used to designate nodes to prevent possible confusion with the numbers one or zero. The nodes were established as part of this analysis for the convenience of specifying various strategic locations along the water system routing.

Node to Node Description of the Water System

Node information, along with estimated pipe lengths between nodes, is summarized in Table 9 and Table 10. Elevations and node descriptions are also shown in these two tables. As indicated above, node locations are shown on the Appendix R Mine Map, Figure R-1.

Node A

This node is at the discharge from the storage tanks. Its elevation was reported to be 1308 feet MSL. Assuming a tank height of 28 feet including cone roof, and a fill level of 25 feet within each tank, the elevation when the tank is full would be at approximately 1333 ft MSL.

Piping to next node

The exact route of piping was not determined, but was approximated based upon the location of most likely useful mine entries. It is assumed that all piping is 8-inch Yelomine with an SDR of 13.5.

Node B

The exact location of this node is assumed based upon the location of mine entries. The elevation is approximately 1125 ft MSL.

Piping to next node

As with the piping between Node A and B, the exact route of piping was not determined, but was approximated based upon the location of most likely

[2] A US 60 sieve will prevent passage of particles larger than 250 microns.

useful mine entries. It is assumed that all piping is 8-inch Yelomine with an SDR of 13.5.

Node C

The exact location of this node is assumed. The connection point to the East Mains water line in this area could not be found due to a large build up of rib sloughage and rock dust which buried this part of the water line. The elevation is approximately 1146 ft MSL.

Piping to next node

Except for the portion near the No 1 belt Silo Portal exit where the pipe was covered in sloughage, the piping was field verified as 8-inch Yelomine, SDR 13.5 piping. It ran on the mine floor alongside the belt conveyor in the East Mains.

Node D

This node is located at the No. 17 Break of the East Mains belt entry, at approximately 1128 ft MSL.

Piping to next node

This piping was field verified as 6-inch Yelomine, SDR 13.5 piping which moved over to an adjacent entry for two breaks, possibly to avoid the congestion created by a section-belt dumping point onto the main belt at Break 18.

Node E

This node is located at the No. 19 Break of the East Mains in the belt entry. It's elevation is approximately 1128 ft MSL.

Piping to next node

This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. It ran on the mine floor alongside the No.1 Belt conveyor in the East Mains.

Nodes F and G

These two nodes are at an elevation of approximately 1131 ft MSL. They are located in the belt entry, between break Nos. 24 and 25, and represent the connections into and out of a filter set consisting of ten parallel metal basket filters contained within individual cylindrical stainless steel pressure enclosures. These filters are Rosedale model 8-30-2P-150-S-B-S-BM60 filters.

Even under the highest flow rate considered (344 gpm), the flow through this filter set would be split roughly equally between the ten filters, or about 35 gpm through each. Examination of performance curves in the Rosedale technical literature indicate that at a flow of approximately 35 gpm, the loss across the filter is about 0.1 psi. Even with the short lengths of intervening 2-inch piping and fittings, the loss across the entire filter set is considered negligible at less than 1 psi.

Piping to next node
This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. As before, it ran on the mine floor alongside the No.1 Belt conveyor in the East Mains.

Node H
This node is located at the No. 49 Break of the East Mains in the belt entry. It's elevation is approximately 1097 ft MSL. At this point, the line makes a 90 degree turn into the Northeast Mains.

Piping to next node
This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. It ran on the mine floor alongside the Northeast Mains belt conveyor line.

Node J
This node is located at the No. 15 Break of the Northeast Mains in the belt line entry. It's elevation is approximately 1071 ft MSL.

Piping to next node
At Node J, the 8 inch piping reduces to 6-inch Yelomine, SDR 13.5 piping and moved over to the adjoining parallel entry for two breaks.

Node K
This node is located at the No. 17 Break of the Northeast Mains in the belt conveyor entry. It's elevation was also approximately 1071 ft MSL.

Piping to next node
At Node K, the 6-inch piping transitions back to 8-inch Yelomine, SDR 13.5 piping and continued along the belt line. At about No. 31/32 Break, the water line was located near the roof, crossing over the track entering along the North Portal Mains.

Node L
This node is located at the No. 51 Break of the East Mains in the belt entry. It's elevation was approximately 1015 ft MSL.

Piping to next node
At Node L, the water line rerouted over to the adjacent track entry and continued along the track for approximately 4 breaks. It then returned to the

belt entry at No. 56 Break and continued inby. This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. Starting at No. 56 Break, the Northeast Mains became the North Mains.

Node M

This node is located between the No. 59 and 60 Breaks of the North Mains in the belt entry. It's elevation is approximately 1018 ft MSL.

Piping to next node

At Node M, the piping reduced to 6-inch Yelomine, SDR 13.5 piping. It ran on the mine floor alongside the Belt conveyor. However, the belt conveyor ends at No. 61 Break.

Node N

This node is located between the No. 62 and 63 Breaks of the North Mains in the belt entry. It's elevation is approximately 1014 ft MSL.

Piping to next node

This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. It ran on the mine floor in the former belt entry in the North Mains. This run of pipe is the second longest section of piping at just over 7000 feet in length.

Node P

This node is located at the No. 128 Break of the North Mains. It's elevation is approximately 944 ft MSL. At this location, an in-line pressure reducing valve (CLA-VAL model CLA 90-01/690, rated at 0 to 300 psi) was installed. Statements by mine personnel indicated the valve was set to maintain a maximum pressure of 150 psig to the inlet of the booster pump at the longwall mule train. Based upon the difference in elevation between the pump and this reducing valve, the valve would have been set to reduce pressure to approximately 115 psig at the reducing valve outlet. (The pump is located at Node U.)

Piping to next node

This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. It continued north, and at the No. 134 Break of the North Mains, crossed the east/west track serving the Ellis Portal. It continued one more break north to the No. 4 belt entry in the Old North Mains.

Node Q

This node is located at Survey Station # 18655 in the Old North Mains. It has an elevation of approximately 943 ft MSL.

<u>Piping to next node</u>
This piping was field verified as 8-inch Yelomine, SDR 13.5 piping. It ran on the mine floor alongside the belt conveyor in the Old North Mains. This is the longest run of water line at just under 7700 feet in length.

<u>Node R</u>
This node is located at the No. 76 Break of the Old North Mains belt entry. It's elevation is approximately 910 ft MSL.

<u>Piping to next node</u>
From this node, the water line turns into the belt entry in the North Glory Mains. The piping was field verified as 8-inch Yelomine, SDR 13.5 piping.

<u>Node S</u>
This node is located between the No. 103 and 104 Break of the North Glory Mains. It's elevation is approximately 862 ft MSL. At this location, the water line flow path splits into two directions. The first direction is the existing the 8-inch line continuing inby along the belt conveyor toward for the No. 22 Longwall panel development section. The other flow path, the 6-inch pipe discussed next, is routed in the adjacent parallel entry to the belt entry for the No. 1 Headgate North Mains.

<u>Piping to next node</u>
This piping was field verified as 6-inch Yelomine, SDR 13.5 piping. It ran on the mine floor alongside the No. 1 Longwall Panel belt conveyor toward the mule train. At the No. 8 Break of the No. 1 Headgate North Mains, the track enters this entry and continues inby alongside the water line.

<u>Node T</u>
This node is located just inby No. 17 Break of the No. 1 Headgate North Mains. It's elevation is approximately 852 ft MSL.

<u>Piping to next node</u>
At this node, the 6-inch pipe changes to 4-inch hydraulic hose. This arrangement consisted of approximately 26 feet of 4-inch hydraulic hose connected to a 5 foot length of 4-inch schedule 40 steel pipe. Four 2-inch schedule 40 steel pipes tap off of the 4-inch pipe to feed four individual metal basket filters, each in a stainless steel filter housing. On the discharge side of the filters, 2-inch piping then connected the flow to a second 4-inch schedule 40 steel pipe approximately 7 feet long which fed the suction sides of the two parallel booster pumps.

The four filters were similar to the ten filters at the filter set located between Nodes F and G. The valving to one of the four filters was found shut, thus splitting the maximum considered flow of 344 gpm pump flow approximately evenly between the other three filters, or approximately 115 gpm through each. Even at this higher flow, the pressure loss across the filters was less than 1 psi and thus considered negligible. However, the 115 gpm flow through the 2inch piping was not considered negligible.

The 2-inch piping consisted of approximately 4 feet of actual pipe and 51 feet of equivalent pipe for the fittings consisting of four elbows, two gate valves, and one tee (total of 55 feet of equivalent 2 inch pipe). The equivalent pipe length for the fittings is based upon a Hazen-Williams C value of 150. To simplify the analysis, the Hazen-Williams equation was used to determine an equivalent length of 4 inch hose for the three parallel paths of 55 feet of 2-inch hose. This can be expressed as:

$$\frac{4.52 Q_4^{1.85}}{C_4^{1.85} D_4^{4.87}} L_4 = \frac{4.52\left(\frac{Q_4}{3}\right)^{1.85}}{C_2^{1.85} D_2^{4.87}} L_2 \qquad \text{(R-2)}$$

Here the subscripts refer to the 2-inch and 4-inch pipe respectively. Assuming the C values for both pipes are the same (150) and using nominal diameter for the four inch hose (4.00 inches) and the schedule 40 steel pipe diameter (2.067 inches) for the 2-inch pipe, solving equation R-2 for L_4 yields an equivalent length of 180 feet for a single four inch hose carrying 344 gpm versus three parallel paths of 55 feet of 2-inch steel pipe, each carrying 115 gpm.

In addition to the 26 feet of 4-inch hydraulic hose, the total 4 inch steel pipe was approximately 11 feet in length. This brings the total length of equivalent four inch hose to 217 feet (26+180+11).

Node U

This node is located at the longwall mule train No. 1 booster pump. The pump is on the first car of the mule train just inby No. 17 Break of Headgate No. 1 North Mains. The elevation of this node is approximately 852 ft MSL.

There are actually two booster pumps plumbed in parallel. They were normally operated one at a time. After the accident, the pump located on the pump car toward the belt side of the entry (referred to as pump No. 1) was found with its valves open, indicating it was in use. The inlet and discharge valves for the other pump (referred to as pump No. 2) were found closed.

The nameplate data for the No. 1 booster pump is:

Mfgr: Sunflo
Model: P3-BVK
s/n B1020796-01
Rating: 350 gpm at 1470 feet discharge head

The No. 1 pump is powered by a three-phase AC induction motor with the following nameplate data.

Mfgr: Reliance Electric
Horsepower: 300
Volts: 460
Amps: 326
Service factor: 1.15
Model: P44G5183B
Frame: 449TS
Design: B
Speed: 3570 RPM

For reference, the No. 2 booster pump had a rating of 350 gpm at 1480 feet of head, and was thus nearly identical to the No. 1 pump.

Piping to next node
This piping is the discharge manifold off the pump and consists of 3-inch schedule 40 steel pipe. Together with the fittings, the equivalent length of 3-inch piping was 68 feet.

Node V
This node is at the inby end of the pump discharge manifold piping where the discharge flows into two parallel 2-inch hydraulic hoses. The elevation is also 852 ft MSL.

Piping to next node
This piping consists of two 2-inch hydraulic hoses running in parallel on the mine floor to No. 20 Break, where it turns and travels over to the longwall belt entry.

Node W
This node is located at a water distribution box referred to as the "glut." At the glut, the flow connects to the hoses running in the longwall monorail system. The elevation of the glut is approximately 847 ft MSL.

Piping to next node

This piping is two 2-ich hydraulic hoses running in parallel on the monorail system.

Node X

At this node, located approximately one break outby the location of the longwall face, the two monorail 2-inch hoses connect into a distribution box that splits the incoming flow into three out going flows: water to the Shear, water to the shield dust sprays, and water to the Stage Loader sprays and cooling for the crusher motor.

It is assumed for the analysis that all three flows normally add to the flow rating of the booster pumps of 350 gpm, which would be the basis for the rating of the pumps used.

The elevation of this node is approximately 842 ft MSL.

Piping to next node

For the supply to the Shearer, the water traveled in a single 2-inch hydraulic hose that ran in a hose/wire bundle suspended beneath the chain conveyor framing.

The elevation of this node is approximately 840 ft MSL.

Node Y

This node is located where the 2-inch hydraulic hose connects to the hose in the Bretby cable handler. This is a traveling cable tray that runs between the center of the longwall and the Shearer. It allows cables and the water supply needed by the Shearer to travel back and forth with the Shearer as it traverses the length of the longwall from headgate to tailgate.

Piping to next node

This piping is single 2-inch hydraulic hose that is enclosed in the Bretby cable handler.

Node Z

This node is located at the Shearer water inlet connection on the Shearer body. At the location where the Shearer was found after the accident, the elevation was approximately 851 ft MSL.

STEP 1, Longwall Shearer Water Requirements

There are two aspects to developing the flow characteristics of the longwall Shearer. The first is to develop an estimate for minimum acceptable needed flow to the sprays on the Shearer to meet the requirements of the approved dust control plan. The second is to develop an estimate of the actual hydraulic characteristics of the Shearer water spray distribution system.

Required minimum Shearer flow per the dust control plan
The shearer dust sprays included a mixture of nozzles of various types different from those listed in the approved dust control plan. The approved dust control plan listed Conflow Code 2801CC full-cone staplelock nozzles having a 1/16-inch orifice. However, documentation from the mine operator indicated use of 116 nozzles identified as Flow Technologies model 791C full cone staplelock sprays having 3/32-inch orifices (0.094 inches). There were also 41 sprays listed as made by the Spraying Systems Company. Field examination of the nozzles confirmed them to be those made by Flow Technologies. Flow Technologies maintains that at the same pressure, their nozzles produce equivalent flow and patterns to Conflow nozzles having 3/32 inch orifice. The field examination found that approximately 1/3 of the installed staplelock sprays were jet sprays, with the remainder being cone sprays. Each pattern type produces a different flow rate at any given pressure.

The Spraying Systems nozzles were reported as model BD-5, based upon field examination of the nozzles installed on the Shearer and Stage Loader. Some spare nozzles found in the longwall supply area were BD-3 or Steinin 5-5 nozzles. Steinin indicated their 5-5 nozzles had the same flow characteristics as the Spraying Systems BD-5 nozzles. There were no BD-3 nozzles observed as installed on the Shearer or Stage Loader.

The dust control plan required all nozzles at the shearer to have at least 90 psi when flowing. At this pressure, the staplelock full cone spray nozzles would flow approximately 1.32 gpm each, while the staplelock jet spray nozzles would flow approximately 1.75 gpm each. The BD-5 nozzles had a flow of 1.5 gpm each.

Based upon nozzle counts and field observations, two possible flow conditions were estimated. These were based upon summing the minimum flow from each nozzle on the Shearer when each nozzle is at a pressure of 90 psi. A third flow condition was developed based upon data from the mine operator for nozzles at 125 psi (refer to Step 1 in the analysis for more detail).

Shearer Flow Condition 1
116 staplelock cone sprays

41 Systems Spraying BD-5 nozzles.
Total flow 214 gpm.

Flow condition 1 at the Shearer has been included in the analysis, but is not representative of nozzles observed as installed on the Shearer.

<u>Shearer Flow Condition 2</u>
116 staplelock nozzles,
  78 cone sprays,
  38 jet spray
41 Systems Spraying BD-5 nozzles.
Total flow 231 gpm.

This second flow condition is based upon the field observation that approximately one third of the Shearer staplelock nozzles were jet sprays, while the remainder were cone sprays.

Note that the total flows provided in the flow conditions are the minimum flows into the Shearer needed to conceptually meet the 90 psi criteria. Since it is not likely that all nozzles will have the same pressure at any given total flow condition, total flows higher than the minimum would probably be needed under realistic conditions to ensure each nozzle having the minimum pressure of 90 psi. However, only the minimum flow is considered here since determining or predicting the pressure at all nozzles simultaneously is not practicable.

<u>Equivalent flow characteristics of the Shearer as found</u>
To establish an estimated equivalent flow characteristic for the Shearer, it was necessary to flow test the Shearer spray system. Since the normal mine water system was damaged by the explosion and out of service, it was necessary to provide a temporary water supply. During the flow test, gravity fed water from the surface above the mine was delivered through a bore hole near the longwall section and then through temporary piping over to the Shearer. At the Shearer, a test manifold was assembled consisting of filters, an adjustable pressure reducing valve, two in-line flow meters (one belonging to MSHA and the other to the mine operator), and appropriate pressure gages. The pressure reducing valve was used to regulate and adjust the pressure into the Shearer. The flow was then measured at various inlet pressures.

Four tests were conducted on the Shearer on December 20, 2010. However, one of the tests was actually conducted twice after problems were identified when the filters on the test manifold had plugged up.

Because of the location of the Shearer, most nozzles on the headgate drum could not be reached and examined up close as this drum was mostly beneath unsupported roof and was not safely accessible. Additionally, fallen coal and rock around both Shearer drums created a situation making it impossible to view the condition of all nozzles, especially those at the bottom of the drums. Visible nozzles were identified as open, plugged, or missing.

The Shearer flow tests are summarized as follows:

Field Test No. 1
This was the Shearer tested in the post accident (as-found) condition including both plugged and missing nozzles.

Field Test Nos. 2 and 2A
Test 2 was also with the Shearer in the "as-found" condition including plugged and missing nozzles, but with one plugged nozzle on each drum replaced with a pressure gage. The second test (2A) was run after the filters that plugged during test 2 were replaced with clean filters.

Field Test No. 3
In this test, those accessible nozzle openings with missing nozzles had open nozzles installed in those openings. This test represents the Shearer in an arrangement under conditions closer to what it should have been during operating in a properly maintained condition.

Field Test No. 4
In this test, the nozzles that had been installed in openings with missing nozzles for Test No. 3 were again removed. However, nozzles found to be plugged were replaced with un-plugged nozzles. Again, this was done only for nozzle locations that were safely accessible and visible. This test also represents the Shearer in a semi-repaired condition.

For each of the above flow tests, the flow and pressure data were used to estimate an equivalent single orifice nozzle having the same flow characteristics as the entire Shearer with its individual nozzles.

A single orifice nozzle, or an equivalent single orifice nozzle representing multiple nozzles, will have flow characteristics that can be modeled as:

$$Q = kP^n \qquad \text{(R-3)}$$

Where Q is the flow in gpm, P is the nozzle pressure in psi, n is an exponent (equal to 0.5 for an ideal smooth circular orifice), and k is a factor associated with the characteristics of a particular nozzle and takes into account the size, shape, and smoothness of the orifice.

Using appropriate logarithmic identities, equation R-3 can be recast as:

$$\ln Q = n \ln P + \ln k \qquad \text{(R-4)}$$

Equation R-4 has the form of a straight line given as:

$$y = mx + b \qquad \text{(R-5)}$$

Where *x* and *y* are the independent and dependent variable respectively, *m* is the slope of the line, and *b* is the y-axis intercept. The association between equations R-5 and R-4 is as follows:

$$y \to \ln Q,\quad m \to n,\quad x \to \ln P,\quad b \to \ln k$$

For reasonably well behave nozzles, the plot of ln[3](*Q*) versus ln(*P*) will result in a straight line, or nearly straight line, having slope *n* and intercept ln(*k*). Using linear regression analysis, such as provided in the linear trend line feature of Microsoft Excel, the equation for the line can be determined. This linear equation then establishes the values for *n* and *k*. With these values determined, the pressure needed at the Shearer to maintain any specified flow can be estimated from the following:

$$P = \left(\frac{Q}{k}\right)^{1/n} \qquad \text{(R-6)}$$

Test No. 1 is the initial test and most closely represents the Shearer in its as-found condition. Test No. 3 and No. 4 each represent the Shearer in a partially repaired condition, more closely representing how it should have been arranged during normal mining conditions. Using the methodology described above, the equations for the "equivalent nozzle" represented by the Shearer in the various conditions can be expressed in the form of equation R-3. The results were the following:

Test No. 1 Configuration: $Q = 12.44P^{0.469}$

Test No. 3 Configuration: $Q = 7.61P^{0.539}$

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[3] The symbol 'ln' represents the natural log function.

Test No. 4 Configuration: $Q = 12.99P^{0.468}$

Note that the collective effects of various nozzle orifices are reflected in the equivalent *k* factor in equation R-3. The difference between the *k* factors for Test No. 1 and No. 3 should reflect the effect of installing unplugged nozzles where nozzles were missing. This should reduce the total effective discharge opening of the Shearer sprays. The result should be a reduced *k* factor from Test No. 1 to Test No. 3, which as the data reflects, is observed.

The difference between the *k* factors for Test No. 1 and No. 4 should reflect the effect of installing unplugged nozzles where plugged nozzles originally existed. This should increase the effective Shearer discharge opening and result in an increased *k* factor between Test No. 1 and Test No. 4, which as the data reflects, is also observed.

To estimate the overall effect of installing open nozzles where they were found missing (Test No. 3) and replacing plugged nozzles with unplugged nozzles (Test No. 4), the change in *k* factor between Test No. 1 and Test No. 4 is added to the *k* factor of Test No. 3. Inserting the appropriate values into equation R-6 results in an effective Shearer equivalent nozzle of:

Pre-accident Expected Configuration: $Q = 8.16P^{0.539}$

This would approximately be the hydraulic characteristics of the Shearer in the pre-accident condition when properly maintained (no missing nozzles and no plugged nozzles).

Using equation R-6, the appropriate values for *n* and *k* above, and the two flow conditions identified previously, the resulting needed Shearer inlet pressure was:

<u>Flow condition 1</u>: $P = \left(\frac{214}{8.16}\right)^{1/0.539}$ = 428 psi (990 feet of head)

<u>Flow condition 2</u>: $P = \left(\frac{231}{8.16}\right)^{1/0.539}$ = 494 psi (1141 feet of head)

A third flow condition was identified by the mine operator based upon documentation submitted as part of the plan to conduct the underground flow tests on the Shearer. That documentation identified a flow through the Shearer at 224 gpm with all nozzles at a minimum pressure of 125 psi. Additionally, Joy, the longwall mining machine manufacturer, quoted a pressure loss across the

Shearer of 250 psi, although the flow at which this loss occurs was not specified. Hence, a third flow condition was included in the analysis as follows.

Flow Condition 3: 224 gpm at a Shearer inlet pressure of 375 psi (125 + 250).

These flow conditions establish the minimum pressures needed at the Shearer water inlet to conceptually provide either the minimum 214 gpm or 231 gpm spray flows, based upon the flow test results. These pressures become the starting points for Step 3 in the analysis process.

Estimated flow for the Longwall Stage Loader

There were a number of spray nozzles in the Stage Loader and crusher area, including three banks of 5 nozzles and 3 banks of 6 nozzles. The nozzles were identified as a variety of staplelock nozzles and BD-5 nozzles.. The dust control plan referenced a minimum pressure of 60 psi for these sprays. Assuming six full cone staple lock sprays and twelve BD-5 nozzles, all flowing at the minimum 60 psi, a minimum flow of 21 gpm was estimated for the Stage Loader dust sprays. Because the Stage Loader is hydraulically upstream of the Shearer, the pressure in the supply to these Stage Loader nozzles, in reality, could be substantially higher than the minimum 60 psi indicated in the plan. Hence, the actual flow at the Stage Loader could very well have been measurably higher than the minimum estimated 21 gpm.

In addition to the sprays, the water system also supplied cooling water for the Stage Loader and Crusher motors. Four permanent flow meters were mounted on the Stage Loader. The readings of these flow meters were periodically documented in maintenance records. The last records for these flows were 10, 8, 9, and 10 gpm to each cooling circuit. This represents an additional possible flow demand of 37 gpm.

Estimated flow for the Longwall Shields

The survey of the Shields indicated that approximately every fourth or fifth shield was equipped with a pair of BD-5 spray nozzles. Most of these nozzles were operated manually by the longwall operator as the Shearer traveled the face. Most nozzles had control valves, although a limited number did not and were thus always on. Some were identified as having the control valves partially open. A few were disconnected. The Accident Investigation Team estimated the shield spray flow would have likely been about 55 gpm.

The flows for the Stage Loader and Shield sprays are added to the Shearer flow at Node X (emulsion panel distribution box) when these flows are considered in any given scenario.

Four flow scenarios were considered.

<u>Scenario 1</u>: This scenario only included the flow of 214 gpm from the Shearer (Flow Condition 1) in the calculations.

<u>Scenario 2</u>: This Scenario considered the more likely 231 gpm Shearer flow (Flow Condition 2) plus the addition of the minimum Stage Loader flow of 21 gpm, for a total flow upstream beyond Node X of 252 gpm. The Stage Loader motor cooling flow and the Shield spray flow were not considered.

<u>Scenario 3</u>: This Scenario considered Shearer Flow Condition 2 plus all other flows at the Stage Loader and Shield sprays for a total flow of 344 gpm. This is the most realistic flow required. Note that this flow lends credence to the chosen rated capacity of the mule train booster pumps of 350 gpm for each.

<u>Scenario 4</u>: This Scenario considers only the Shearer flow condition 3. No flow demands for the Stage Loader or shield sprays are included.

<u>STEP 2, Determine the Available Pressure at the Mule Train Booster Pump Discharge.</u>

The pressure from the tank to the pump is supplied by gravity. Hence, the pressure available at the pump inlet is the static pressure at the pump inlet minus the friction losses in the piping from Node A to Node U. However, a pressure reducing value is located in this run of pipe (at Node P) and affects the maximum pressure available to the pump inlet. It was reported that this pressure reducing valve was normally set to ensure the pressure at the pump inlet did not exceed 150 psi (347 feet of head).

If the losses in the upstream main piping reduce the pump inlet pressure below the regulated pressure of 150 psi, then the lower pressure is used in the analysis. If the losses do not reduce the pressure at the pump inlet below the regulated value, then the regulated pressure value of 150 psi is used for the pump inlet. To determine which condition exists, the losses in the water line from the tank to the pump inlet must be determined.

<u>Pressure losses in the water supply from the storage tanks to the pump under flowing conditions</u>
The run of pipe from Node A to Node U consists approximately of:

27,525 feet of 8-inch, SDR=13.5 piping (actual ID of 7.347 inches)
2635 feet of 6-inch, SDR=13.5 piping (actual ID of 5.644 inches)
217 equivalent feet of 4-inch hydraulic hose (actual diameter of 4.00 inches)

It is a common practice in water supply analysis to use the Hazen-Williams formula to convert pipes of different sizes to an equivalent length of pipe of one referenced size. In this case, the 6-inch pipe and 4-inch hydraulic hose are converted to equivalent lengths of 8-inch SDR 13.5 piping.

For the 6-inch SDR piping, the equivalent length is:

$$\textbf{Equiv. Length of 8 inch} = (2635)\times\left(\frac{7.347}{5.644}\right)^{4.87} = 9515 \text{ feet}$$

For the 4-inch hose, the equivalent is:

$$\textbf{Equiv. Length of 8 inch} = (217)\times\left(\frac{7.347}{4.0}\right)^{4.87} = 4190 \text{ feet}$$

The total equivalent length of 8-inch pipe from Node A to Node U is thus:

27,525 + 9515 + 4190 = 41,230 feet

Hence, 41,230 feet of 8-inch SDR 13.5 piping will create the same losses at any given flow as the sum of the losses in the actual 8-inch, 6-inch, and 4-inch piping and hoses.

The maximum static pressure occurs with the tank full. This would be at an elevation of 1333 ft MSL. The elevation of Node U is 852 ft MSL, resulting in a difference in elevation of 481 feet of head, or 209 psi of static pressure at the pump inlet.

The four flows were previously identified as: 214 gpm, 252, gpm, 344 gpm, and 224 gpm. Using the Hazen-Williams formula, the losses in the equivalent length of 8-inch piping (41,230 ft) can be calculated for each flow and then subtracted from the available static pressure of 209 psi to get the resulting residual flow at the inlet of the pump. The results are summarized in Table 1. Since all of the resulting net residual pressures are above the regulated pressure of 150 psi, the 150 psi regulated value will be used as the pump input pressure for all four scenarios.

Table 1 – Residual Pressure Available at Pump Inlet for Each Flow Scenario

Flow Scenario	Flow Amount (gpm)	Pressure loss per foot of 8-inch (psi/foot)	Total pressure loss from Node A to Node U (psi)	Net Residual pressure at pump inlet Node U (psi)
1	214	0.0005	21	188
2	252	0.0007	29	180
3	344	0.0013	52	157
4	224	0.0006	23	186

<u>Pressure added by the booster pump.</u>
For each flow Scenario, the inlet pressure to the pump must be added to the net pump discharge pressure. This net pump pressure is the pressure added by the pump to the incoming pressure at the pump inlet. The net discharge pressure varies with flow and is usually provided by the pump manufacturer in the form of a curve plotting pressure against flow, tabulated test data of pressure and flow, or both. In general, as the flow increases through the pump, the discharge pressure decreases.

Although the pump nameplate data indicated a discharge head of 1470 feet (637 psi) at the rated flow of 350 gpm, additional information was obtained from the manufacturer's pump test data for this particular pump. The as-new shop test data indicated a pump curve slightly higher than that identified for this general model of pumps. The information is summarized below.

Table 2 – Booster Pump Net Discharge Characteristics

Pump Flow (gpm) (7.760 inch impeller)	Sunflo Model Discharge Head (feet)	Sunflo Shop Test Discharge Head (feet)
0	1548	n/a
70	n/a	1598
140	1545	1617
210	1532	1621
280	1506	1585
350	1470	1543
385	n/a	1492
420	1351	1428

For the analysis, the higher tested pump data was used. Additionally, where the scenario flow values do not match a test flow, it is a common practice to interpolate the discharge pressure from the curve or tabulated data. However, in this case for any flow scenario, in order to give the water system the benefit of the doubt, the discharge pressure at the next lower flow (higher pressure) is used rather than interpolating the data. This is justified at least in part because the interpolation is a linear process while the curve is non-linear. Linear interpolation will slightly under predict the discharge pressure.

The net pump discharge pressures used in the analysis are summarized in Table 3. In Table 4, the regulated pump inlet pressure of 150 psi has been added to the net pump discharge pressure to arrive at the total pump discharge pressure available for each flow scenario.

Table 3 – Net Pump Discharge Pressure Used for Each Flow Scenario

Flow Scenario	Flow Amount in analysis (gpm)	Pump flow test datum used (gpm)	Net discharge head at flow datum (ft)	Equivalent discharge pressure (psi)
1	214	210	1621	702
2	252	210	1621	702
3	344	280	1585	686
4	224	210	1621	702

Table 4– Total Pressure at Pump Discharge Used for Each Flow Scenario

Flow Scenario	Total Available Pump Discharge pressure (psi)	Equivalent available discharge head (ft)	Elevation plot point on hydraulic profile (ft MSL)
1	852	1968	2820
2	852	1968	2820
3	836	1931	2783
4	852	1968	2820

<u>STEP 3, Determine the Required Pressure needed at the Mule Train Booster Pump Discharge to maintain required flow at the Shearer.</u>

This process requires taking the pressure needed at the Shearer connection (Node Z) and then working backward upstream to Node U. The total required pressure is the sum of the pressure needed at the Shearer plus the losses in the piping or hoses from Node Z back to Node U.

From Node Z back to Node X represents a single run of 1210 feet of 2-inch hydraulic hose. The pressure losses are as follows for the four scenarios, assuming the actual hose diameter is the nominal diameter, which is usually the case for hydraulic hoses.

At node X, additional flow is added for Scenarios 2 and 3, resulting in the total flows of 252 and 344 gpm respectively. Scenarios 1 and 4 do not include any additional flows to the Shearer flow. Table 5 summarized the pressure needed at the Shearer inlet, the line loss back to Node X, and the sum of these pressures resulting in the total required pressure at this node.

Table 5 Resulting Pressure Required at Node X for Each Flow Scenario

Flow Scenario	Flow Amount (gpm)	Required pressure at Node Z	Pressure loss per foot of 2-inch hose (psi/ft)	Total pressure loss from Node Z to Node X	Total pressure required
1	214	428	0.298	360	788
2	231	494	0.344	415	909
3	231	494	0.344	415	909
4	224	375	0.325	392	767

From Node X back to Node V, the total flow is through 1400 feet of dual 2-inch hydraulic hoses in parallel. Because the lines are in parallel, it is only necessary to calculate the loss for one line, with the flow assumed to split evenly between the two hoses. For a 1400 foot length of 2-inch hydraulic hose, the pressure losses are as follows.

Table 6 Resulting Pressure Required at Node V for Each Flow Scenario

Flow Scenario	Total flow Amount (gpm)	Split flow amount	Pressure loss per foot of 2-inch hose (psi/ft)	Total pressure loss from Node X to Node V	Total pressure required
1	214	107	0.083	115	903
2	252	126	0.112	156	1065
3	344	172	0.199	278	1187
4	224	112	0.090	126	893

Finally, from Node V to Node U, we have a single run of 3-inch piping consisting of 68 equivalent feet of schedule 40 pipe. The pressure losses and the final total pressures required are summarized in Table 7.

Table 7 Resulting Pressure Required at Node U – Pump Discharge

Flow Scenario	Total flow Amount (gpm)	Pressure loss per foot of 3-inch Sch 40 pipe (psi/ft)	Total pressure loss from Node V to Node U	Total pressure required at pump discharge (psi)	Elevation plot point on Hydraulic profile (ft MSL)
1	214	0.037	2	905	2942
2	252	0.050	3	1068	3319
3	344	0.089	6	1193	3607
4	224	0.040	2	895	2919

STEP 4, Compare the required pressure to the available pressure.

Table 8 summarizes the results of this comparison.

Table 8 Summary of System Pressure Shortages at Pump Discharge

Flow Scenario	Total flow Amount (gpm)	Total pressure available at pump discharge (psi)	Total pressure required at pump discharge (psi)	Pressure difference (psi) (negative number indicates a deficit)
1	214	852	905	–53
2	252	852	1068	–216
3	344	836	1193	–357
4	224	852	895	–43

Conclusion

For all of the scenarios, the required pump pressures exceed the available pump discharge pressures. Note that Scenario 4 is the closest to being adequate but does not include any flows for the Stage Loader or the shield sprays. Additionally, the pressure required for this scenario, 375 psi, is based upon data from the manufacturer of the longwall but does not indicate for what flow the pressure loss of 250 psi occurs. Note that using the pressure versus flow characteristics of the Shearer as tested, coupled with the associated methods utilized within this report, the required pressure at a flow of 224 gpm would be 466 psi, not 375. Hence, a more realistic pressure deficit for scenario 4 would be closer to a value of –134 psi rather than to –43 psi.

It must be emphasized that Scenario 3 represents the most realistic flow requirement for the dust control effort on the No. 1 Longwall Panel mining machine because it includes flows for the Shield sprays and the Stage Loader sprays and motor cooling. As the analysis indicates, there is a significant water pressure deficit between what is required to maintain this identified flow and what is available from the water system. The other three scenarios, included for reference, are also inadequate but represent less realistic water flows since they do not include complete water flows for the dust control sprays and motor cooling needs on all parts of the mining machine.

TABLE 9 —NODE DATA FROM TANK TO LONGWALL MULE TRAIN

Node	Elevation	Delt Elev	8" length to next node	6" length to next node	size of pipe to next node	SS	Break No.	Mains Reference	Comments
A	1308		280	0	8		n/a		Water Tanks
B	1125	-183	520	0	8		2	EAST	#1 East Mains South Belt-pipe routing assumed
C	1146	21	1045	0	8		2	EAST	Location of connection assumed
D	1128	-18	0	270	6		17	EAST	
E	1128	0	365	0	8		19	EAST	
F	1131	3	0	0	8		btwn 24 & 25	EAST	Filter set Between F and G
G	1131	0	1785	0	8			EAST	
H	1097	-34	1310	0	8		49	EAST	
J	1071	-26	0	356	6		15	NORTHEAST	
K	1071	0	3120	0	8		17	NORTHEAST	
L	1015	-56	975	0	8		51	NORTHEAST	
M	1018	3	0	300	6		btwn 59 & 60	NORTH	
N	1014	-4	7015	0	8		btwn 62 & 63	NORTH	
P	944	-70	715	0	8		128	NORTH	Pressure regulating valve at Node P.
Q	943	-1	7680	0	8		135 /0	NORTH /OLD NORTH	
R	910	-33	2715	0	8		76	OLD NORTH	
S	862	-48	0	1710	6		btwn 103 & 104	NORTH GLORY	
T	852	-10	0	0			17	HG 1 NORTH	Mule train

TABLE 10 — NODE DATA FROM LONGWALL MULE TRAIN TO SHEARER CONNECTION

Node	Elevation	Length	Node description	Pipe description	Notes
T	852	217	6" SDR Connection to 4 inch pump feed hydraulic hose and piping and filters	26 ft 4" HH, 55 ft equiv 2" pipe, 4 ft 4" after filter to pump	total Equvalent feet of 4 inch
U	852	68	Pump	3 inch Sch 40	total equivalent feet of 3 inch
V	852	400	End of 3" pump discahrge manifold	Parallel 2 inch HH to glut	111 equiv feet for parallel split flow
W	847	1000	Glut	Parallel 2 inch on monorail system	280 equiv feet for parallel split flow
X	842	710	Distribution box on emulsion panel	single 2 inch for shear water demand	
Y	840	500	connection into Bretby cable handler	single 2 inch for shear water demand	
Z	851		SHEARER connection		

HH = hydraulic hose

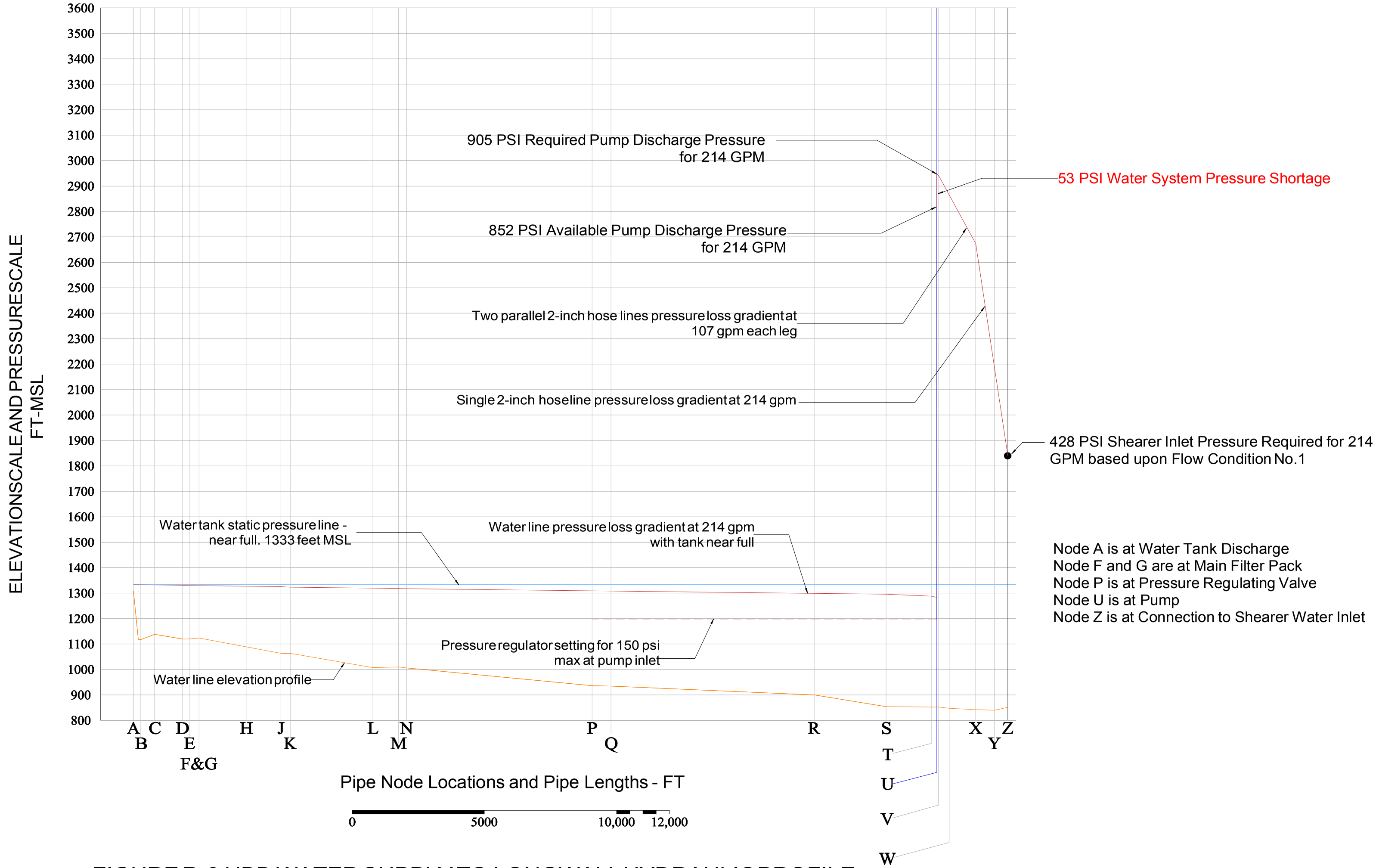


FIGURE R-2 UBB WATER SUPPLY TO LONGWALL HYDRAULIC PROFILE
Flow Scenario 1
Shearer Flow 214 GPM
Total Flow 214 GPM

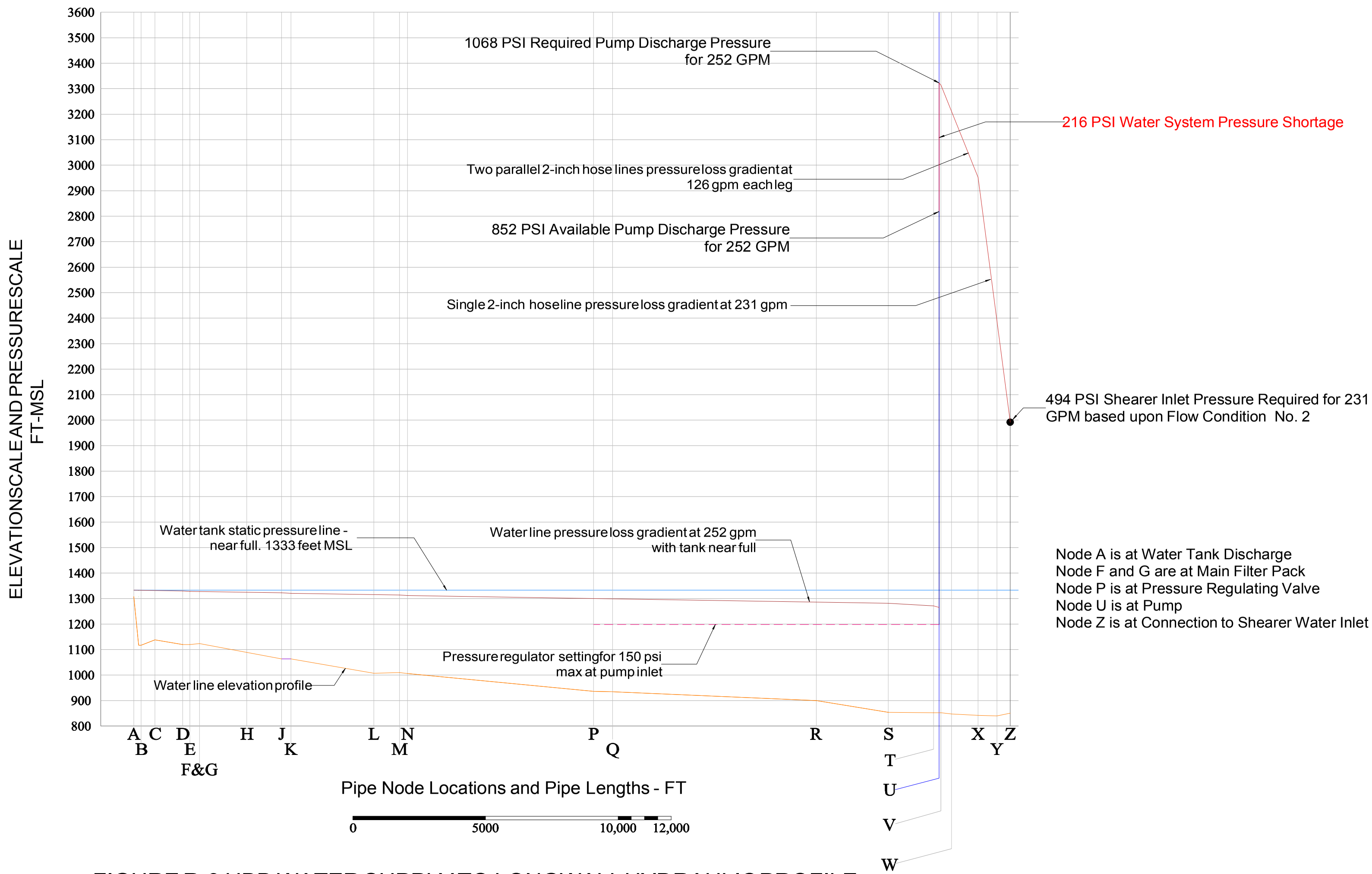


FIGURE R-3 UBB WATER SUPPLY TO LONGWALL HYDRAULIC PROFILE
Flow Scenario 2
Shearer Flow 231 GPM
Total Flow 252 GPM

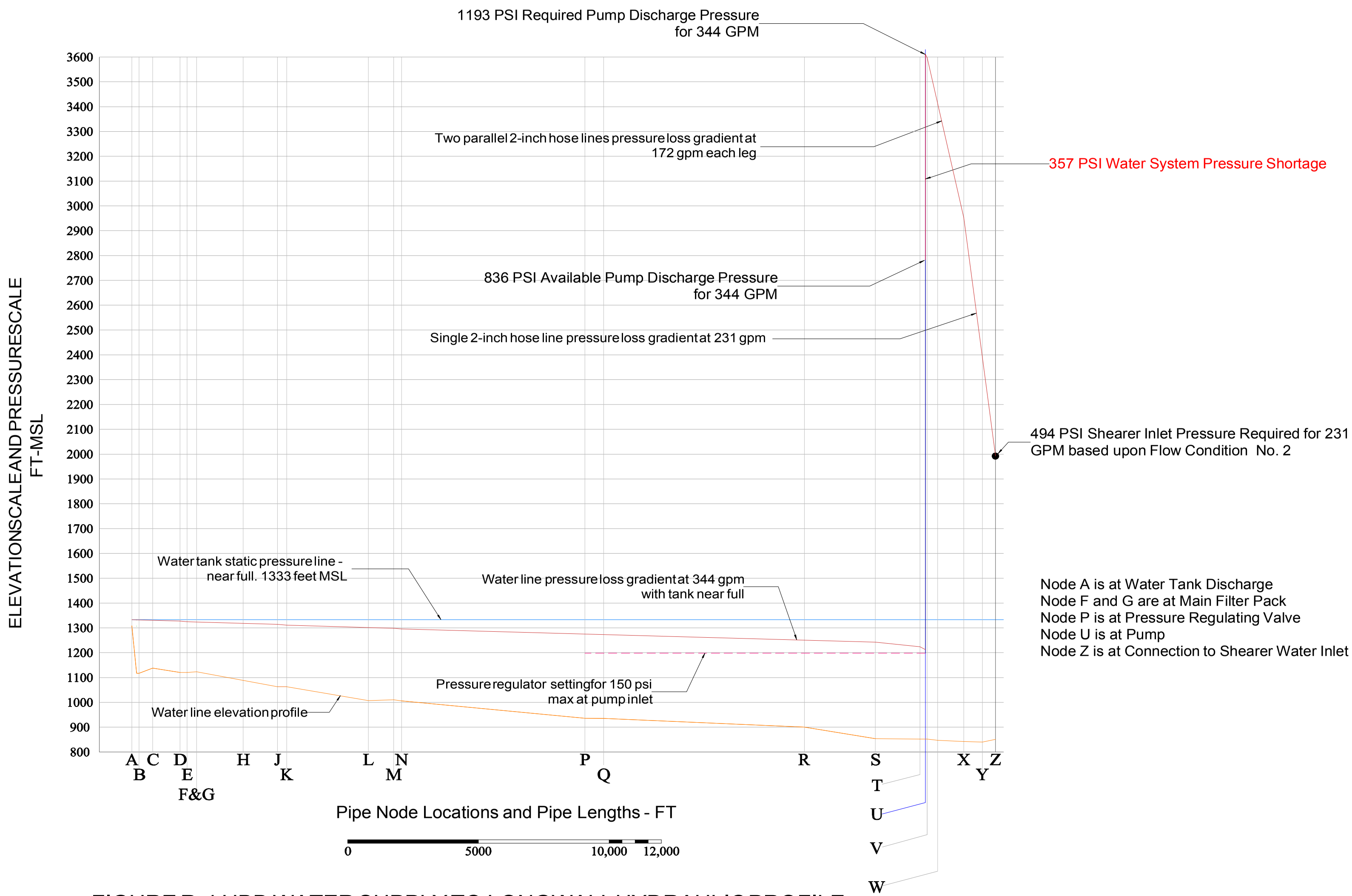


FIGURE R-4 UBB WATER SUPPLY TO LONGWALL HYDRAULIC PROFILE
Flow Scenario 3
Shearer Flow 231 GPM
Total Flow 344 GPM

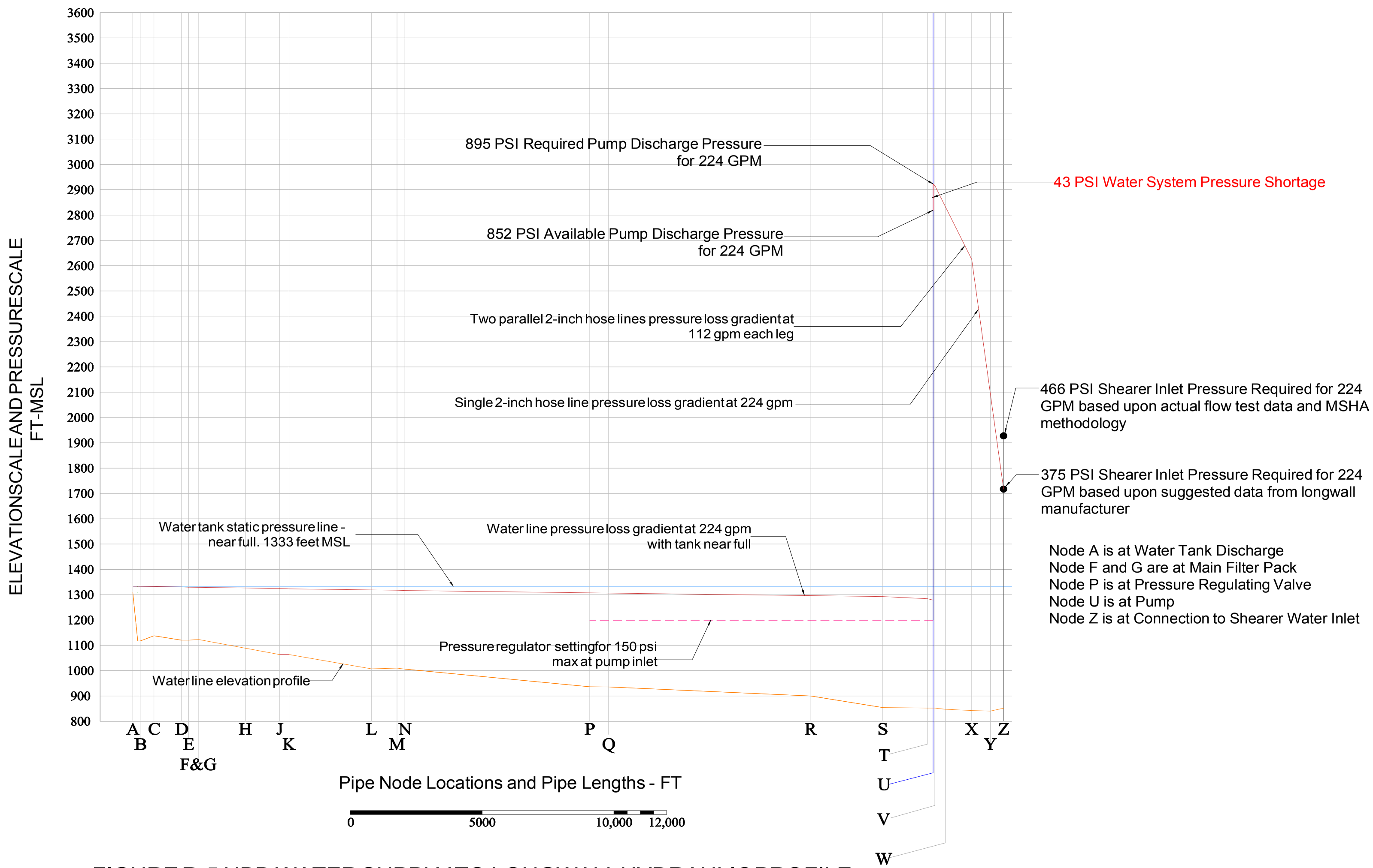


FIGURE R-5 UBB WATER SUPPLY TO LONGWALL HYDRAULIC PROFILE
Flow Scenario 4
Shearer Flow 224 GPM
Total Flow 224 GPM

APPENDIX S

SEDIMENT ANALYSIS FROM WATER BASKETS AND SPRAY NOZZLES

APPENDIX S

SEDIMENT ANALYSIS FROM WATER BASKETS AND SPRAY NOZZLES

Appendix S
Sediment Collection and Analysis from Water Baskets and Spray Nozzles

<u>Water Baskets</u>

Background

On March 10, 2011 sediment was collected from two wire mesh filters obtained by MSHA's Accident Investigation Team from UBB. The filters are designated as PE-0448 (1 South Belt Water Basket) and PE-0423 (1 North Panel Pump Car).

After sediment was collected from the filters, the sediment was weighed and then subjected to separation of particle sizes by a series of sieves. The sieves were stacked in order of decreasing grain size from top to bottom, with U.S. Standard Sieve Size No. 8 on top, followed successively downward by No.'s 60, 100, 140, 200, and 325. A pan placed at the bottom of the sequence collected any particles small enough to pass through the No. 325 sieve. The No. 8 sieve uses a mesh spacing of 2.36 mm, which corresponds to the geological size designation of "granule" and was used to catch visibly large particles such as cellophane wrappers and plant debris. The No. 60 sieve uses a mesh spacing of 0.250 mm, which corresponds to the boundary between the geological designations for medium-grained sand and fine-grained sand. The No. 100 sieve uses a mesh spacing of 0.150 mm, which corresponds to the geological particle size of fine sand. The No. 140 and 200 sieves use a mesh size of 0.106 mm and 0.075 mm, respectively, which correspond to the upper and lower ranges of the geological particle size of very fine sand. The No. 325 sieve uses a mesh size of 0.045 mm, which corresponds to the geological particle size of coarse silt. Any particles collected in the bottom pan would be designated as -325 mesh, and would represent material finer than coarse silt.

After the stack of sieves was placed on a shaker table for 10 minutes, each size fraction was weighed, and the particles in each fraction were described by spreading the particles on a clean, white sheet of paper and inspecting the particles with a 10-power lens under bright light. Upon completion of the description, each size fraction was stored separately in a glass vial marked with the PE number and size fraction. Upon completion of all documentation activities, the vials were placed together in a freezer bag, which was stored inside the respective water basket.

Observations

<u>PE-0448</u>

Sediment was collected from the 1 South Belt water basket by dumping loose material out onto a clean, white sheet of paper. Additional material was obtained by brushing the inside of the basket with a paint brush and depositing any resulting material on the sheet of paper. The screen mesh of the basket itself was generally dirty and appeared mostly clogged with fine, gray material. A dial-gauge micrometer indicates that the mesh screen size is 0.01 inches, which is equivalent to 0.254 mm. Therefore, material corresponding to U.S. Standard Sieve Size No. 60 (0.250 mm) and smaller would theoretically be able to pass through the water filter. This size would represent the upper boundary of the “fine sand” geological particle size. After all available sediment was collected on the white sheet of paper, it was funneled into a glass dish for weighing on a digital balance. It was determined that 1.15 g of sediment was collected from the water basket. It should be noted that due to likely measuring error, the aggregate weight of size fractions represents 110% of the initial sample weight.

- The +8 sieve material weighed 0.12 g and consisted of fibrous mats of interlocking grass blades and stems. The agglomerated grass blades hosted sporadically distributed, 1 mm-diameter particles of coal, biotite, quartz, and yellowed cellophane wrappers, along with rare, spherical slag pellets.
- The +60 sieve material weighed 0.8 g and consisted of angular fragments of coal (30%), angular grains of frosted quartz (20%), thin sheets of limonite and goethite-altered rust flakes that were attracted by a small magnet (10%), yellowed cellophane (<1%), and plant debris that consisted dominantly of seed pods (40%). There were also a few grains of broken concrete in which the aggregate sand was visible, one of which hosted heavy iron staining that suggested rusted rebar.
- The +100 sieve material weighed 0.17 g and consisted of angular coal fragments, a large number of spherical seeds, and abundant plant debris that dominated the sample. Also present were angular rust flakes and only minor quartz.
- The +140 sieve material weighed 0.04 g and consisted of angular coal fragments, quartz, plant debris, limonite-altered rust fragments that were attracted by a small magnet, and feldspars. The plant debris is represented by long fragments of cellulose stalks longer than +140 but of sufficient diameter to pass through the mesh.
- The +200 sieve material weighed 0.04 g and consisted of coal, quartz, feldspars, and minor limonite-altered rust. Plant debris included only a few fibers of cellulose.
- The +325 sieve material weighed 0.04 g and was dominated by coal and quartz, with grains that are subangular to subrounded due to abrasion. Minor limonite-altered rust flakes were present, and minor plant debris consisted of individual hair-like fibers.
- The -325 sieve material weighed 0.02 g and consisted almost exclusively of coal (40%) and quartz (60%).

<u>PE-0423</u>

Sediment had previously been collected from the 1 North Panel Pump Car on February 18, 2011 and stored in a plastic container, with preliminary descriptions of the material presented in a March 8th memorandum from Matthew Babington, Esq. (SOL) to Benjamin Wood, Patton Boggs, LLP. The collected material was viewed by all parties attending the testing in order to confirm that the container and material was the same as portrayed in photos included with the March 8th memorandum. The sample was weighed and represented 8.32 g of material.

- The +8 sieve material weighed 0.58 g and consisted of cellophane and tinfoil-coated wrapping paper of the type used for snacks. Printing on the clear cellophane indicated that it represented a package of “Cheddar and Bacon” crackers and printing on the foil-coated paper indicated that it had represented a bag of “Potato Skins” chips. Other clear wrappers were unmarked, but hosted a UPC code. The remaining material included 5 mm-diameter leaf fragments and a single shale pebble that was 8 mm in diameter.

- The +60 sieve material weighed 7.57 g and consisted dominantly of plant debris (65%) and coal fragments (30%). Plant debris consists of dried leaf fragments, grass stems and/or pine needles, small twigs, fragments of wood chips, and grass blades. Small red plastic fragments were intermixed with this material. The mineral fraction was dominated by square and angular coal fragments, with minor quartz grains. A small magnet was used to attract several small rust flakes, which showed orange-colored limonite alteration.
- The +100 sieve material weighed 0.11 g, and consisted of angular coal fragments (40%), angular limonite-altered rust fragments (40%), plant debris (10%), and quartz grains (10%). The plant debris represents grass blades and twigs, with small, hair-like stems and numerous spherical seeds.
- The +140 sieve material weighed 0.03 g and consisted of subangular to subrounded quartz (40%) and angular coal fragments (40%), with limonite-stained rust fragments (10%), and minor plant debris (10%). Plant debris consists of hair-like fibers.
- The +200 sieve material weighed 0.03 g and consisted of quartz (55%), coal (35%), plant fibers (7%), and limonite-stained rust fragments (3%). This sample is noticeable lighter in color compared to other samples, due to its greater quartz content.
- The +325 sieve material weighed 0.04 g and consisted of quartz (60%), coal (25%), plant fibers (10%), and limonite-stained rust flakes (5%). Quartz grains are subangular to subrounded, compared to coarser samples in which quartz was angular, reflecting abrasion of grains.
- The -325 sieve material weighed 0.02 g and consisted of quartz (80%), coal (15%), and plant fibers (5%) with no other material present.

Conclusion

It appears that with decreasing grain size, noted especially with the +140 (0.106 mm) material that corresponds to the geological particle size of very fine sand, the samples begin to be dominated by quartz grains of the very fine sand to coarse silt size. The increase in the degree of rounding corresponding to decreasing grain size is an indication that quartz is more able to survive the processes of mechanical abrasion at smaller sizes. Quartz and coal are the only naturally occurring minerals in the sediment, which at larger size fractions host significant plant debris and man-made material such as rust flakes and snack wrappers.

Based on a measurement of the screen size of the water baskets, which indicates a mesh spacing of 0.254 mm (0.01 in.), material smaller than the No. 60 mesh size could have been able to pass through the filter baskets. The -60 to +140 material is generally dominated by plant debris and coal, while material smaller than +140 is dominated by very fine-grained quartz sand, and by coarse-grained quartz silt. These size fractions represent less than 1.5% of the total weight of collected material, which is generally dominated by plant debris and coal.

Based on the analysis of the filter basket sediment, it should be expected that any downstream equipment might contain -60 (less than 0.250 mm) material that could include plant debris, coal, quartz, and rust flakes. It would be unlikely that material larger than 60 mesh (0.250 mm) found in any downstream equipment would have passed through the filter baskets, and would instead have to have been derived from an intervening source. It should also be noted that no shale, and only very sparse mica flakes, were documented in the water basket sediment. Therefore, clay minerals identified in downstream equipment would be expected to have a source other than the water supply, such as shale pulverized during the mining process.

Spray Nozzles

Background

On March 17-18, 2011 sediment that had been previously collected from spray nozzles obtained by MSHA's Accident Investigation Team from UBB was described in terms of grain size and mineralogy. Fine-grained material was sent to an independent, commercial laboratory for identification by x-ray diffraction. Under a previous protocol (Protocol for Collecting Material and Measuring Dimensions of Spray Nozzles Recovered from Longwall Shearer, Performance Coal Co., Upper Big Branch Mine), sediment had been collected from 20 spray nozzles and stored in glass vials. In some cases, sediment was collected from different portions of the same nozzle. The vials of sediment were documented under the same nomenclature as the spray nozzle from which they were collected, including PE-0391, PE-0395, and PE-0397.

Sediment from each vial was separated into three size fractions by passing it through two screens. The top screen was U.S. Standard Sieve Size No. 12, which corresponds to 1/16th-inch; the second screen was U.S. Standard Sieve Size No. 60, which corresponds to the 0.01 inch screen size used in the longwall shearer water supply basket filters.

After the stack of sieves was placed on a shaker table for 10 minutes, each size fraction was weighed, and the particles in each fraction were described by spreading the particles on a clean, white sheet of paper and inspecting the particles with a 10-power lens under bright light. Upon completion of the description, each size fraction was stored separately in a glass vial marked with the PE number and size fraction. Upon completion of all documentation activities, the vials were placed together in a freezer bag, which was stored inside the respective water basket. Particles from the +12 and +60 fractions were stored together, while particles from the -60 fraction were returned to their original vial and sent to an independent, commercial laboratory for quantitative analysis by x-ray diffraction.

Observations

PE-0391 Nozzle 1 J16

Material consists dominantly of coal fines with subordinate quartz fines and orange limonite staining occurs on grains of coal and sandstone.

PE-0391 Nozzle 1 #3

- +12 size material consists of large, blocky coal fragments up to 1 cm in length. Material in this size fraction weighs 0.64 g.
- +60 size material consists of approximately one-third each of angular coal, bony coal, and rust flakes. The largest fragments are represented by angular coal fragments, with limonite-altered rust flakes also occurring as larger pieces. The weight of this size fraction is 0.03 g.
- -60 size material weighs 0.01 g and is insufficient in volume for analysis. Based on visual inspection, the fraction consists of up to 10% rust flakes, 10% sandstone, and the remainder represented by coal and bony coal.

PE-0391 Nozzle 1 #7

Material consists of two large rust flakes (+60 size), with several +60 size mud balls that are composed of coal fines and quartz, with sparse, angular coal fragments. Fines consist of "black dirt" that may include some coal fines, but fine grains are clumped together possibly by oil or grease.

PE-0391 Nozzle 1 Bit #8

Material consists dominantly of +60 size material, and minor -60 size material, in proportions of 5% sandstone, 10% bony coal, and 85% coal.

PE-0391 Nozzle 1 #10

- +12 size material consists of flat rust fragments that show iron oxide alteration, along with angular coal fragments that show iron oxide staining. There is also a single clast of gray, coarse-grained siltstone. The weight of this size fraction is 0.02 g.
- +60 size material consists of 85% angular fragments of fine-grained micaceous sandstone and gray coarse-grained siltstone, 10% angular coal fragments, and 5% thin flakes of heavily limonite-altered rust. Gray siltstone/sandstone exhibits freshly broken surfaces. The weight of this size fraction is 0.69 g.
- -60 size material weighs 0.5 g and was sent for XRD analysis.

PE-0391 Nozzle 1 #15

- +12 size material consists of a single fragment of bony coal, with weight below the measuring capability of the balance.
- +60 size material consists of 85% angular fragments of coal and bony coal, 10% angular sandstone fragments, and 5% rust flakes, weighing 0.22 g.
- -60 size material weighs 0.26 g and was sent for XRD analysis.

PE-0392 Nozzle 1 1-1

Material consists of +60 coal, bony coal, and dark gray siltstone fragments with very minor amounts of -60 fines. Minor rust staining occurs on a few bony coal and dark gray siltstone fragments.

PE-0395 Internal to Nozzle #1

- +12 size material consists of a single piece of coal, with the remaining pieces consisting of dark gray micaceous coarse-grained siltstone. The siltstone consists of angular, broken fragments characterized by fresh surfaces. The weight of this fraction is 0.10 g.
- +60 size material consists of 75% dark gray siltstone, 15% sandstone, and 10% coal. Some siltstone hosts carbonized plant fossil traces; some sandstone hosts iron staining. All fragments exhibit angular, freshly broken surfaces. The weight of this fraction is 0.58 g.
- -60 size material weighs 0.63 g and was sent for XRD analysis.

PE-0395 Nozzle 1 #2 Inter Portion of Housing Vial A

- +12 size material consisted of several rounded mud balls, that when lightly probed, were disaggregated into -60 size quartz silt with a single +12 fragment of coal.
- +60 size material consists of angular fragments of sandstone (50%), dark gray siltstone (40%), and coal (10%). The dark gray siltstone hosts some iron staining. This size fraction weighs 0.13 g.
- -60 size material weighs 0.25 g and was sent for XRD analysis.

PE-0395 Internal to Nozzle #2 Vial B

- +12 size material consists of rounded mud balls that, when disaggregated, are actually a composite of light-colored quartz silt that are considered as part of the -60 size fraction
- +60 size material consists of rust 5% rust, 15% coal, 30% dark gray siltstone, and 50% sandstone. Rust flakes are heavily altered to limonite and colored orange. This size fraction weighs 0.39 g.
- -60 size material weighs 0.9 g and was sent for XRD analysis.

PE-0395 Nozzle 1 #3 Inter Portion of Housing Vial A

- +12 size material consists of several large, rounded mud balls, which are easily disaggregated into fines that consist of quartz silt and coal, and are considered as part of the -60 size fraction.
- +60 size material consists of 2% rust flakes, 10% angular coal fragments, 35% dark gray siltstone, and 53% light-colored quartz sandstone. Fragments are bounded by freshly broken surfaces with rounded-off edges, suggestive of milling. This size fraction weighs 0.61 g.
- -60 size material weighs 1.09 g and was sent for XRD analysis.

PE-0395 External Sides of Nozzle #3, No Ends, Vial B

- +12 size material consists of subangular fragments of light-colored sandstone (15% and dark-gray, micaceous siltstone (85%), and weighs 0.07 g.
- +60 size material consists of angular, freshly broken fragments of coal (10%) and bony coal (5%), with 30% subrounded milled fragments of dark gray siltstone and 50% light-colored micaceous sandstone that sometimes is stained with limonite. The size fraction also contains 5% rust flakes. The weight of this fraction is 0.49 g.
- -60 size material weighs 0.96 g and was sent for XRD analysis.

PE-0395 Internal to Nozzle #3 Vial C

- +12 size material at first appears to consist of three angular granules of sandstone. However, with light probing, each "granule" easily disaggregates in a fine-grained mixture of agglomerated quartz sand that contains small particles of coal. The agglomerated material hosts imprints of flat, machined parts, similar to congealed mud. No material was actually in the +12 size fraction, but is instead considered part of the -60 fraction
- +60 size material consists of angular fragments of coal (3%), bony coal (5%), sandstone (35%) and dark gray, coarse-grained micaceous siltstone (57%). Angular fragments of sandstone and siltstone exhibit freshly broken surfaces, and exhibit some limonite staining. This size fraction weighs 0.82 g.
- -60 size material weighs 0.86 g and was sent for XRD analysis.

PE-0395 Nozzle 1 #4

Material consists of a single, large +12 fragment of bony coal with light gray sandstone adjoining and affixed to it, like a broken rock fragment. The grain is accompanied by -60 size angular fragments of coal and sandstone.

PE-0395 Nozzle 1 #10

- +12 size fraction contains no material
- +60 size material consists of 10% sandstone, 15% coal, and 75% dark gray siltstone. The sandstone hosts visible muscovite flakes and some iron staining. This fraction weighs 0.54 g.
- -60 size material weighs 0.67 g and was sent for XRD analysis.

PE-0397 Nozzle 1 #3

- +12 size material consists of a single grain of angular coal that is below the operating range of the balance.
- +60 size material consists of 15% coal, 10% bony coal, 40% sandstone, and 35% dark gray siltstone, along with two heavily limonite-altered rust flakes. Coal and sandstone fragments host orange limonite staining. The weight of this size fraction is 0.76 g.
- -60 size material weighs 0.33 g and was sent for XRD analysis.

PE-0397 Nozzle 1 #5

- +12 size material consists of a single grain of coal that is below the operating range of the balance.
- +60 size material consists of 10% coal, 5% bony coal, 20% sandstone, and 65% dark gray siltstone with a single rust flake. The sandstone hosts visible muscovite flakes, and the siltstone hosts iron staining. This size fraction weighs 0.27 g.
- -60 size material weighs 0.25 g and was sent for XRD analysis.

PE-0397 Nozzle 1 #6

- +12 size material consists of two grains, which are quartz + coal "mud balls" that when disaggregated represent -60 quartz fines and a few angular fragments of coal that are -12 in size.
- +60 size material consists of 5% coal, 15% sandstone, and 80% dark gray siltstone. Orange limonite staining is present on approximately half of all siltstone and sandstone. This size fraction weighs 0.37 g.
- -60 size material weighs 0.2 g and was sent for XRD analysis even though it is slightly below the sample size requirement. The sample was visible assessed as being composed of intermixed dark gray siltstone, sandstone, and coal.

PE-0397 Nozzle 1 #7

- +12 size fraction contains no material.
- +60 size material consists of angular fragments of coal (15%, dark gray siltstone (35%), and sandstone (50%). Sandstone is light-colored and commonly affected by iron staining. This size fraction weighs 0.66 g.
- -60 size material weighs 0.46 g and was sent for XRD analysis.

PE-0397 Nozzle 1 #9

- +12 size material consists of two grains, one of coarse-grained dark gray siltstone and the other of fine-grained sandstone, which together weigh 0.02 g.
- +60 size material consists of 10% coal, 40% sandstone, 50% dark gray siltstone, and fragments are characterized by freshly broken surfaces.
- -60 size material weighs 0.56 g and was sent for XRD analysis.

Conclusions

Sediment from the 1 North Longwall Panel shearer spray nozzles were separated into three size fractions. The +12 U.S. Standard Sieve mesh size was chosen because it is similar to the 1/16-inch diameter size of the spray nozzle orifices. Thus, any material larger than +12 could not have entered the nozzle from the outside, or been blown into the orifice by the explosion. The +60 U.S. Standard Sieve mesh size (0.250 mm) was chosen because it is similar to the 0.01-inch mesh (0.254 mm) used as screening on the water supply filter baskets. Thus, any material larger than +60 should not have been able to pass through the water basket filter screen, and must have entered the spray nozzle by some mechanism other than the water supply.

The presence of +60 and +12 size fragments in the spray nozzles may be an indication that the material entered through open nozzle ports on the shearer drum. It is significant that all of the +60 material consists of angular fragments of sandstone, siltstone, and coal, and that the fragments exhibit freshly broken, clean surfaces that are suggestive of generation by cutting activity of the longwall shearer. In contrast, quartz grains collected from the water baskets were characterized by subangular to subrounded, frosted grains that are considered typical of abrasion during transport on a geological time scale, and are likely to have been entrained in the water supply from the river or other surface supply. Individual sand grains of this nature were not observed in the +60 spray nozzle material. Furthermore, it is significant that the +60 size material contains sandstone, as well as dark gray, coarse-grained siltstone. During previous petrographic study of rock samples collected from the roof and floor of the longwall face, as part of the assessment of incendive potential, it was determined that while the immediate floor is composed of sandstone alone, the immediate roof is composed of sandstone and thin layers of siltstone, which is represented by dark gray laminations. It therefore appears that chips of sandstone and siltstone from the roof had been falling into openings in the cutting drums for some unknown period of time.

A significant conclusion of this observation is that it seems highly unlikely that the drum could have been filled with freshly cut rock chips if the spray nozzles had been removed only after the tail drum cut out as part of routine maintenance just prior to the explosion. The presence of a significant volume of the +60 material being represented by dark gray, coarse-grained siltstone is an indication of rock chips falling from the immediate roof. Therefore, the drum must have been operating with open nozzle ports, and concomitant lack of water pressure, for some unknown length of time prior to the explosion. This is not an indication that the drum was operating in the moments before the explosion, but does indicate that the drum was most likely being operated without functional water sprays in the hours or days prior to the explosion.

The presence of imprints of flat, machined surfaces on mud composed of quartz and coal fines is an indication that these fines had been caked onto the sides of the nozzles in the presence of water, forming an agglomerated mixture. "Mud balls" composed of the same material were also collected from inside the spray nozzles. The sediment collected from the nozzles contained very few actual rust flakes, generally no more than 5%. It therefore seems unreasonable to conclude that the sprays were clogged by rust that had formed in the drum upon restoration of water to the shearer during the December 2010 test. Furthermore, the goethite-altered rust flakes collected from the water baskets is of a different nature than the bright-orange limonite that apparently formed inside the drum. Although the bright orange limonite was found as thin coatings on some sandstone and siltstone fragments, it was not a constituent of the "mud balls" found within the spray nozzles. It would therefore appear that the quartz + coal fines were already present and hardened within the spray nozzles prior to restoration of water to the shearer.

Tailgate Drum Spray Nozzles

Background

On April 13-14, 2011 sediment that had been previously collected from spray nozzle ports, as well as sediment secured within spray nozzles collected by MSHA's Accident Investigation team from UBB was described in terms of grain size and mineralogy. Although similar activity had been conducted previously for sediment collected during the course of measuring dimensions of nozzles retrieved from the headgate drum, tailgate drum, and ranging arm of the 1 North Panel longwall shearer, the activities of April 13-14 were conducted on nozzles and material collected from the tailgate drum only, after it had been rotated to expose the underside portion of the drum. Sediment had been collected in Zip-Loc baggies, and spray nozzles were taped closed and placed in baggies where plastic basal inserts were not present, and provided by members of the Accident Investigation team. Nozzles and sediment were listed under the designations PE-0464 and PE-0465.

Sediment from each vial was separated into four size fractions by passing it through three screens. The top screen was U.S. Standard Sieve Size No. 8, which corresponds to 3/32nd-inch and reflects the orifice diameter of the majority of spray nozzles utilized on the tailgate drum; the next screen was U.S. Standard Sieve Size No. 12, which corresponds to 1/16th-inch and reflects the orifice diameter of the spray nozzle stipulated in the company's approved plan; the third screen was U.S. Standard Sieve Size No. 60, which corresponds to the 0.01-inch screen size used in the longwall shearer water supply basket filters. Material finer than No. 60 mesh was collected in a pan at the bottom of the sieve array. The first sample (PE-0465, Spray Port #38) was broken into seven size fractions (+8, +12, +60, +100, +140, +200, and -200), but due to the very small volume of material present, and the virtual absence of several intervening size fractions, subsequent samples were broken into only the four previously described fractions.

Some sediment was provided loose in individual bags, while other bags contained a spray nozzle and associated staple lock. Some spray nozzles were wrapped with black electrical tape to ensure that any sediment present remained inside the nozzle. Other nozzles were not wrapped with tape but retained their original plastic insert at the base of the nozzle. In each respective case, the black electrical tape was unwrapped to first expose the nozzle outlet orifice, and the presence of any foreign matter was determined. Subsequently, the base of the nozzle was exposed by removing the tape, and a photograph of the inside of the nozzle and any material stuck to the tape was taken. If sediment was present, the stratigraphy of the sediment was noted in order to determine which sediment was deposited first and which most recently, with sediment at the base of the nozzle interpreted to have been deposited most recently. Where plastic inserts were in place, it was determined whether the orifices were clogged, and upon removal of the insert, the presence of foreign material was documented on the inside of the insert. Additionally, the presence of plastic flaps indicative of incomplete drilling was documented.

After the stack of sieves was placed on a shaker table for 10 minutes, each size fraction was weighed, and the particles in each fraction were described by spreading the particles on a clean, white sheet of paper and inspecting the particles with a 10-power lens under bright light. Upon completion of the description, each size fraction was stored separately in a glass vial marked with the PE number and size fraction. Upon completion of documentation activities, the vials were placed together in the original sample bag, containing the spray nozzle, staple, and black electrical tape or insert used to retain material inside nozzles.

Observations

PE-0465 Spray Port #10 (loose in bag) 5.57 g

- +8 material (5.15 g) consists of a single large piece of welding bead or slag (17 mm long), two pieces of dark gray siltstone (4 mm long), and ten pieces of coal (3-10 mm long). The welding slag has a light patina of rust but mostly is shiny, beaded metal.
- +12 material (0.07 g) consists of six pieces of coal/bony coal and four pieces of dark gray siltstone.
- +60 material (0.3 g) consists of round, beaded welding spatter that has a light patina of rust but is still mostly shiny metal. The fraction is dominated by angular fragments of coal (60%), with dark gray siltstone (35%) and light gray sandstone (5%). The fraction also contains a bright silver lump of metal that is soft enough to be cut with a steel knife blade, and is interpreted to represent a bead of solder.
- -60 material (0.05 g) consists of angular fragments of coal (35%), dark gray siltstone (50%), and light gray sandstone (5%) with sparsely distributed rust flakes (10%).

PE-0465 Spray Port #38 (loose in bag)

- +8 material (0.35 g) consists of a large, rectangular piece of coal that is 11 mm long, an angular piece of light gray, fine-grained sandstone with a portion of coal streak attached that is 3 mm long, and a large, flat rust flake that is 5 mm long and showing dark-colored goethite alteration. Two “mud balls” that were easily disaggregated into fines are also present.
- +12 material (0.03 g) consists of two rust flakes that are 4 mm long, and a “mud ball” that is 3.5 mm long and composed of an aggregate of fines.
- +60 material (0.4 g) is dominated by rust flakes (86%) with 10% angular coal fragments, 3% angular, dark gray siltstone, and 1% angular fragments of light gray, fine-grained sandstone. The size fraction also contains a single “mud ball” composed of fines.
- +100 material consists of angular flat, angular fragments of rust (15%), as well as angular fragments of coal (15%), dark gray siltstone (50%), and light gray sandstone (25%).
- +140 material (<0.01 g) consists of angular fragments of rust (15%), coal (20%), dark gray siltstone (50%), and light gray sandstone (15%).
- +200 material (<0.01 g) consists of angular fragments of rust, coal, sandstone, and siltstone.
- -200 material (0.02 g) consists of milled rock flour, which is dominated by dark gray siltstone and light gray sandstone that fives a salt-and-pepper color, with sparsely scattered coal but no rust.

PE-0465 Spray Port #39 (loose in bag) 1.64 g

- +8 material (0.07 g) consists of five large, angular rust flakes that are characterized by dark brown goethite alteration.
- +12 material (0.17 g) consists dominantly of rust flakes (about 12-15 in number), with two coal fragments and three fragments of dark gray siltstone. The fraction

contains one possible piece of welding slag that is hollowed out with extensive limonite alteration inside.

- +60 material (0.92 g) consists dominantly of rust flakes, with 2% dark gray, angular siltstone fragments and 5% angular coal fragments.
- -60 material (0.38 g) consists of dark and "greasy" coal fines that have a tendency to adhere to the bottom collection pan. The fraction contains angular flakes of bright orange limonite rust flakes, as well as sparsely distributed discernible angular coal fragments.

PE-0465 Port #40 (loose in bag) 1.42 g

- +8 material (0.62 g) consists of five angular fragments of coal that have had the sides and corners polished off, like in a rock tumbler. The largest fragment is 1 cm long. The fraction also contains a single rounded, bulbous metal fragment of welding slag.
- +12 material (0.03 g) consists of two rust flakes, one angular fragment of coal with fresh, sharp edges, and one angular fragment of dark gray siltstone.
- +60 material (0.51 g) consists dominantly of rust flakes (85%), with subordinate angular fragments of dark gray siltstone (10%) and coal fragments (5%) that exhibit freshly broken surfaces.
- -60 material (0.2 g) consists of orange limonite and dark brown goethite-altered rust flakes that are abundantly intermixed with a brown-tinted mixture of dark gray siltstone and angular coal fragments. The fines have a tendency to adhere to the pan and contain significant coal fines.

PE-0464 C (spray/staple) 0.15 g

When the electrical tape was unwrapped, there was no loose material inside the nozzle, although it was evident that the nozzle outlet orifice was clogged with an angular piece of coal or dark gray siltstone. Small fragments of coal and dark gray siltstone are congealed together and blocked the nozzle orifice. The inside diameter of the nozzle hosts a thick rind of agglomerated fines that represent material referred to as "mud balls" in previous observations. A few small rust flakes and angular siltstone fragments were adhered to the electrical tape where it had covered the open base of the nozzle.

- +8 material was not present
- +12 material (0.02 g) consists of a single, angular fragment of coal as well as three remnant aggregates of fines, dominantly representing coal, that formerly coated the inside of the spray nozzle. A thin, fragile rust flake was also present.
- +60 material (0.07 g) is dominated by rust flakes with very sparse angular fragments of dark gray siltstone and "mud balls" of coal fines that are remnants of the coating rind on the insides of the nozzle. The "mud balls" are easily disaggregated into fines with a slight touch.
- -60 material (0.03 g) is dominated by coal, with scattered rust flakes and dark gray siltstone.

PE-0464 D (spray/staple) 0.5 g

When the electrical tape was unwrapped, it was evident that the nozzle orifice was plugged with sediment. Upon removal of the tape across the base of the nozzle, it was evident that loose rust flakes were trapped inside the nozzle. After the loose rust flakes were dumped out, there was still congealed material inside the nozzle on the inner surface of the plugged orifice. The sediment was removed in stages: at the base of the nozzle, loose rust flakes represent the most recent material deposited, while the material farthest in the innermost recesses of the nozzle, consisting of milled sandstone and coal fines, represent material that had been deposited first, prior to the introduction of the rust flakes.

- +8 material (0.13 g) consists of one angular, blocky fragment of coal and one angular, milled fragment of light gray sandstone.
- +12 material (0.07 g) consists of one angular fragment of light gray sandstone, two angular fragments of dark gray siltstone, and five angular fragments of coal, some of which exhibit light, surficial iron staining.
- +60 material (0.22 g) consists of 5% angular fragments of light gray sandstone, 10% angular fragments of dark gray siltstone, 15% coal, and 70% rust flakes.
- -60 material (0.04 g) is dominated by light gray sandstone and dark gray siltstone with minor coal and sporadic orange limonite-altered rust flakes.

PE-0464 E (spray/staple) 0.43 g

When the electrical tape was unwrapped, angular rust flakes were revealed in the interior of the nozzle, with many flakes stuck to the tape. After several seconds of aggressive tapping, angular rust flakes remained congealed together inside the nozzle. The mass was removed by pushing a stiff wire through the orifice, which induced the disaggregation of the mass of rust flakes.

- +8 material (0.03 g) consists of two angular fragments of coal that are 4 mm in length.
- +12 material (0.05 g) consists of one angular fragment of light gray sandstone, three angular fragments of dark gray siltstone, a single angular fragment of coal, and two flat rust flakes. The rust flakes were characterized by dark brown goethite alteration with patchy orange limonite.
- +60 material (0.29 g) consists of 1% light gray sandstone that exhibits some iron staining, 2% angular coal fragments, and 97% rust flakes.
- -60 material (0.04 g) is dominated by rust flakes, with 10% angular coal fragments.

PE-0464 #10 (spray/staple) 0.02 g

There was no tape on this nozzle, although the basal plastic insert was in place. It was evident that the outlet orifice was not clogged, but that all three holes in the plastic insert at the rear of the nozzle were filled with fines. Although there is some minor coating of coal dust inside the nozzle, there was no appreciable material inside the nozzle. Two of the three holes on the inner surface of the plastic insert have “hanging chads” and the third hole was drilled cleanly but still clogged. The inside surface of the plastic insert was coated with coal dust. The very slight amount of material consisted of -60 mesh coal fines.

<u>PE-0464 #35 (spray/staple) 0.51 g</u>
When the electrical tape was unwrapped, it was evident that the nozzle outlet orifice was clogged with small, angular fragments of dark gray siltstone that abut against each other along angular corners. Upon removal of tape from the open bottom, it was evident that the inside of the nozzle was packed with fine-grained sediment that had been aggregated and completely filled the inside of the nozzle. The packed material consists of dark brown fines and angular fragments of coal and dark gray siltstone, but no rust flakes.

- +8 material (0.16 g) consists of two angular fragments of coal and four angular fragments of dark gray siltstone.
- +12 material (0.07 g) consists of three angular fragments of dark gray siltstone and five angular fragments of coal, with the corners rounded off.
- +60 material (0.14 g) consists of 5% rust flakes, 30% coal, and 65% dark gray siltstone. Rock fragments exhibit angular, freshly broken surfaces.
- -60 material (0.08 g) consists of bright orange limonite rust flakes (10%), light gray sandstone (5%), and coal fines with dark gray siltstone (85%). The fraction contains coal dust that is “greasy” and adheres to the pan.

<u>PE-0464 #38 (spray/staple) 0.8 g</u>
When the electrical tape was unwrapped, it was evident that a small rock chip was lodged in the nozzle orifice. Upon removal of the tape covering the open bottom of the nozzle, it was evident that the inside of the nozzle was packed with fine-grained rock flour that constitutes the “mud balls” collected from other sprays. The material was dislodged with a stiff, thick wire and required significant force to push through. The fines have partially lithified into a pseudo-rock and are not easily disaggregated when in-place.

- +8 material (0.27 g) consists of two angular fragments of light gray sandstone, which exhibit sharp edges and angular corners.
- +12 material (0.03 g) consists dominantly of “mud balls” that represent the pseudo-lithified fines found inside the spray nozzle, but are easily disaggregated into fines with slight pressure after being shaken. The only real +12 material consists of three angular fragments of coal, and the “mud ball” material was added to the -60 fraction.
- +60 material (0.19 g) consists of angular fragments of light gray to white sandstone (10%), dark gray siltstone (30%), and coal (58%) that exhibit freshly broken surfaces, as well as “mud balls” that have been rounded off during shaking. The “mud balls” represent the pseudo-lithified fines that are easily disaggregated. The fraction also includes very rare rust flakes (2%).
- -60 material (0.28 g) consists dominantly of fines from the disaggregated, pseudo-lithified deposits on the inside of the nozzle. Discernible pieces are angular

fragments of coal and dark gray siltstone. The fines include the "mud ball" material from the +12 fraction.

PE-0464 #42 (spray/staple) no material
There was no tape on this nozzle, although the basal plastic insert was in place. It was evident that the outlet orifice was not clogged, but that all three of the holes in the plastic insert were clogged. Upon removal of the insert, it was evident that there was no material inside the nozzle. Inspection of the inner surface of the plastic insert indicated that the center hole was clogged, and that it is the only hole with a "hanging chad." Inspection of the outer surface indicated that all three holes were filled with coal fines and angular fragments of dark gray siltstone.

PE-0464 #43 (spray/staple) 0.13 g
There was no tape on this nozzle, although the basal plastic insert was in place. It was evident that the outlet orifice was not clogged, and that of the three holes in the plastic insert, one was clogged with coal fines and one (central hole) was clogged with a shiny, metallic bead that is indicative of welding spatter. Upon removal of the plastic insert, it was apparent that the rear (inside surface) of the holes had flaps of plastic still attached, similar to a "hanging chad" that had impeded the passage of sediment through the hole. An angular fragment of dark gray siltstone, as well as a metal bead had been trapped by the "hanging chads."

- +8 material (0.1 g) consists of a single, rounded, shiny metallic piece that represents a welding bead, with some yellow brass or brazing on one part. The rounded ends are shiny metal, while the intervening part shows rust oxidation.
- +12 size fraction contains no material
- +60 material (<0.01 g) consists of 5% rust flakes, 35% angular coal fragments, and 60% angular fragments of dark gray siltstone.
- -60 material (<0.01 g) consists of 5% rust flakes, 25% dark gray siltstone, and 70% coal fragments and coal fines.

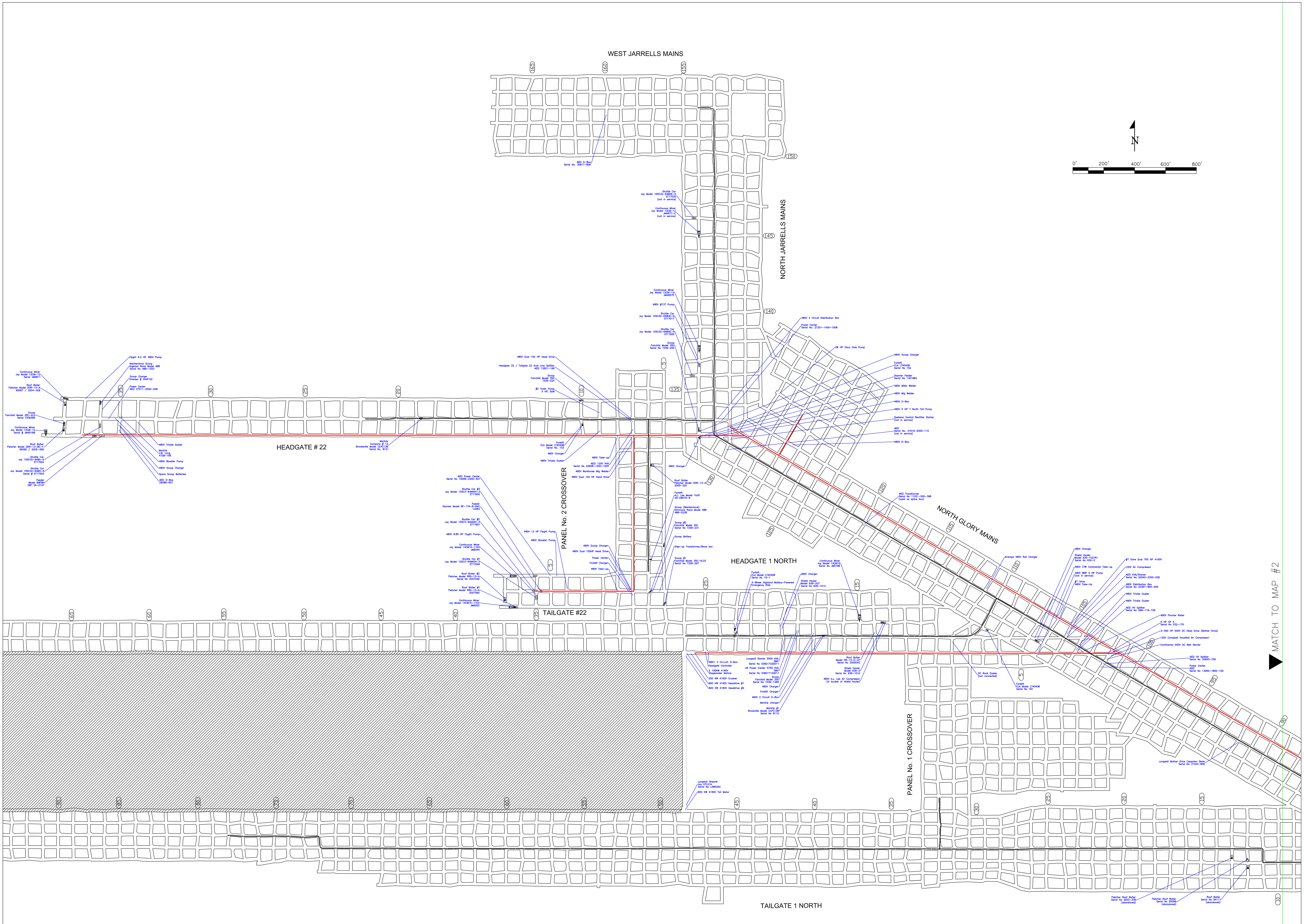
Conclusions
Sediment from the 1 North Longwall shearer's tailgate drum spray nozzles were separated into four size fractions. The No. 8 and No. 12 U.S. Standard Sieve mesh sizes were chosen because they are similar to the 3/32nd and 1/16th -inch diameter sizes of spray nozzle orifices used on the tailgate drum. Thus, any material larger than +8 or +12 could not have entered the respective nozzle from the outside. The No. 60 U.S. Standard Sieve mesh size (0.250 mm) was chosen because it is similar to the 0.01-inch mesh (0.254 mm) used as screening on the water supply filter baskets. Thus, any material larger than +60 should not have been able to pass through the water basket filter screen, and is more likely to have entered the spray nozzle by some mechanism other than the water supply.

The presence of +60, +12, and +8 size fragments in the spray nozzles may be an indication that the material entered through open nozzle ports on the shearer drum. It is significant that all of the +60 material consists of angular fragments of sandstone, siltstone, and coal, and that the fragments exhibit freshly broken, clean surfaces that are suggestive of generation by cutting activity of the longwall shearer. In contrast, quartz grains collected from the water baskets were characterized by subangular to subrounded, frosted grains that are considered typical of abrasion during transport on a geological time scale, and are likely to have been entrained in the water supply from the river or other surface supply. Individual quartz grains of this nature were not observed in any of the spray nozzle material. Furthermore, it is significant that the +60, +12, and +8 size material contains light gray to white sandstone, as well as dark gray, coarse-grained siltstone. During previous petrographic study of rock samples collected from the roof and floor of the longwall face, as part of the assessment of incendive potential, it was determined that while the immediate floor is composed of sandstone alone, the immediate roof is composed of light gray sandstone and thin layers of siltstone, which is represented by dark gray laminations. It therefore appears that chips of sandstone and siltstone from the roof had been falling into openings in the cutting drums for some unknown period of time.

A significant conclusion of this observation is that it seems highly unlikely that the drum could have been filled with freshly cut rock chips if the spray nozzles had been removed only after the tail drum cut out as part of routine maintenance just prior to the explosion. The presence of a significant volume of the +60 material being represented by dark gray, coarse-grained siltstone is an indication of rock chips falling from the immediate roof. Therefore, the drum must have been operating with open nozzle ports, and concomitant lack of water pressure, for some unknown length of time prior to the explosion. This is not an indication that the drum was operating in the moments before the explosion, but does indicate that the drum was most likely being operated without functional water sprays in the hours or days prior to the explosion.

The insides of several spray nozzles contained a rind of agglomerated coal fines and rock flour that in some cases had dried to a cement, and required significant force to dislodge. This material had in some cases coated the inside of the nozzle, clogging the outlet orifice especially where angular fragments of coal or siltstone had already become stuck inside the orifice. Although the nozzles in this batch of samples generally contained more rust flakes than the previous nozzles, and those rust flakes were of the +60/-12 fraction, the rust flakes occupied the basal portion of the spray nozzle interior, indicating that the coal/rock flour cement had been deposited first and clogged the spray, with the rust flakes deposited at some later time. In contrast to the sediment collected from the previously studied nozzles, which contained generally no more than 5% rust flakes, the nozzles collected from the bottom of the drum hosted a significant volume of rust flakes in the +60/-12 size fraction. This would suggest that the rust flakes preferentially settled to the bottom of the drum. However, it is not clear that the rust flakes were introduced during the restoration of water to the shearer in December 2010, because they should not have been able to pass through the water basket screen. Rust fragments are characterized by thin, flat flakes with a dark brown coloration and metallic luster, indicating the initial stages of oxidation to form lepidocrocite and goethite. This rust is of a different nature than the bright-orange, amorphous limonite staining that forms coatings on some angular rock chips collected from the spray nozzles and collected in a 20-ounce bottle by members of the Accident Investigation team during the December 2010 restoration of water to the shearer. Although the timing of rust introduction is unknown, it was definitely introduced after the coal/rock flour cement had already clogged the spray nozzles.

A significant amount of foreign material in the form of welding spatter and welding slag was present in this subset of nozzle samples, likely reflecting the propensity of high-density material to settle to the bottom of the drum. Welding spatter exhibited shiny, polished surfaces that are interpreted to reflect abrasion from the numerous rock fragments entrained inside the rotating drum, producing a scouring action similar to a ball mill. Welding spatter in some cases had clogged the spray nozzle outlet orifices, and become lodged in the holes of the plastic inserts.



CONVEYOR BELT

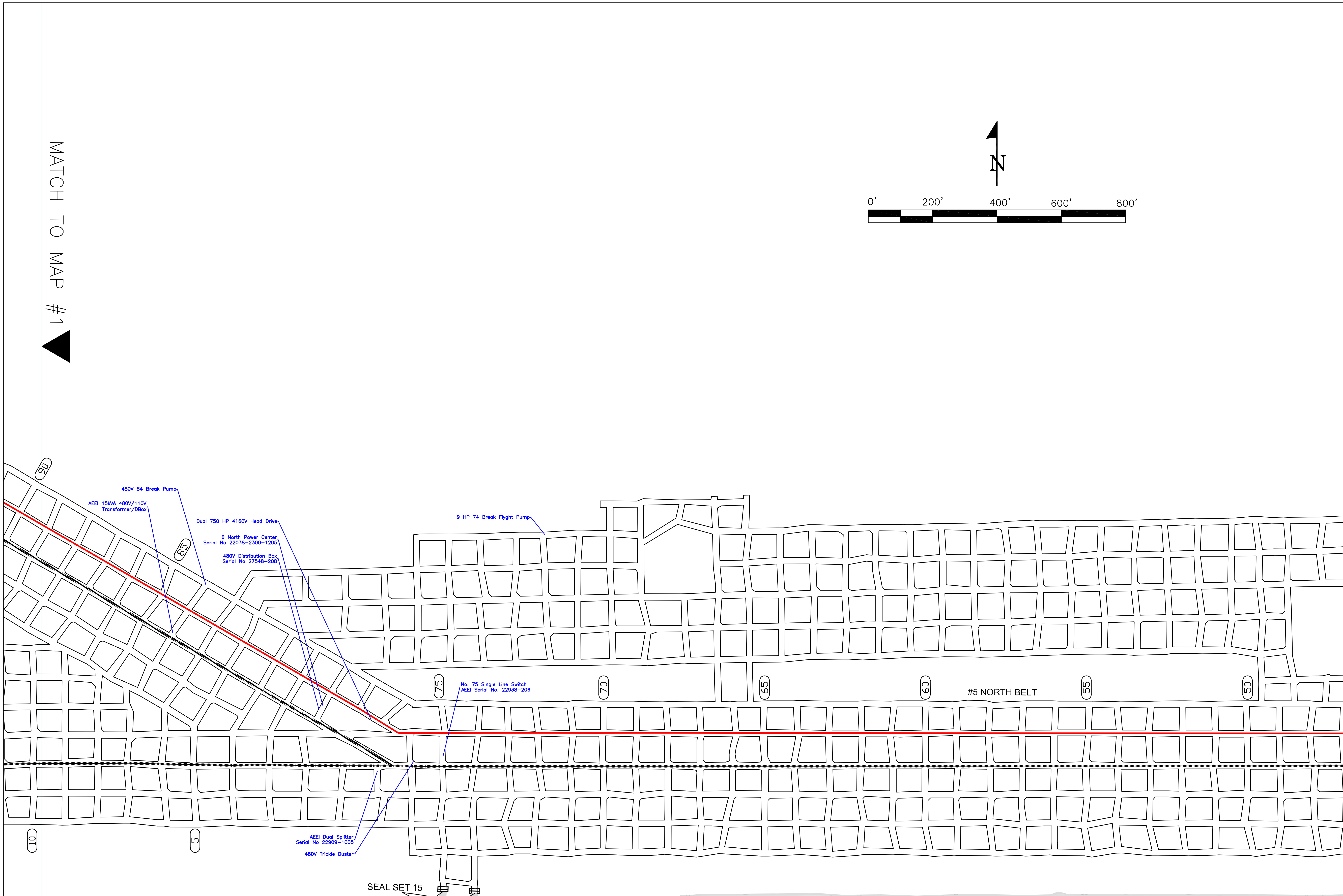
TRACK

LEGEND
Scale 1"=200'

MAPPING NOTES

MAPPING OF SELECTED ELECTRICAL EQUIPMENT.

FIGURE T-1
Map of Electrical System, Equipment, and Associated Items
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436



CONVEYOR BELT

TRACK

LEGEND
Scale 1"=200'

MAPPING NOTES

MAPPING OF SELECTED ELECTRICAL EQUIPMENT.

FIGURE T-2
Map of Electrical System, Equipment, and Associated Items
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

Appendix T

Elimination of Electrical Ignition Sources

<u>Lightning</u>
Lightning strikes were eliminated as a possible ignition source of the explosion event. Vaisala's National Lightning Detection Network showed no lightning strikes within a ten mile radius of the mine site between 10:09:42 a.m. and 7:07:02 p.m. (See Vaisala Report 258028 in Appendix V). At the time of the explosion, there was no evidence of power outages related to storms in the area.

<u>Welding and Cutting</u>
There was no evidence of welding or cutting being performed at the time of the explosion, and no cutting equipment was found in the area of the longwall face. However, two electric welders were located near the longwall face in the headgate area. One welder (designated as "DC PTO") was installed inside the third bay of the 480 Vac permissible headgate controller enclosure. This welder was interlocked with the longwall control circuitry, such that it could not be energized while the longwall 4,160 Vac power circuits were energized. Thus, the shearer and this welder could not be energized at the same time. In order to energize the welder through its circuit breaker "CB1," the "DC PTO" switch handle on the outside of the headgate controller must be put in the "DC PTO" position. This switch was found in the "Normal" position, indicating the CB1 circuit breaker and the welder were de-energized. The two individual welding leads, approximately 15 feet long, exited the controller enclosure and were not connected to any other leads.

The other electric welder, which normally hung on the monorail outby the headgate controller, was a portable unit that was found just inby the headgate controller enclosure. The power switch for this welder was found in the "off" position. The cable coupler to the distribution power box was found disconnected, indicating this welder was de-energized at the time of the explosion. No welding leads were connected to this welder when it was found. The only welding leads found in the area of the longwall face were in a flat cable, which was routed from the area of the headgate controller across the longwall face in the face conveyor's (panline) cable handling tray. The end of this flat cable near the headgate enclosure had two male welding connectors, for the face welding leads, and were found disconnected and locked with a chain and padlock in the cable handling tray near the headgate controller. The keys for this padlock were normally kept on top of the headgate controller, and were found on the ground under the controller.

From witness testimony, the last known welding operations in the longwall area was on the midnight maintenance shift prior to the accident. At that time, a welder was used to add additional flights to the face conveyor, and to replace the shearer head drum cowl blade. Both of these welding tasks were conducted on the headgate side of the longwall face.

Shearer Electrical Components

The Joy Mining Machinery, Model 07LS1A shearer, serial number LSW525C, MSHA Shearer Evaluation No. SE-18630-0, was located at the tailgate end of the longwall. The electrical components on the shearer included explosion-proof enclosures (motors, main controller enclosure, shearer power cable connection enclosure, and solenoid valve enclosure), a methane monitoring system with warning light enclosure, various intrinsically safe circuits, components and sensors, and all associated cables. Electrical cables were examined and no damaged areas were found.

The electrical control components of the shearer were housed in the main controller enclosure, MSHA Certification No. X/P-4161-0. The controller consisted of three bays; access to this single enclosure was provided by three separate covers for the left, middle and right controller bays. There was a small lens on the left cover, and a larger window on the middle cover.

All accessible flame-arresting path surfaces of the permissible explosion-proof enclosures were measured on the shearer, and no excessive openings were found. All unused lead entrances were plugged. A visual inspection of the windows and lenses showed no visible cracking or crazing (network of fine cracks). All fasteners and retainers were in place, and all fasteners were tight.

On the controller enclosure cover, all selector switches and circuit breaker handles were in their normal operating positions. The shearer e-stop mushroom switch, located on the main controller enclosure, was wired properly and functional, and was not activated.

Wiring and components inside the explosion-proof enclosures were examined and checked against the electrical approval documentation, and no deficiencies that would affect shearer operation were found. There was no evidence of abnormal arcing, sparking, or heating of components. No unusual odors were noted, and no abnormal residue was noted on any of the flame-arresting path surfaces.

The JNA event log recorded no protective circuit trip functions or alarms in the hours before the explosion. The last protective device trip was for an overload on the right-hand cutter motor, approximately 7 hours and 10 minutes before the explosion, but evidence indicates that this was not a prolonged shutdown of the machine.

Other mechanical features, including the ranging arm pins and cutter torque shafts, were inspected. Evidence and testimony indicated that the tail ranging arm “B-Lock” came out when the shearer was at the headgate. No electrical or mechanical deficiencies were found associated with the shearer.

Shearer Remote Control Transmitter
Shearer functions were controlled by two operators with handheld radio remote transmitters (Appendix U-1), designated by the JNA control system as left- and right-hand stations. The left transmitter and receiver operated at a frequency of 458.525 MHz, while the right transmitter and receiver operated at a frequency of 472.100 MHz. The station selector switch on the front panel of the shearer’s main controller was set to “both,” for the JNA control system to receive data from both remote transmitters. Therefore, both remotes must be functioning for the machine to be operational.

The right-hand transmitter, identified by its frequency of 472.100 MHz, was a Matric Limited, Model TX1, Remote Control Transmitter, MSHA Approval No. 9B-220-0, and was found at shield 100. This transmitter was taken to the manufacturer for further examination and testing. The transmitter case and internal components had physical damage consistent with external forces. When attempting to turn the transmitter on, a “stuck button” error occurred. The microcontroller socket had physical damage, and after being replaced by a Matric Limited technician, the transmitter was used to perform functional testing for the shearers’ JNA0 and JNA1 units, without the need for its internal battery to be recharged. Testing found each switch on the remote transmitter to be in operating order. An inspection at A&CC did not identify signs of heating, arcing, or sparking inside or outside the remote transmitter. Evaluation and testing showed that the maximum voltage and current available on any of the external pins of the remote transmitter was intrinsically safe. Therefore, MSHA concluded that this transmitter was not the ignition source.

The left-hand remote control transmitter was never found, but there was no indication that it was not functioning properly. The last record on the JNA event log prior to the explosion showed that the right-hand remote (Exhibit No. PE-0238) caused the shearer to stop.

Automatic Chain Tensioning System
A Joy Automatic Chain Tensioning System (ACTS) was installed at the tailgate area of the face to automatically control the face conveyor chain tension. The ACTS components included: an explosion-proof controller enclosure, a connection enclosure for the intrinsically safe circuits (referred to as a “marshalling box”), and various intrinsically safe transducers, sensors, a display beacon, and solenoids. This intrinsically safe system was accepted under MSHA Evaluation No. IA-18031-0.

All accessible flame-arresting path surfaces of the ACTS controller enclosure were measured, and no excessive openings were found. All unused lead entrances were plugged. An ACTS “PanelView” window display, located on the front enclosure cover, showed no visible cracking or crazing. All window fasteners and retainers were in place, and all fasteners were tight. All the intrinsically safe components were inspected, and no improper connections or damaged components were observed. None of the fuses in the intrinsically safe barriers, which protect the intrinsically safe circuits, measured “open.” There was no evidence of abnormal arcing, sparking, or heating of components inside the controller enclosure and the marshalling box, and no unusual odors were noted. No abnormal residue was noted on any of the flame-arresting path surfaces.

A communication cable linked the ACTS programmable logic controller (PLC), located in the tailgate controller, to the PLC located in the headgate enclosure. This cable entered both enclosures, but the conductors were not connected to the PLC components in either. The 120 Vac power supply from the headgate was still connected inside both the headgate and the ACTS enclosure, although without communication to the headgate PLC, the ACTS could not operate in automatic mode. The selector switch control was found in the “Auto” position, but longwall employees stated that the ACTS was always operated by manual hand valves, without electrical controls.

The PanelView connected to the PLC was designed to record the last 100 alarms of the ACTS programmable control system. When the alarm history was viewed, there were 100 identical alarms of a tailgate speed sensor fault, recorded within one second of each other, on September 11, 2009. Although the processor clock was off from “real time” by approximately one hour, it was concluded that the ACTS had not been used for many months prior to the accident.

<u>Tail Conveyor Drive Motor</u>
All accessible flame-arresting path surfaces of the enclosure, including the motor connection box, were measured, and no excessive openings were found. All unused lead entrances were plugged.

Wiring and components inside the connection box enclosure were examined and checked against the longwall electrical approval documentation; no deficiencies were found. There was no evidence of abnormal arcing, sparking, or heating of components. No unusual odors were noted, and no abnormal residue was noted on any of the flame-arresting path surfaces. A Fluke 1520 megohmmeter was used to verify that no degradation of the motor insulation had occurred.

<u>Electrical Cables Along the Longwall Face</u>
Electrical cables along the longwall face were located either in the cable handling system of the panline or hung along the longwall shields. The cable handling system consisted of four vertically-stacked sections of a cable trough, accessible from the side of the panline facing the shields. Another cable tray on top of the panline allowed the shearer electrical and water hoses, in its “bretby” handling system, to follow the shearer as it progressed across the face. At shield 88, the

shearer power cable and water hose exited the second section of the cable trough, and entered the cable tray in its “bretby” handling system.

The top section of the trough contained seven electrical cables: 1) flat electrical cable (#2/0 AWG, type W) that contained the welding conductors; 2) blue armored cable for the methane monitor sensor located at the tailgate; 3) yellow communication cable for the ACTS, which was disconnected at both ends, but entered the two enclosures; 4) #6 AWG, 3 conductor, type G-GC cable (previous pump cable disconnected at both ends), which was routed from the headgate area but ended at Shield 86; 5) #6 AWG, 3 conductor, type G-GC cable, (previous pump cable disconnected at both ends), which was routed from the headgate to the tailgate, but was severed, with the ends four feet apart, at shield 115; 6) #14 AWG, 3 conductor, type Remote Control and Drill Cord cable, which was disconnected at both ends, and; 7) #14 AWG, 4 conductor, type Remote Control and Drill Cord cable, which provided 120 Vac to the ACTS controller enclosure. Progressing downward, the second section of the cable trough contained two 4,160 Vac power cables. One was a blue power cable for the tailgate conveyor drive motor. The other was a yellow power cable for the shearer. The third section of the cable trough contained a 1-1/2” hydraulic hose for the shields, 1” hose for the tail conveyor motor drive cooling water, and a hose to the tail drive water coupling. The fourth (bottom) section of the cable trough contained a water hose that supplied the shearer, and a return hydraulic hose for the shield hydraulic system.

Examination of the shearer power cable where it exited the second section of the cable trough at mid-face, and where it entered the shearer, indicated that the bretby handling system containing the hose and cable had sufficient slack. The examination revealed no deficiencies in any cables in the panline cable trough. The shearer cable had been replaced from mid-face to the shearer in mid-March; splices examined at shields 45 and 87 were constructed adequately. Two repairs to the tail face conveyor motor cable, at shields 91 and 105, were found to be constructed adequately.

<u>Insulation Testing of Power Cables (Panline)</u>

The shearer and tail conveyor motor cables were type SHD-GC, with a shield around each of the power conductors, and each conductor shield in contact with the ground conductor. The insulation of the power conductors in both the shearer and tail conveyor motor cables were tested, using an Extech Digital High Voltage Insulation Tester, Model 380395, set at 5,000 volts. For both cables, the tester was placed sequentially between each power conductor and the ground conductor at the respective disconnect enclosures. This tested the insulation of each of the cables’ power conductors for their entire length. The testing showed no degradation in the insulation of any of the power conductors in either cable.

Lighting System Components
The lighting system power cable was a #6 AWG, 3-conductor, type G-GC cable, which provided 120 Vac three-phase power to the lighting power supply, explosion-proof enclosures. The type G-GC cable consisted of three-phase power conductors, an insulated ground-check “pilot” conductor, and two ground conductors. A lighting power supply enclosure was located at shields 3, 23, 43, 63, 83, 103, 123, 143, 163, and 173, each of which housed two intrinsically safe power supplies, accepted under MSHA Evaluation No. IA-13827-0. Each intrinsically safe power supply provided a nominal 12 volts direct current (Vdc) output to power five KH Controls Inc., Model LX1 luminaires (light assembly), located on every other shield. The luminaires were accepted under MSHA Evaluation No. IA-16453-0 and Certification No. X/P-4036-0.

At shield 171, the lighting power cable was damaged, exhibiting a severed ground-check conductor and insulation damage on the black and white phase conductors. The lighting cable is normally zip-tied to the shield water line away from the chock interface unit (CIU). When inspected, the damaged area of the cable was laying on the damaged area of the CIU. The CIU had a bent mounting bracket, deformed enclosure, damaged internal circuit boards, and a damaged face plate. Upon initial inspection, the damage to the lighting cable was determined to have been caused by the same explosive forces, traveling from the tailgate toward the headgate, which damaged the CIU. The damaged section of the cable was recovered and sent to the A&CC for analysis...

The lighting system power cable was protected by an SMC Electrical Products, Inc., Model C54-006, ground wire monitor in the headgate controller. (See Appendix - U-11) This ground wire monitor is designed to trip the lighting circuit breaker when an open or a short in the pilot wire occurs, thus de-energizing the entire longwall lighting circuit. There were no reports of the longwall lights not working and no evidence of maintenance being performed on the lighting circuit. The ground wire monitor circuitry and the pilot wire terminating diode were removed and tested at the A&CC to determine if sufficient energy existed in the pilot wire conductor to ignite an 8.3% methane-in-air mixture. Tests were conducted with and without simulated value of cable inductance. No testing ignited the methane-air mixture. The following protective circuit components were removed from the enclosure; lighting current transformer, lighting relay, ground fault relay, ground wire monitor, and lighting circuit breaker. A&CC performed functional testing of the protective circuitry components and no deficiencies were found.

The lighting power supply explosion-proof enclosures located at shields 163 and 173 were examined. All accessible flame-arresting path surfaces of these enclosures were measured, and no excessive openings were found. There was no evidence of abnormal arcing, sparking, or heating of components in the enclosures (Appendix U-2). No unusual odors were detected, and no abnormal residue was noted on any of the flame-arresting path surfaces.

Various lighting system components were retrieved for further examination and testing at A&CC. The components retrieved were:

Six KH Controls Model ISS1 – 13.0 – 8.10, IA-13827-0 Power Supplies

- Exhibit No. PE-0246-a*, S/N 1034, recovered from shield 173 (written on the front of the supply)
- Exhibit No. PE-0246-b*, S/N 1832, recovered from shield 173 (written on the front of the supply)
- Exhibit No. PE-0247-a**, S/N 2536, recovered from shield 163 (written on the front of the supply)
- Exhibit No. PE-0247-b**, S/N 995, recovered from shield 163 (written on the front of the supply)
- Exhibit No. PE-0248-a***, S/N 2185, recovered from shield 3 (written on the back of the supply)
- Exhibit No. PE-0248-b***, S/N 1295, recovered from shield 3 (written on the back of the supply)

**A case with Exhibit No. PE-0246 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos.*
PE-0246-a and PE-0246-b when the case was opened.

***A case with Exhibit No. PE-0247 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos.*
PE-0247-a and PE-0247-b when the case was opened.

**** A case with Exhibit No. PE-0248 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos. PE-0248-a and PE-0248-b when the case was opened.*

Thirteen KH Controls Model LX1 Luminaire, IA-16453-0, X/P-4036-0

- Exhibit No. PE-0254-a*, S/N 10774, recovered from shield 167
- Exhibit No. PE-0254-b*, S/N unknown (missing approval plate), recovered from shield 124
- Exhibit No. PE-0258-a**, S/N 12483, recovered from the area of shield 62
- Exhibit No. PE-0258-b**, S/N 7791, recovered from the area of shield 66
- Exhibit No. PE-0258-c**, S/N 6712, recovered from the area of shield 89
- Exhibit No. PE-0258-d**, S/N 7353, recovered from the area of shield 173
- Exhibit No. PE-0258-e**, S/N 12535, recovered from the area of shield 64
- Exhibit No. PE-0258-f**, S/N 10437, recovered from the area of shield 139
- Exhibit No. PE-0474, S/N unknown (missing approval plate), recovered from the area of Survey Spad 22567

- Exhibit No. PE-0475, S/N unknown (missing approval plate), recovered from the area of the cross cut adjacent to Survey Spad 22567
- Exhibit No. PE-0476, S/N unknown (missing approval plate),recovered from the area of the tailgate entry at the shearer
- Exhibit No. PE-0477, S/N unknown (missing approval plate), recovered from the area of Shield 175
- Exhibit No. PE-0478, S/N unknown (missing approval plate), recovered from the area of Shield 172

The recovered from location information was obtained from the shield number written on the light, and/or the evidence tag.

**A cardboard box with Exhibit No. PE-0254 was received and contained two KH Controls Model LX1 Luminaire exhibits. These two exhibits were assigned the newly generated Exhibit Nos. PE-0254-a, and PE-0254-b when the box was opened.*

**A cardboard box with Exhibit No. PE-0258 was received and contained six KH Controls Model LX1 Luminaire exhibits. These six exhibits were assigned the newly generated Exhibit Nos. PE-0258-a, PE-0258-b, PE-0258-c, PE-0258-d,*
PE-0258-e, and PE-0258-f when the box was opened.

IS Lighting Cable with connectors- Exhibit No. PE-0324, 91 feet of 14AWG, 3/C SOW, recovered from shield 143 to shield 152

Based on technical analysis and inspection of the underground installation, no evidence was found that the lighting system was an electrical ignition source. All lighting power supplies were functional, tested within approved safety settings, and exhibited no sign of internal tampering or damage significant enough to affect the operation. Each recovered luminaire showed effects of explosion-related heat and/or impact damage, which was consistent with all observed luminaires on the face. Luminaires from shields 124 and 66 (Exhibit Nos. PE-0254-b and PE-0258-b) were found in a condition indicating they were not maintained in permissible condition prior to the explosion, but these did not contribute to the explosion. Exhibit No. PE-0254-b had electrical tape wrapped around a significant crack in the connection where the polycarbonate tube, which contained dust and dirt, threaded into the maintenance sleeve. Exhibit No. PE-0258-b had a missing end cap, and the polycarbonate tube, which had electrical tape wrapped around it, was broken off at the threaded end. A crack would defeat the explosion-proof integrity of the assembly. However, these exhibits were not located where the ignition occurred. None of the other damaged luminaires taken as evidence or examined underground had electrical tape covering cracks.

Electrohydraulic Shield System

The Joy MS40 electrohydraulic system, consisting of a Master Supply Unit (MSU) and a Support Control Centre (SCC) at the headgate, controlled the movement of the shields. The intrinsically safe components were accepted under MSHA Evaluation No. IA-408-10. The MSU and SCC were powered by their own intrinsically safe power supplies, (KH Controls, Inc. Model ISSA-13.0-6.8-AL1, accepted under MSHA Evaluation No. IA-13827-0), installed in explosion-proof enclosures, MSHA Certification No. X/P-3929-0. A CIU control enclosure was located on each of the 176 shields along the longwall face. The MSU supplied intrinsically safe, nominal 12 Vdc power for the CIU enclosures via a “roadway” armored cable. On each shield, the CIU controlled six hydraulic solenoid valves, which initiated movement of the shields, and connected to a pressure and a distance transducer.

A dump valve kit, consisting of a solenoid and pressure switch, was designed to release the main system hydraulic pressure to the return line, if any e-stop button was depressed on any face CIU or the MSU, or if the system hydraulic pressure was inadequate. The MSU provided power for the dump valve, and provided monitoring for the e-stop system to protect against solenoid valve short circuit or low voltage conditions.

CIU enclosures were mounted on each shield. Two spare CIU enclosures, missing faceplates and internal printed circuit boards, were found at shields 27 and 77. The CIU enclosures at shields 1, 2, and 6 were damaged, and had several circuit boards missing. CIU circuit boards found in the tailgate area would likely correspond either to CIU enclosures at shields 1, 2, or 6, or from the spare CIU enclosures.

Various components were retrieved for further examination and testing at A&CC, including:

- CIU enclosures from shields 62, 64, 169, 170, 171, 172, 173, 174, 175, and 176. CIU enclosures from shields 169 through 176 were retrieved because they exhibited signs of external heat or physical damage. CIU enclosures from shields 62 and 64 were retrieved because of visible heat damage on the infrared receiver lens.
- The roadway cable between CIU enclosures at shields 169 and 170, which was found disconnected at the headgate side of the CIU enclosure at shield 170.
- The KH Controls, Inc. Model ISSA-13.0-6.8-AL1 power supply for the MSU unit, accepted under MSHA Evaluation No. IA-13827-0.
- The MSU unit.

- The SCC, which was taken to the manufacturer's facility, where engineers and technicians familiar with this equipment attempted to view and recover the event and fault logs. Damage to the SCC and its internal circuitry was too extensive to allow data recovery.
- Six hydraulic solenoid valves recovered from shield 170, and two hydraulic solenoid valves recovered from shield 145.

The intrinsic safety analysis conducted at A&CC examined:

- Output of the intrinsically safe MSU power supply.
- Inductive energy stored in the roadway cable.
- Energy stored in the hydraulic solenoid valves of the shields.
- Energy stored in the total system capacitance of the connected system.
- The possibility of thermal ignition from small-gauge wire strands.

The analysis indicated that no signs of electrical heating, arcing, or sparking were observed on any of the components in the CIU enclosures, solenoids, power supplies, or associated cables. Based on the technical analysis and inspection of the underground installation, the electro-hydraulic shield control system is not considered an electrical ignition source (Appendix U-3).

Comtrol Communication System

The Comtrol longwall face communication/conveyor lock-out system, MSHA Approval No. 9B-71-2, consisted of Longwall Loudmouth Model LM115 phones positioned at the headgate area and typically, every eighth shield. Each phone is powered by its own 12-volt battery. An 18 AWG, 4 conductor, type SOOW cable connected each of the phone enclosures, and was protected by hose conduit up to the in-line connector near the phone. The system was linked to the startup sequence of the longwall face conveyor, through a Model LM1574A start up alarm control receiver, so that an alarm was given over the speakers when the conveyor was about to start. Each phone enclosure was provided with a lockout control capability to prevent the face conveyor from operating.

Investigators noted that some phones were not in their original positions (i.e. mounted on shields). The phone at shield 173, the last in the system, was missing, as was the phone at shield 117. At least four phones were missing on the headgate side of the longwall. Phone circuit boards and enclosure pieces were found at several different locations across the face, as well as in the No. 7 tailgate entry. Electrical investigators that have traveled the face area did not observe any components or cables that showed signs of being an electrical ignition source.

Various system components were retrieved for further examination and testing at A&CC . Worst case tests for intrinsic safety were performed on the power supply, start-up alarm/phone (located near the headgate enclosure), and an equivalent end-of-line termination unit, which was used because the actual termination unit was not located prior to the test, but found later at shield 110 approximately 360 feet from shield 173. This unit was also tested. All tests were performed with a worst case methane-in-air mixture of 8.3%, and indicated that a page transmitted from the headgate enclosure area would not ignite a methane-in-air mixture at the tailgate. A conveyor lockout switch passed the same test.

Five Loudmouth phones and the start-up alarm/phone (from the headgate) were tested at A&CC for functionality. The phone from shield 165 was spark-ignition tested, and did not ignite an 8.3% methane-in-air mixture. Three face phones (shields 85, 109, and 165) and the headgate start-up alarm/phone were fully functional (communication and lock-out functions). Two phones obtained near the crusher and belt conveyor tailpiece had functioning conveyor lock-out switches, but had slight communication issues, in that the tailpiece phone could receive but not transmit, whereas the stageloader/crusher phone could receive, but transmitted a low, audible signal. Two terminating devices and additional Loudmouth phone components found across the longwall face were also sent to AC&C for further examination.

Witness testimony did not indicate any issues with the longwall communication/conveyor lock-out system. The phone at shield 173 has not been found. An electrician that worked the midnight shift prior to the explosion stated that it was working properly. Pieces of telephone components were found around the longwall tailgate area that was possibly from the 173 phone. None of these components showed any signs of arcing and sparking (Appendix U-4).

<u>Multi-Gas Detector</u>
A MSA Solaris multi-gas detector (Exhibit No. B-15-B), carried by Richard Lane, Longwall Section Foreman, was retrieved from mid-face for examination and testing at A&CC. Testing determined that it was in working order. Downloaded data indicated that the device was energized at the time of the explosion and continued operating for several hours thereafter. During thermal ignition testing, the detector did not cause an ignition of a 7.75% methane-in-air mixture when energized (Appendix U-5).

<u>Personal Electrical Items</u>
Various electrical items were removed from six victims found and the longwall face.

Tracking Tags
Pyott-Boone Model 1980 tracking tag transmitters, MSHA Approval No. 23-A080004-0, were used by the miners. The following tracking tags belonged to victims found on the longwall face:

- Tracking Tag ID 570, belonging to Chris Bell, Exhibit No. PE-0483;
- Tracking Tag ID 584, belonging to Joel Price, Exhibit No. PE-0239;
- Tracking Tag ID 564, belonging to Rick Lane, Exhibit No. B-15-D;
- Tracking Tag ID 547, belonging to Gary Quarles, Exhibit No. B-11-A;
- Tracking Tag ID 540, belonging to Dillard Persinger, Exhibit No. B-10-A; and,
- Tracking Tag ID 546, belonging to Grover Skeens, Exhibit No. B-9-A.

Exhibits PE-0483 and PE-0239 were found near shields 109 and 94-95, respectively. Exhibits B-9-A, B-10-A, B-11-A, and B-15-D were brought out of the mine in the days immediately after the accident. Twenty-four tracking tags, including the six already noted, were retrieved for further examination and testing at A&CC. The examination of the tags indicated that the tracking tag enclosures were not exposed to heat or fire, electrical energy within the tracking tags was not exposed to the mine atmosphere, and that none of the tracking tags represented a thermal or a spark ignition source (Appendix U-6).

Cap Lamps
An assortment of intact cap lamps and components were retrieved. Of these, thirty-three individual items were subjected to further examination and testing at A&CC. Many items exhibited explosion-related damage, i.e. heat, charring, soot, missing pieces or severe physical force. No evidence indicated that any of the cap lamp batteries had sufficient electrical energy to ignite a methane-in-air mixture or enough thermal energy to ignite coal dust (Appendix U-7).

Air-Purifying Helmet Components
Seven components from the air purifying helmets including four batteries, a portion of a battery case, and pieces of the helmet and cable were retrieved for further examination and testing at A&CC. None of the electrical components indicated signs of arcing, sparking or electrical heating. Methane ignition did not occur during a spark ignition test with the highest short circuit current and highest open circuit voltage that was measured from any of the batteries (Appendix U-8).

Watches and Calculators
Several non-permissible electrical items, including six watches and two calculators, were recovered from the longwall face and subjected to examination and testing at A&CC. These items were all disassembled and inspected. Four watches and one calculator were functional and working as expected. None of the items indicated signs of arcing, sparking, or electrical heating, and there is no

evidence that any of these items were a source of spark or thermal ignition (Appendix U-9).

Methane Monitor Sensor Components.
Two CSE Model 140B LD IR methane monitor sensors (Exhibit Nos. PE-0169 and PE-0170) were retrieved from the tailgate area and tested at A&CC. The inspection of these components did not reveal any conditions that would suggest that the components caused an explosion. The sensors did not cause an ignition of a 7.5% methane-in-air mixture when energized in the test gas (Appendix U-10).

See Figures T-1 and T-2 for maps of the Electrical System, Equipment, and Associated Items that shows locations of some of these items and others inspected during the investigation.

APPENDIX U

TESTING RESULTS FOR ALL EQUIPMENT TESTED AT A&CC

Appendix T

Elimination of Electrical Ignition Sources

Lightning
Lightning strikes were eliminated as a possible ignition source of the explosion event. Vaisala's National Lightning Detection Network showed no lightning strikes within a ten mile radius of the mine site between 10:09:42 a.m. and 7:07:02 p.m. (See Vaisala Report 258028 in Appendix V). At the time of the explosion, there was no evidence of power outages related to storms in the area.

Welding and Cutting
There was no evidence of welding or cutting being performed at the time of the explosion, and no cutting equipment was found in the area of the longwall face. However, two electric welders were located near the longwall face in the headgate area. One welder (designated as "DC PTO") was installed inside the third bay of the 480 Vac permissible headgate controller enclosure. This welder was interlocked with the longwall control circuitry, such that it could not be energized while the longwall 4,160 Vac power circuits were energized. Thus, the shearer and this welder could not be energized at the same time. In order to energize the welder through its circuit breaker "CB1," the "DC PTO" switch handle on the outside of the headgate controller must be put in the "DC PTO" position. This switch was found in the "Normal" position, indicating the CB1 circuit breaker and the welder were de-energized. The two individual welding leads, approximately 15 feet long, exited the controller enclosure and were not connected to any other leads.

The other electric welder, which normally hung on the monorail outby the headgate controller, was a portable unit that was found just inby the headgate controller enclosure. The power switch for this welder was found in the "off" position. The cable coupler to the distribution power box was found disconnected, indicating this welder was de-energized at the time of the explosion. No welding leads were connected to this welder when it was found. The only welding leads found in the area of the longwall face were in a flat cable, which was routed from the area of the headgate controller across the longwall face in the face conveyor's (panline) cable handling tray. The end of this flat cable near the headgate enclosure had two male welding connectors, for the face welding leads, and were found disconnected and locked with a chain and padlock in the cable handling tray near the headgate controller. The keys for this padlock were normally kept on top of the headgate controller, and were found on the ground under the controller.

From witness testimony, the last known welding operations in the longwall area was on the midnight maintenance shift prior to the accident. At that time, a welder was used to add additional flights to the face conveyor, and to replace the shearer head drum cowl blade. Both of these welding tasks were conducted on the headgate side of the longwall face.

Shearer Electrical Components

The Joy Mining Machinery, Model 07LS1A shearer, serial number LSW525C, MSHA Shearer Evaluation No. SE-18630-0, was located at the tailgate end of the longwall. The electrical components on the shearer included explosion-proof enclosures (motors, main controller enclosure, shearer power cable connection enclosure, and solenoid valve enclosure), a methane monitoring system with warning light enclosure, various intrinsically safe circuits, components and sensors, and all associated cables. Electrical cables were examined and no damaged areas were found.

The electrical control components of the shearer were housed in the main controller enclosure, MSHA Certification No. X/P-4161-0. The controller consisted of three bays; access to this single enclosure was provided by three separate covers for the left, middle and right controller bays. There was a small lens on the left cover, and a larger window on the middle cover.

All accessible flame-arresting path surfaces of the permissible explosion-proof enclosures were measured on the shearer, and no excessive openings were found. All unused lead entrances were plugged. A visual inspection of the windows and lenses showed no visible cracking or crazing (network of fine cracks). All fasteners and retainers were in place, and all fasteners were tight.

On the controller enclosure cover, all selector switches and circuit breaker handles were in their normal operating positions. The shearer e-stop mushroom switch, located on the main controller enclosure, was wired properly and functional, and was not activated.

Wiring and components inside the explosion-proof enclosures were examined and checked against the electrical approval documentation, and no deficiencies that would affect shearer operation were found. There was no evidence of abnormal arcing, sparking, or heating of components. No unusual odors were noted, and no abnormal residue was noted on any of the flame-arresting path surfaces.

The JNA event log recorded no protective circuit trip functions or alarms in the hours before the explosion. The last protective device trip was for an overload on the right-hand cutter motor, approximately 7 hours and 10 minutes before the explosion, but evidence indicates that this was not a prolonged shutdown of the machine.

Other mechanical features, including the ranging arm pins and cutter torque shafts, were inspected. Evidence and testimony indicated that the tail ranging arm “B-Lock” came out when the shearer was at the headgate. No electrical or mechanical deficiencies were found associated with the shearer.

Shearer Remote Control Transmitter

Shearer functions were controlled by two operators with handheld radio remote transmitters (Appendix U-1), designated by the JNA control system as left- and right-hand stations. The left transmitter and receiver operated at a frequency of 458.525 MHz, while the right transmitter and receiver operated at a frequency of 472.100 MHz. The station selector switch on the front panel of the shearer’s main controller was set to “both,” for the JNA control system to receive data from both remote transmitters. Therefore, both remotes must be functioning for the machine to be operational.

The right-hand transmitter, identified by its frequency of 472.100 MHz, was a Matric Limited, Model TX1, Remote Control Transmitter, MSHA Approval No. 9B-220-0, and was found at shield 100. This transmitter was taken to the manufacturer for further examination and testing. The transmitter case and internal components had physical damage consistent with external forces. When attempting to turn the transmitter on, a “stuck button” error occurred. The microcontroller socket had physical damage, and after being replaced by a Matric Limited technician, the transmitter was used to perform functional testing for the shearers’ JNA0 and JNA1 units, without the need for its internal battery to be recharged. Testing found each switch on the remote transmitter to be in operating order. An inspection at A&CC did not identify signs of heating, arcing, or sparking inside or outside the remote transmitter. Evaluation and testing showed that the maximum voltage and current available on any of the external pins of the remote transmitter was intrinsically safe. Therefore, MSHA concluded that this transmitter was not the ignition source.

The left-hand remote control transmitter was never found, but there was no indication that it was not functioning properly. The last record on the JNA event log prior to the explosion showed that the right-hand remote (Exhibit No. PE-0238) caused the shearer to stop.

Automatic Chain Tensioning System

A Joy Automatic Chain Tensioning System (ACTS) was installed at the tailgate area of the face to automatically control the face conveyor chain tension. The ACTS components included: an explosion-proof controller enclosure, a connection enclosure for the intrinsically safe circuits (referred to as a “marshalling box”), and various intrinsically safe transducers, sensors, a display beacon, and solenoids. This intrinsically safe system was accepted under MSHA Evaluation No. IA-18031-0.

All accessible flame-arresting path surfaces of the ACTS controller enclosure were measured, and no excessive openings were found. All unused lead entrances were plugged. An ACTS “PanelView” window display, located on the front enclosure cover, showed no visible cracking or crazing. All window fasteners and retainers were in place, and all fasteners were tight. All the intrinsically safe components were inspected, and no improper connections or damaged components were observed. None of the fuses in the intrinsically safe barriers, which protect the intrinsically safe circuits, measured "open." There was no evidence of abnormal arcing, sparking, or heating of components inside the controller enclosure and the marshalling box, and no unusual odors were noted. No abnormal residue was noted on any of the flame-arresting path surfaces.

A communication cable linked the ACTS programmable logic controller (PLC), located in the tailgate controller, to the PLC located in the headgate enclosure. This cable entered both enclosures, but the conductors were not connected to the PLC components in either. The 120 Vac power supply from the headgate was still connected inside both the headgate and the ACTS enclosure, although without communication to the headgate PLC, the ACTS could not operate in automatic mode. The selector switch control was found in the "Auto" position, but longwall employees stated that the ACTS was always operated by manual hand valves, without electrical controls.

The PanelView connected to the PLC was designed to record the last 100 alarms of the ACTS programmable control system. When the alarm history was viewed, there were 100 identical alarms of a tailgate speed sensor fault, recorded within one second of each other, on September 11, 2009. Although the processor clock was off from "real time" by approximately one hour, it was concluded that the ACTS had not been used for many months prior to the accident.

<u>Tail Conveyor Drive Motor</u>
All accessible flame-arresting path surfaces of the enclosure, including the motor connection box, were measured, and no excessive openings were found. All unused lead entrances were plugged.

Wiring and components inside the connection box enclosure were examined and checked against the longwall electrical approval documentation; no deficiencies were found. There was no evidence of abnormal arcing, sparking, or heating of components. No unusual odors were noted, and no abnormal residue was noted on any of the flame-arresting path surfaces. A Fluke 1520 megohmmeter was used to verify that no degradation of the motor insulation had occurred.

<u>Electrical Cables Along the Longwall Face</u>
Electrical cables along the longwall face were located either in the cable handling system of the panline or hung along the longwall shields. The cable handling system consisted of four vertically-stacked sections of a cable trough, accessible from the side of the panline facing the shields. Another cable tray on top of the panline allowed the shearer electrical and water hoses, in its "bretby" handling system, to follow the shearer as it progressed across the face. At shield 88, the

shearer power cable and water hose exited the second section of the cable trough, and entered the cable tray in its “bretby” handling system.

The top section of the trough contained seven electrical cables: 1) flat electrical cable (#2/0 AWG, type W) that contained the welding conductors; 2) blue armored cable for the methane monitor sensor located at the tailgate; 3) yellow communication cable for the ACTS, which was disconnected at both ends, but entered the two enclosures; 4) #6 AWG, 3 conductor, type G-GC cable (previous pump cable disconnected at both ends), which was routed from the headgate area but ended at Shield 86; 5) #6 AWG, 3 conductor, type G-GC cable, (previous pump cable disconnected at both ends), which was routed from the headgate to the tailgate, but was severed, with the ends four feet apart, at shield 115; 6) #14 AWG, 3 conductor, type Remote Control and Drill Cord cable, which was disconnected at both ends, and; 7) #14 AWG, 4 conductor, type Remote Control and Drill Cord cable, which provided 120 Vac to the ACTS controller enclosure. Progressing downward, the second section of the cable trough contained two 4,160 Vac power cables. One was a blue power cable for the tailgate conveyor drive motor. The other was a yellow power cable for the shearer. The third section of the cable trough contained a 1-1/2” hydraulic hose for the shields, 1” hose for the tail conveyor motor drive cooling water, and a hose to the tail drive water coupling. The fourth (bottom) section of the cable trough contained a water hose that supplied the shearer, and a return hydraulic hose for the shield hydraulic system.

Examination of the shearer power cable where it exited the second section of the cable trough at mid-face, and where it entered the shearer, indicated that the bretby handling system containing the hose and cable had sufficient slack. The examination revealed no deficiencies in any cables in the panline cable trough. The shearer cable had been replaced from mid-face to the shearer in mid-March; splices examined at shields 45 and 87 were constructed adequately. Two repairs to the tail face conveyor motor cable, at shields 91 and 105, were found to be constructed adequately.

Insulation Testing of Power Cables (Panline)

The shearer and tail conveyor motor cables were type SHD-GC, with a shield around each of the power conductors, and each conductor shield in contact with the ground conductor. The insulation of the power conductors in both the shearer and tail conveyor motor cables were tested, using an Extech Digital High Voltage Insulation Tester, Model 380395, set at 5,000 volts. For both cables, the tester was placed sequentially between each power conductor and the ground conductor at the respective disconnect enclosures. This tested the insulation of each of the cables’ power conductors for their entire length. The testing showed no degradation in the insulation of any of the power conductors in either cable.

Lighting System Components
The lighting system power cable was a #6 AWG, 3-conductor, type G-GC cable, which provided 120 Vac three-phase power to the lighting power supply, explosion-proof enclosures. The type G-GC cable consisted of three-phase power conductors, an insulated ground-check “pilot” conductor, and two ground conductors. A lighting power supply enclosure was located at shields 3, 23, 43, 63, 83, 103, 123, 143, 163, and 173, each of which housed two intrinsically safe power supplies, accepted under MSHA Evaluation No. IA-13827-0. Each intrinsically safe power supply provided a nominal 12 volts direct current (Vdc) output to power five KH Controls Inc., Model LX1 luminaires (light assembly), located on every other shield. The luminaires were accepted under MSHA Evaluation No. IA-16453-0 and Certification No. X/P-4036-0.

At shield 171, the lighting power cable was damaged, exhibiting a severed ground-check conductor and insulation damage on the black and white phase conductors. The lighting cable is normally zip-tied to the shield water line away from the chock interface unit (CIU). When inspected, the damaged area of the cable was laying on the damaged area of the CIU. The CIU had a bent mounting bracket, deformed enclosure, damaged internal circuit boards, and a damaged face plate. Upon initial inspection, the damage to the lighting cable was determined to have been caused by the same explosive forces, traveling from the tailgate toward the headgate, which damaged the CIU. The damaged section of the cable was recovered and sent to the A&CC for analysis...

The lighting system power cable was protected by an SMC Electrical Products, Inc., Model C54-006, ground wire monitor in the headgate controller. (See Appendix - U-11) This ground wire monitor is designed to trip the lighting circuit breaker when an open or a short in the pilot wire occurs, thus de-energizing the entire longwall lighting circuit. There were no reports of the longwall lights not working and no evidence of maintenance being performed on the lighting circuit. The ground wire monitor circuitry and the pilot wire terminating diode were removed and tested at the A&CC to determine if sufficient energy existed in the pilot wire conductor to ignite an 8.3% methane-in-air mixture. Tests were conducted with and without simulated value of cable inductance. No testing ignited the methane-air mixture. The following protective circuit components were removed from the enclosure; lighting current transformer, lighting relay, ground fault relay, ground wire monitor, and lighting circuit breaker. A&CC performed functional testing of the protective circuitry components and no deficiencies were found.

The lighting power supply explosion-proof enclosures located at shields 163 and 173 were examined. All accessible flame-arresting path surfaces of these enclosures were measured, and no excessive openings were found. There was no evidence of abnormal arcing, sparking, or heating of components in the enclosures (Appendix U-2). No unusual odors were detected, and no abnormal residue was noted on any of the flame-arresting path surfaces.

Various lighting system components were retrieved for further examination and testing at A&CC. The components retrieved were:

Six KH Controls Model ISS1 – 13.0 – 8.10, IA-13827-0 Power Supplies

- Exhibit No. PE-0246-a*, S/N 1034, recovered from shield 173 (written on the front of the supply)
- Exhibit No. PE-0246-b*, S/N 1832, recovered from shield 173 (written on the front of the supply)
- Exhibit No. PE-0247-a**, S/N 2536, recovered from shield 163 (written on the front of the supply)
- Exhibit No. PE-0247-b**, S/N 995, recovered from shield 163 (written on the front of the supply)
- Exhibit No. PE-0248-a***, S/N 2185, recovered from shield 3 (written on the back of the supply)
- Exhibit No. PE-0248-b***, S/N 1295, recovered from shield 3 (written on the back of the supply)

**A case with Exhibit No. PE-0246 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos.*
PE-0246-a and PE-0246-b when the case was opened.

***A case with Exhibit No. PE-0247 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos.*
PE-0247-a and PE-0247-b when the case was opened.

**** A case with Exhibit No. PE-0248 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos. PE-0248-a and PE-0248-b when the case was opened.*

Thirteen KH Controls Model LX1 Luminaire, IA-16453-0, X/P-4036-0

- Exhibit No. PE-0254-a*, S/N 10774, recovered from shield 167
- Exhibit No. PE-0254-b*, S/N unknown (missing approval plate), recovered from shield 124
- Exhibit No. PE-0258-a**, S/N 12483, recovered from the area of shield 62
- Exhibit No. PE-0258-b**, S/N 7791, recovered from the area of shield 66
- Exhibit No. PE-0258-c**, S/N 6712, recovered from the area of shield 89
- Exhibit No. PE-0258-d**, S/N 7353, recovered from the area of shield 173
- Exhibit No. PE-0258-e**, S/N 12535, recovered from the area of shield 64
- Exhibit No. PE-0258-f**, S/N 10437, recovered from the area of shield 139
- Exhibit No. PE-0474, S/N unknown (missing approval plate), recovered from the area of Survey Spad 22567

- Exhibit No. PE-0475, S/N unknown (missing approval plate), recovered from the area of the cross cut adjacent to Survey Spad 22567
- Exhibit No. PE-0476, S/N unknown (missing approval plate),recovered from the area of the tailgate entry at the shearer
- Exhibit No. PE-0477, S/N unknown (missing approval plate), recovered from the area of Shield 175
- Exhibit No. PE-0478, S/N unknown (missing approval plate), recovered from the area of Shield 172

The recovered from location information was obtained from the shield number written on the light, and/or the evidence tag.

**A cardboard box with Exhibit No. PE-0254 was received and contained two KH Controls Model LX1 Luminaire exhibits. These two exhibits were assigned the newly generated Exhibit Nos. PE-0254-a, and PE-0254-b when the box was opened.*

**A cardboard box with Exhibit No. PE-0258 was received and contained six KH Controls Model LX1 Luminaire exhibits. These six exhibits were assigned the newly generated Exhibit Nos. PE-0258-a, PE-0258-b, PE-0258-c, PE-0258-d,
PE-0258-e, and PE-0258-f when the box was opened.*

IS Lighting Cable with connectors- Exhibit No. PE-0324, 91 feet of 14AWG, 3/C SOW, recovered from shield 143 to shield 152

Based on technical analysis and inspection of the underground installation, no evidence was found that the lighting system was an electrical ignition source. All lighting power supplies were functional, tested within approved safety settings, and exhibited no sign of internal tampering or damage significant enough to affect the operation. Each recovered luminaire showed effects of explosion-related heat and/or impact damage, which was consistent with all observed luminaires on the face. Luminaires from shields 124 and 66 (Exhibit Nos. PE-0254-b and PE-0258-b) were found in a condition indicating they were not maintained in permissible condition prior to the explosion, but these did not contribute to the explosion. Exhibit No. PE-0254-b had electrical tape wrapped around a significant crack in the connection where the polycarbonate tube, which contained dust and dirt, threaded into the maintenance sleeve. Exhibit No. PE-0258-b had a missing end cap, and the polycarbonate tube, which had electrical tape wrapped around it, was broken off at the threaded end. A crack would defeat the explosion-proof integrity of the assembly. However, these exhibits were not located where the ignition occurred. None of the other damaged luminaires taken as evidence or examined underground had electrical tape covering cracks.

Electrohydraulic Shield System

The Joy MS40 electrohydraulic system, consisting of a Master Supply Unit (MSU) and a Support Control Centre (SCC) at the headgate, controlled the movement of the shields. The intrinsically safe components were accepted under MSHA Evaluation No. IA-408-10. The MSU and SCC were powered by their own intrinsically safe power supplies, (KH Controls, Inc. Model ISSA-13.0-6.8-AL1, accepted under MSHA Evaluation No. IA-13827-0), installed in explosion-proof enclosures, MSHA Certification No. X/P-3929-0. A CIU control enclosure was located on each of the 176 shields along the longwall face. The MSU supplied intrinsically safe, nominal 12 Vdc power for the CIU enclosures via a "roadway" armored cable. On each shield, the CIU controlled six hydraulic solenoid valves, which initiated movement of the shields, and connected to a pressure and a distance transducer.

A dump valve kit, consisting of a solenoid and pressure switch, was designed to release the main system hydraulic pressure to the return line, if any e-stop button was depressed on any face CIU or the MSU, or if the system hydraulic pressure was inadequate. The MSU provided power for the dump valve, and provided monitoring for the e-stop system to protect against solenoid valve short circuit or low voltage conditions.

CIU enclosures were mounted on each shield. Two spare CIU enclosures, missing faceplates and internal printed circuit boards, were found at shields 27 and 77. The CIU enclosures at shields 1, 2, and 6 were damaged, and had several circuit boards missing. CIU circuit boards found in the tailgate area would likely correspond either to CIU enclosures at shields 1, 2, or 6, or from the spare CIU enclosures.

Various components were retrieved for further examination and testing at A&CC, including:

- CIU enclosures from shields 62, 64, 169, 170, 171, 172, 173, 174, 175, and 176. CIU enclosures from shields 169 through 176 were retrieved because they exhibited signs of external heat or physical damage. CIU enclosures from shields 62 and 64 were retrieved because of visible heat damage on the infrared receiver lens.
- The roadway cable between CIU enclosures at shields 169 and 170, which was found disconnected at the headgate side of the CIU enclosure at shield 170.
- The KH Controls, Inc. Model ISSA-13.0-6.8-AL1 power supply for the MSU unit, accepted under MSHA Evaluation No. IA-13827-0.
- The MSU unit.

- The SCC, which was taken to the manufacturer's facility, where engineers and technicians familiar with this equipment attempted to view and recover the event and fault logs. Damage to the SCC and its internal circuitry was too extensive to allow data recovery.
- Six hydraulic solenoid valves recovered from shield 170, and two hydraulic solenoid valves recovered from shield 145.

The intrinsic safety analysis conducted at A&CC examined:

- Output of the intrinsically safe MSU power supply.
- Inductive energy stored in the roadway cable.
- Energy stored in the hydraulic solenoid valves of the shields.
- Energy stored in the total system capacitance of the connected system.
- The possibility of thermal ignition from small-gauge wire strands.

The analysis indicated that no signs of electrical heating, arcing, or sparking were observed on any of the components in the CIU enclosures, solenoids, power supplies, or associated cables. Based on the technical analysis and inspection of the underground installation, the electro-hydraulic shield control system is not considered an electrical ignition source (Appendix U-3).

<u>Comtrol Communication System</u>

The Comtrol longwall face communication/conveyor lock-out system, MSHA Approval No. 9B-71-2, consisted of Longwall Loudmouth Model LM115 phones positioned at the headgate area and typically, every eighth shield. Each phone is powered by its own 12-volt battery. An 18 AWG, 4 conductor, type SOOW cable connected each of the phone enclosures, and was protected by hose conduit up to the in-line connector near the phone. The system was linked to the startup sequence of the longwall face conveyor, through a Model LM1574A start up alarm control receiver, so that an alarm was given over the speakers when the conveyor was about to start. Each phone enclosure was provided with a lockout control capability to prevent the face conveyor from operating.

Investigators noted that some phones were not in their original positions (i.e. mounted on shields). The phone at shield 173, the last in the system, was missing, as was the phone at shield 117. At least four phones were missing on the headgate side of the longwall. Phone circuit boards and enclosure pieces were found at several different locations across the face, as well as in the No. 7 tailgate entry. Electrical investigators that have traveled the face area did not observe any components or cables that showed signs of being an electrical ignition source.

Various system components were retrieved for further examination and testing at A&CC . Worst case tests for intrinsic safety were performed on the power supply, start-up alarm/phone (located near the headgate enclosure), and an equivalent end-of-line termination unit, which was used because the actual termination unit was not located prior to the test, but found later at shield 110 approximately 360 feet from shield 173. This unit was also tested. All tests were performed with a worst case methane-in-air mixture of 8.3%, and indicated that a page transmitted from the headgate enclosure area would not ignite a methane-in-air mixture at the tailgate. A conveyor lockout switch passed the same test.

Five Loudmouth phones and the start-up alarm/phone (from the headgate) were tested at A&CC for functionality. The phone from shield 165 was spark-ignition tested, and did not ignite an 8.3% methane-in-air mixture. Three face phones (shields 85, 109, and 165) and the headgate start-up alarm/phone were fully functional (communication and lock-out functions). Two phones obtained near the crusher and belt conveyor tailpiece had functioning conveyor lock-out switches, but had slight communication issues, in that the tailpiece phone could receive but not transmit, whereas the stageloader/crusher phone could receive, but transmitted a low, audible signal. Two terminating devices and additional Loudmouth phone components found across the longwall face were also sent to AC&C for further examination.

Witness testimony did not indicate any issues with the longwall communication/conveyor lock-out system. The phone at shield 173 has not been found. An electrician that worked the midnight shift prior to the explosion stated that it was working properly. Pieces of telephone components were found around the longwall tailgate area that was possibly from the 173 phone. None of these components showed any signs of arcing and sparking (Appendix U-4).

<u>Multi-Gas Detector</u>
A MSA Solaris multi-gas detector (Exhibit No. B-15-B), carried by Richard Lane, Longwall Section Foreman, was retrieved from mid-face for examination and testing at A&CC. Testing determined that it was in working order. Downloaded data indicated that the device was energized at the time of the explosion and continued operating for several hours thereafter. During thermal ignition testing, the detector did not cause an ignition of a 7.75% methane-in-air mixture when energized (Appendix U-5).

<u>Personal Electrical Items</u>
Various electrical items were removed from six victims found and the longwall face.

Tracking Tags
Pyott-Boone Model 1980 tracking tag transmitters, MSHA Approval No. 23-A080004-0, were used by the miners. The following tracking tags belonged to victims found on the longwall face:

- Tracking Tag ID 570, belonging to Chris Bell, Exhibit No. PE-0483;
- Tracking Tag ID 584, belonging to Joel Price, Exhibit No. PE-0239;
- Tracking Tag ID 564, belonging to Rick Lane, Exhibit No. B-15-D;
- Tracking Tag ID 547, belonging to Gary Quarles, Exhibit No. B-11-A;
- Tracking Tag ID 540, belonging to Dillard Persinger, Exhibit No. B-10-A; and,
- Tracking Tag ID 546, belonging to Grover Skeens, Exhibit No. B-9-A.

Exhibits PE-0483 and PE-0239 were found near shields 109 and 94-95, respectively. Exhibits B-9-A, B-10-A, B-11-A, and B-15-D were brought out of the mine in the days immediately after the accident. Twenty-four tracking tags, including the six already noted, were retrieved for further examination and testing at A&CC. The examination of the tags indicated that the tracking tag enclosures were not exposed to heat or fire, electrical energy within the tracking tags was not exposed to the mine atmosphere, and that none of the tracking tags represented a thermal or a spark ignition source (Appendix U-6).

Cap Lamps
An assortment of intact cap lamps and components were retrieved. Of these, thirty-three individual items were subjected to further examination and testing at A&CC. Many items exhibited explosion-related damage, i.e. heat, charring, soot, missing pieces or severe physical force. No evidence indicated that any of the cap lamp batteries had sufficient electrical energy to ignite a methane-in-air mixture or enough thermal energy to ignite coal dust (Appendix U-7).

Air-Purifying Helmet Components
Seven components from the air purifying helmets including four batteries, a portion of a battery case, and pieces of the helmet and cable were retrieved for further examination and testing at A&CC. None of the electrical components indicated signs of arcing, sparking or electrical heating. Methane ignition did not occur during a spark ignition test with the highest short circuit current and highest open circuit voltage that was measured from any of the batteries (Appendix U-8).

Watches and Calculators
Several non-permissible electrical items, including six watches and two calculators, were recovered from the longwall face and subjected to examination and testing at A&CC. These items were all disassembled and inspected. Four watches and one calculator were functional and working as expected. None of the items indicated signs of arcing, sparking, or electrical heating, and there is no

evidence that any of these items were a source of spark or thermal ignition (Appendix U-9).

Methane Monitor Sensor Components.

Two CSE Model 140B LD IR methane monitor sensors (Exhibit Nos. PE-0169 and PE-0170) were retrieved from the tailgate area and tested at A&CC. The inspection of these components did not reveal any conditions that would suggest that the components caused an explosion. The sensors did not cause an ignition of a 7.5% methane-in-air mixture when energized in the test gas (Appendix U-10).

See Figures T-1 and T-2 for maps of the Electrical System, Equipment, and Associated Items that shows locations of some of these items and others inspected during the investigation.

APPENDIX U

TESTING RESULTS FOR ALL EQUIPMENT TESTED AT A&CC

APPENDIX U-1

EXECUTIVE SUMMARY OF INVESTIGATION OF REMOTE CONTROL UNITS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Remote Control Units Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation associated with respect to Remote Control Units recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The components received were:

1. Exhibit No. PE-0209 Matric Limited TX1 Remote Control Approval Number 9B-220-0 (Found between Survey Spads (S.S.) 22701 and 22692 as documented by the Evidence Identification Tag).
2. Exhibit No. PE-0210 Matric Limited TX1 Remote Control Approval Number 9B-220-0 (Found between S.S. 22701 and 22692 as documented by the Evidence Identification Tag).
3. Exhibit No. PE-0211 Matric Limited TX1 Remote Control Approval Number 9B-220-0 (Found in crosscut adjacent to S.S. 22692 as documented by the Evidence Identification Tag).
4. Exhibit No. PE-0238 Matric Limited TX1 Remote Control Approval Number 9B-220-0 (Found at Shield 100 as documented by the Evidence Identification Tag).
5. Exhibit No. PE-0315 Matric Limited TX3 Remote Control Approval Number 2G-4096-0 (Found in TG-22 Entry #3 as documented by the Evidence Identification Tag).
6. Exhibit No. PE-0347 Matric Limited TX3 Remote Control Approval Number 2G-4096-0 (Found in HG-22 Section, #1 Entry RT Crosscut as documented by the Evidence Identification Tag).
7. Exhibit No. PE-0348 Matric Limited TX3 Remote Control Approval Number 2G-4096-0 (Found in HG-22 Section, #3 Entry as documented by the Evidence Identification Tag).

8. Exhibit No. PE-0376 Matric Limited TX3 Remote Control Approval Number 2G-4096-0 (Labeled as "Left Miner Remote TG-22" as documented by the Evidence Identification Tag).

The exhibits were initially documented and photographed during a Preliminary Inspection in the condition in which they were received. The Preliminary Inspection included decontamination of items that were considered potentially biohazardous, documenting visual observations, and photographing conditions of the exhibits. This inspection was conducted as the equipment was received by the Primary Investigator during the accident investigation.

After the Preliminary Inspection was completed, a Detailed Inspection was conducted. The Detailed Inspection included noting any signs of arcing, sparking, or electrical heating on both the outside and inside of the equipment. This involved disassembling the equipment and performing any applicable testing as modified per ASOP2026, Investigative Procedures for Evaluating Equipment from Mine Explosions. At the conclusion of the Detailed Inspection, each piece of equipment was compared to approval documentation.

These inspections and tests found:

- There were no signs of internal heating, arcing, or sparking on any of the units.

- Several minor discrepancies were noted when the Remote Controls were compared to approval documentation. These discrepancies did not affect operation, safety features, or the intrinsic safety of the remotes. A comparison of the components and circuitry under the RF shield for Exhibit Nos. PE-0347, PE-0348, and PE-0376 and under the RF shield and battery potting for Exhibit Nos. PE-0209, PE-0210, PE-0211 was deemed unnecessary by the Accident Investigation Team since they determined that these exhibits were not located near the origin of the explosion.

APPENDIX U-2

EXECUTIVE SUMMARY OF INVESTIGATION OF LONGWALL LIGHTING SYSTEM COMPONENTS

APPENDIX U-2

EXECUTIVE SUMMARY OF INVESTIGATION OF LONGWALL LIGHTING SYSTEM COMPONENTS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 18, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Longwall Lighting System Components Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by the Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation on the longwall lighting system components recovered from the April 5, 2010 mine explosion at the Upper Big Branch Mine-South.

The components received were:

Six KH Controls Model ISS1 – 13.0 – 8.10, IA-13827-0 Power Supplies.

- Exhibit No. PE-0246-a*, S/N 1034, recovered from shield 173 (written on the front of the supply).
- Exhibit No. PE-0246-b*, S/N 1832, recovered from shield 173 (written on the front of the supply).
- Exhibit No. PE-0247-a**, S/N 2536, recovered from shield 163 (written on the front of the supply).
- Exhibit No. PE-0247-b**, S/N 995, recovered from shield 163 (written on the front of the supply).
- Exhibit No. PE-0248-a***, S/N 2185, recovered from shield 3 (written on the back of the supply).
- Exhibit No. PE-0248-b***, S/N 1295, recovered from shield 3 (written on the back of the supply).

**A case with Exhibit No. PE-0246 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos. PE-0246-a and PE-0246-b when the case was opened.*

***A case with Exhibit No. PE-0247 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos. PE-0247-a and PE-0247-b when the case was opened.*

**** A case with Exhibit No. PE-0248 was received and contained two power supplies. These two power supplies were assigned the newly generated Exhibit Nos. PE-0248-a and PE-0248-b when the case was opened.*

Thirteen KH Controls Model LX1 Luminaire, IA-16453-0, X/P-4036-0.

- Exhibit No. PE-0254-a*, S/N 10774, recovered from shield 167.
- Exhibit No. PE-0254-b*, S/N unknown (missing approval plate), recovered from shield 124.
- Exhibit No. PE-0258-a**, S/N 12483, recovered from the area of shield 62.
- Exhibit No. PE-0258-b**, S/N 7791, recovered from the area of shield 66.
- Exhibit No. PE-0258-c**, S/N 6712, recovered from the area of shield 89.
- Exhibit No. PE-0258-d**, S/N 7353, recovered from the area of shield 173.
- Exhibit No. PE-0258-e**, S/N 12535, recovered from the area of shield 64.
- Exhibit No. PE-0258-f**, S/N 10437, recovered from the area of shield 139.
- Exhibit No. PE-0474, S/N unknown (missing approval plate), recovered from the area of Survey Spad 22567.
- Exhibit No. PE-0475, S/N unknown (missing approval plate), recovered from the area of the cross cut adjacent to Survey Spad 22567.
- Exhibit No. PE-0476, S/N unknown (missing approval plate), recovered from the area of the tailgate entry at the shearer.
- Exhibit No. PE-0477, S/N unknown (missing approval plate), recovered from the area of Shield 175.
- Exhibit No. PE-0478, S/N unknown (missing approval plate), recovered from the area of Shield 172.

The recovered from location information was obtained from the shield number written on the light, and/or the evidence tag.

**A cardboard box with Exhibit No. PE-0254 was received and contained two KH Controls Model LX1 Luminaire exhibits. These two exhibits were assigned the newly generated Exhibit Nos. PE-0254-a, and PE-0254-b when the box was opened.*

***A cardboard box with Exhibit No. PE-0258 was received and contained six KH Controls Model LX1 Luminaire exhibits. These six exhibits were assigned the newly generated Exhibit Nos. PE-0258-a, PE-0258-b, PE-0258-c, PE-0258-d, PE-0258-e, and PE-0258-f when the box was opened.*

IS Lighting Cable with connectors.

- Exhibit No. PE-0324, 91 feet of 14AWG, 3/C SOW, recovered from shield 143 to shield 152.

The investigation began with a preliminary inspection of all the evidence received. The preliminary inspection included documenting visual observations and photographing the as-received conditions of the components. This inspection was conducted between October 13 and October 14, 2010.

The second phase of the investigation was conducting the electrical and functional tests, including measuring the electrical characteristics of the power supplies, luminaires cable, and energizing the lighting ballasts. These tests were conducted between October 27, 2010 and November 1, 2010.

The third phase involved a detailed inspection of the evidence. The detailed inspection involved disassembling the evidence to investigate any signs of arcing, sparking, damage, or electrical heating. These inspections were conducted between October 29, 2010 and November 18, 2010.

The fourth and final phase involved a comparison of the evidence to approval drawings. This was intended to discover any discrepancies between the evidence and the MSHA approved drawings. These comparisons were conducted between November 3, 2010 and November 19, 2010.

Evidence with Exhibit Nos. PE-0474, PE-0475, PE-0476, PE-0477, and PE-0478 were received at a later date. All inspections took place between May 16 –18, 2011.
All of the power supplies were functional and, when tested, were found to be within the specific manufacturer's electrical parameters under which the power supply was evaluated and accepted. None of the power supplies exhibited any signs of internal tampering or damage significant enough to affect the operation. There were only minor discrepancies found which did not affect the operation or safety features, and are considered non-critical. There is no evidence that these power supplies were a source of spark ignition alone or when electrically connected to the IS lighting cable (excluding connection to the luminaires).

All luminaires showed some damage such as heat damage and/or impact damage. This damage was most likely caused by the explosion, but the condition of these luminaires prior to the explosion is not definitely known. During the comparison to the approval drawings, only minor discrepancies were found which did not affect operation, safety features, or the explosion-proof integrity and are considered non-critical.

The luminaires identified by Exhibit Nos. PE-0254-b and PE-0258-b were found in a condition indicating they were not maintained in permissible condition prior to the explosion.

- Exhibit No. PE-0254-b had electrical tape wrapped around a significant crack in the connection where the polycarbonate tube threads into the maintenance sleeve. Dust and dirt were found inside the polycarbonate tube.

- Exhibit No. PE-0258-b had a missing end cap and the polycarbonate tube was broken off at the threaded end. There was electrical tape wrapped around the polycarbonate tube a few inches down from the broken end.

Based on laboratory testing and inspection of intrinsically safe lighting cables at the Upper Big Branch Mine, no evidence was found that the intrinsically safe lighting cables thermally ignited coal dust on the longwall system.

APPENDIX U-3

EXECUTIVE SUMMARY OF INVESTIGATION OF ELECTROHYDRAULIC SHIELD CONTROL COMPONENTS

APPENDIX U-3

EXECUTIVE SUMMARY OF INVESTIGATION OF ELECTROHYDRAULIC SHIELD CONTROL COMPONENTS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17. 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Electrohydraulic Shield Control Components Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation associated with respect to the electrohydraulic shield control components recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010. The investigation focused on the area for the source of the explosion. The Accident Investigation Team determined this "zone of concern" to be from shield number 160 to the tailgate of the longwall.

The components received were:

One (1) Joy Mining Machinery Master Supply Unit (MSU) recovered from the longwall headgate area.

- Exhibit No. PE-0490, Type 375186-00-30, MSHA IA-408-10, P/N 06-01357, Serial No. JMM003.

One (1) KH Controls, Inc. MSU Power Supply recovered from an explosion proof enclosure at the longwall headgate area.

- Exhibit No. PE-0248-c*, Model ISS1-13.0-6.8-AL1 Power Supply, MSHA IA-13827-0, Serial Number 697.

Ten (10) Joy Mining Machinery MS 40 Chock Interface Units (CIU), Part No. 06-01383, IA-408-9, recovered from the longwall face.

1. Exhibit No. PE-0257, CIU from shield number 62, Serial No. JMM097.
2. Exhibit No. PE-0259, CIU from shield number 64, Serial No. R81M.
3. Exhibit No. PE-0335-a*, CIU from shield number 169, Serial No. JMM 168A.
4. Exhibit No. PE-0335-b*, CIU from shield number 170, Serial No. B867.

5. Exhibit No. PE-0334-a*, CIU from shield number 171, Serial No. E095.
6. Exhibit No. PE-0311-a*, CIU from shield number 172, Serial No. 07/E805.
7. Exhibit No. PE-0334-b*, CIU from shield number 173, Serial No. JMM 171.
8. Exhibit No. PE-0311-b*, CIU from shield number 174, Serial No. 164.
9. Exhibit No. PE-0273-b*, CIU from shield number 175, Serial No. E097.
10. Exhibit No. PE-0273-a*, CIU from shield number 176, Serial No. JMM 060A.

Eight (8) Shield Control Solenoid Valves recovered from the longwall face.

1. Exhibit No. PE-0255-a*, solenoid valve recovered from shield 145 with side label indicating "Joy Mining Machinery HPS04751" and no legible information on bottom nameplate.
2. Exhibit No. PE-0255-b*, solenoid valve recovered from shield 145 with side label indicating "United Mining Equipment 23739" and no pertinent information on bottom nameplate.
3. Exhibit No. PE-0310-a*, solenoid valve recovered from shield 170 with no side label and no bottom nameplate.
4. Exhibit No. PE-0310-b*, solenoid valve from shield 170 with no side label and bottom nameplate indicating "Joy Mining Machinery Type 146420-01-30 66069897".
5. Exhibit No. PE-0310-c*, solenoid valve recovered from shield 170 with side label indicating "United Mining Equipment 14375" and no legible information on bottom nameplate.
6. Exhibit No. PE-0310-d*, solenoid valve recovered from shield 170 with no side label and partially legible information marked on bottom nameplate. The legible nameplate information matches labeling on PE-0310-b.
7. Exhibit No. PE-0310-e*, solenoid valve recovered from shield 170 with no side label and no pertinent information on bottom nameplate.
8. Exhibit No. PE-0310-f*, solenoid valve recovered from shield 170 with no side label and bottom nameplate indicating "Type 146420-01-30 66069897" with no manufacturer's name.

Nine (9) Miscellaneous Components recovered from the longwall face or the longwall tailgate area.

1. Exhibit No. PE-0284, CIU stainless steel cover plate.
2. Exhibit No. PE-0272, shield to shield cable marked 169-170.
3. Exhibit No. PE-0229, front panel circuit board from a CIU.
4. Exhibit No. PE-0283, main circuit board from a CIU.
5. Exhibit No. PE-0488, CIU enclosure containing no circuit boards, and no front cover.

6. Exhibit No. PE-0486-a*, CIU cast aluminum front cover with stainless steel cover plate, and main/front panel PCBs attached.
7. Exhibit No. PE-0486-b*, CIU cast aluminum front cover with missing approximately ¼ of top center area.
8. Exhibit No. PE-0486-c*, approximately ¼ of bottom center area of CIU cast aluminum front cover.
9. Exhibit No. PE-0486-d*, MS40, Part No. 06-01383, Serial No. 096 CIU nameplate.

Fourteen (14) Components recovered from a warehouse.

1. Exhibit No. PE-0326-a*, Joy/Marco Type sns/dmd/d8, P/N 07-00504 leg pressure transducer, Joy Part No. 08-01653, Serial No. 68342/2.
2. Exhibit No. PE-0326-b*, Joy P/N 08-01653, 800mm cable assembly. Joy indicated that this cable interconnects the MS40 CIU and the RS20 solenoid valve junction box. Since no RS20 junction boxes were provided, it is assumed that this cable was mistakenly submitted.
3. Exhibit No. PE-0326-c*, United Mining Equipment P/N 08-00968 RAM transducer cable assembly.
4. Exhibit No. PE-0326-d* is a P/N 66161558 solenoid valve junction box.
5. Exhibit No. PE-0326-e*, United Mining Equipment P/N 08-00675 leg transducer cable.
6. Exhibit No. PE-0326-f*, Joy/Marco Type sns/rs/j1150c RAM transducer and housing tube, Joy Part No. 06-01307, Serial No. 34355-94.
7. Exhibit No. PE-0346-a* is a solenoid valve labeled HPS01952.
8. Exhibit No. PE-0346-b* is a solenoid valve labeled HPS04932.
9. Exhibit No. PE-0346-c* is a solenoid valve labeled HPS02569.
10. Exhibit No. PE-0346-d* is a solenoid valve labeled HPS02087.
11. Exhibit No. PE-0346-e* is a solenoid valve labeled HPS01941.
12. Exhibit No. PE-0346-f* is a solenoid valve labeled HPS02569.
13. Exhibit No. PE-0346-g* is a P/N 08-00676 CIU-to-junction box cable.
14. Exhibit No. PE-0346-h* is a P/N 66161558 solenoid valve junction box.

*Note: Multiple pieces of evidence that arrived at the A&CC under one exhibit number (e.g. Exhibit No. PE-0248 consisted of two lighting system power supplies and one shield control system power supply) were expanded into new unique exhibit numbers containing a dash followed by a letter (e.g. Exhibit No. PE-0248-c).

The investigation began with a preliminary inspection of all the shield control components recovered from the longwall face and a warehouse. The preliminary inspection included documenting visual observations, and photographing the as received condition of the components. The most significant observations were that there were signs of melting observed on some of the CIUs around the buzzer, infrared receiver lens, and switch plate membrane; and differences in the construction of the solenoid valves.

The next phase of the investigation included testing of some of the recovered components as well as experimental testing of non-evidence. Some of the detailed inspection that would not interfere with testing was conducted in conjunction with the testing phase. Tests of the system included spark ignition testing at the output of the power supply, spark ignition testing simulating various system inductances, power supply load capacitance spark ignition testing, and spark ignition testing simulating various solenoid valve configurations. No spark ignition test failures involving the recovered equipment were observed. CIU performance testing revealed that all except for one of the CIUs were functional to some degree. No specific faults of malfunctioning CIU circuits were identified during the performance testing. Experimental testing of non-evidence included determining the maximum current in which several wire strand sizes will remain below 150 °C (minimum ignition temperature of coal dust). Testing of the MSU revealed that all ten opto-isolators were capable of isolating a 20 Vdc power supply from input to output.

The next phase of the investigation included a detailed inspection of all the shield control components recovered from the longwall section and a warehouse. For the equipment recovered from the longwall section, this involved disassembling the equipment to address irregularities found during the preliminary inspection or testing; determining whether any of the components showed signs of electrical heating, arcing, or sparking; and determining if any of the units contained faults which could be an ignition hazard. After disassembling and inspecting the equipment recovered from the longwall section, no faults, signs of arcing or sparking, or signs of electrical heating were observed to be caused by the shield control components. For the equipment recovered from a warehouse, this involved determining interconnection of components and whether the junction boxes used during spark ignition testing contained any components that would affect the results of the test. Additional detailed inspection of cutting open cables to determine minimum strand size used to construct conductors and breaking away encapsulant of two solenoids to determine the diode type and configuration was also conducted.

The last phase of the investigation was comparing the recovered components to documentation on file at the A&CC. The encapsulated equipment (solenoid valves, sensors, and bottom half of the power supply) were not compared to the approval documentation. Discrepancies between the components and approval documentation were found, however, none of the discrepancies were considered to be factors in the accident.

It was concluded that:

1. The output of the power supply is not considered an ignition source of a methane-air atmosphere.

2. The inductive energy stored in the MSU-to-CIU, CIU-to-CIU, and CIU-to-sensor/solenoid valve cabling is not an ignition source of a methane-air atmosphere provided the unrecovered cables are similar to the cable measured at the Approval and Certification Center.

3. The inductive energy stored in twelve (12) solenoid valves is not an ignition source of a methane-air atmosphere provided the unrecovered solenoid valves are similar in construction to those tested. Twelve solenoid valves were chosen for the test since there were two shield operators on the longwall face at the time of the accident, and each shield has a total of six (6) solenoid valves.

4. Based on measurements and evaluation, other inductors used in the system such as relay coils within the MSU, MSU/CIU buzzer drive coils, or the dump valve are not considered an ignition source of a methane-air atmosphere since measurements confirmed that no faults existed that would connect the inductors in a manner capable of being an ignition hazard.

5. The only components identified in the recovered evidence capable of generating electrical energy were a battery within the MSU and piezo-electric crystals used to provide an audible warning for the CIUs and MSU. Based on the approval documentation, the battery does not have adequate energy when compared with published ignition curves to cause a spark ignition of a methane-air atmosphere. Based on measurements, inspection, and the original approval testing of the buzzers, the piezo-electric crystals are not considered an ignition source of a methane-air atmosphere provided the unrecovered CIUs are built according to the approval documentation.

6. The energy stored in the total system capacitance is not considered an ignition source of a methane-air atmosphere provided the unrecovered CIUs are built according to the approval documentation.

7. No signs of electrical heating, arcing, or sparking were observed within or caused by any of the CIUs or solenoid valves recovered from the "zone of concern" of the longwall face. The heat damage observed on the CIU buzzers and infrared receiver lenses was judged to be from an outside force. No faults that would affect the intrinsic safety of the components were found.

8. A thermal ignition caused by wire strands used to construct the individual conductors of the shield control system is not considered an ignition source of a methane-air atmosphere based on testing/evaluation of wire strands, and assuming the minimum measured resistance of the recovered CIU-to-CIU cable (Exhibit No. PE-0272).

9. Circuit board traces of the type used in the CIUs are not considered an ignition source of a methane-air atmosphere provided the unrecovered CIUs are built according to the approval documentation. The circuit board traces have adequate current carrying capacity to not be considered capable of smoldering a coal dust layer with up to 1.2 A of current available at the "zone of concern".

10. Although examples of permissibility discrepancies were identified that may render the components or system less safe than originally approved, none of the identified permissibility discrepancies are considered to be a contributing factor in the accident.

APPENDIX U-4

EXECUTIVE SUMMARY OF INVESTIGATION OF LONGWALL COMMUNICATION SYSTEM COMPONENTS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 23, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Longwall Communication System Components Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of Longwall Communication System Components recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The components received were:

1. Exhibit No. PE-0140, Battery.
2. Exhibit No. PE-0142, Battery.
3. Exhibit No. PE-0148, Battery.
4. Exhibit No. PE-0192, Battery.
5. Exhibit No. PE-0227, Comtrol Phone Printed Circuit Board.
6. Exhibit No. PE-0249*, Pelican Case.
7. Exhibit No. PE-0249A*, Comtrol Power Supply.
8. Exhibit No. PE-0249B*, Comtrol Start-Up Alarm Control Unit.
9. Exhibit No. PE-0276*, Pelican Case.
10. Exhibit No. PE-0276A*, Comtrol Phone.
11. Exhibit No. PE-0276B*, Comtrol Phone.
12. Exhibit No. PE-0280, Comtrol Phone Side Panel.
13. Exhibit No. PE-0281, Comtrol Phone Side Panel.
14. Exhibit No. PE-0285, Comtrol Phone Enclosure.
15. Exhibit No. PE-0336, Comtrol Phone.

16. Exhibit No. PE-0337, Comtrol Phone.
17. Exhibit No. PE-0338, Comtrol Phone.
18. Exhibit No. PE-0344, Communication Cable.
19. Exhibit No. PE-0479, Comtrol Phone Printed Circuit Board.
20. Exhibit No. PE-0480, Comtrol Phone Speaker.
21. Exhibit No. PE-0481-A, Comtrol Phone Terminal Strip.
22. Exhibit No. PE-0484*, Evidence Bag.
23. Exhibit No. PE-0484-A*, Comtrol Phone Internal Mounting Bracket.
24. Exhibit No. PE-0484-B*, Comtrol Phone Speaker.
25. Exhibit No. PE-0487, Comtrol Phone.
26. Exhibit No. PE-0489*, Evidence Bag.
27. Exhibit No. PE-0489-A*, Comtrol Phone Speaker.
28. Exhibit No. PE-0489-B*, Comtrol Phone Printed Circuit Board.
29. Exhibit No. PE-0489-C*, Pyott-Boone Page Phone Printed Circuit Board.

*Note: Multiple pieces of evidence that arrived at the A&CC under one exhibit number (e.g. Exhibit No. PE-0249 consisted of a Comtrol Power Supply and a Comtrol Start-up Alarm Control Unit in a Pelican Case) was expanded into new unique exhibit numbers containing a suffix letter (e.g. Exhibit No. PE-0249A and Exhibit No. PE-0249B).

The West Virginia Office of Miners' Health Safety and Training recovered several pieces of evidence from the longwall communication system. This evidence was inspected and tested as part of this investigation and is listed below. The West Virginia Office of Miners' Health Safety and Training retained custody of these exhibits:

1. Exhibit No. CMTL 02.22.11-S110: Identified as a Comtrol Line Termination Unit.
2. Exhibit No. CMTL 02.22.11-HG-1: Identified as a Comtrol Line Termination Unit with a mounting bracket.
3. Exhibit No. CMTL 02.22.11-S24: Identified as a mounting bracket for a Comtrol Line Termination Unit.
4. Exhibit No. CMTL 02.22.11-S105: Identified as a mounting bracket for a Comtrol Line Termination Unit.
5. Exhibit No. CMTL 02-22-11-S171: Identified as the back, top, bottom and left side of a Comtrol phone enclosure.
6. Exhibit No. CMTL 02.22.11-S104: Identified as the back, top and bottom of a Comtrol phone enclosure.

7. Exhibit No. CMTL 02.22.11-S106A: Identified as the left side of a Comtrol phone enclosure.
8. Exhibit No. CMTL 02.22.11 S85: Identified as the right side of a Comtrol phone enclosure.
9. Exhibit No. CMTL 02.22.11-S61: Identified as a right side of a Comtrol phone enclosure.
10. Exhibit No. CMTL 02-23-11 Spad 22567: Identified as a terminal strip mounting bracket with terminal strip label of a Comtrol phone enclosure.
11. Exhibit No. CMTL 02.22.11-S77: Identified as a front cover of a Comtrol phone enclosure.
12. Exhibit No. CMTL 02.22.11-S109: Identified as a back, top, bottom, and left and right sides of a Comtrol phone enclosure.
13. Exhibit No. CMTL 02.22.11-S106: Identified as a front cover of a Comtrol phone enclosure.
14. Exhibit No. CMTL 02.22.11-S114: Identified as a back, top, bottom and left side of a Comtrol phone enclosure.

The first phase of the investigation began with a preliminary inspection of all the exhibits. The preliminary inspection included documenting observations and photographing as-received conditions of the exhibits. The second phase of the investigation included performing spark ignition and operational tests of the applicable exhibits. The third phase of the investigation included detailed inspection of all exhibits and additional spark ignition tests.

The inspections and tests found:

- There were no signs of internal heating, arcing, or sparking on any of the exhibits.

- Several minor discrepancies were noted when the exhibits were compared to approval documentation. These discrepancies did not affect operation, safety features, or the intrinsic safety of the exhibits.

- Some of the exhibits collected by the West Virginia Office of Miners' Health Safety and Training were physically matched to and therefore were part of the exhibits collected by MSHA.

- The spark ignition testing of the applicable exhibits did not result in any failures; therefore, these exhibits are not considered an ignition source for a methane-air atmosphere.

- The operational tests indicated that the applicable components operated as designed except for Exhibit No. PE-0276B. This component had a relatively low audio level when transmitting a page.

APPENDIX U-5

EXECUTIVE SUMMARY OF INVESTIGATION OF PORTABLE METHANE AND MULTI-GAS DETECTORS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Portable Methane and Multi-Gas Detectors Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of portable methane and multi-gas detectors recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The investigation began with a preliminary inspection of all the exhibits. The preliminary inspection included decontamination of items that were considered potentially biohazardous, documenting visual observations, and photographing as-received conditions of the detectors. These inspections were followed by performance checks ('bump tests') and thermal ignition tests.

Data was downloaded from the detectors that featured datalogging capabilities. This data was provided to all interested parties as it became available.

Where feasible, performance tests were conducted on operational detectors to determine the accuracy of the instruments when tested in the methane-air mixtures specified in 30 CFR Part 22.7. For the datalogging detectors, the time and date displayed by the detectors was observed over a period of up to approximately seven months and compared to time clocks from external time verification sources. The rate of change was calculated from this data; where possible, this rate of change was used to extrapolate the instruments' time on April 5, 2010.

A detailed inspection of all exhibits except Exhibit Number B15B was deemed unnecessary by the Accident Investigation Team since they determined that these exhibits were not located near the origin of the explosion. Therefore, only Exhibit Number B15B was subjected to a detailed inspection.

The results of the inspections, tests, and evaluations are summarized below.

INSPECTIONS, TESTS, AND EVALUATIONS ON EXHIBITS

Performance Checks ('Bump Tests')

The performance of each functional instrument was checked at least once; some were checked contemporaneously with receipt but all were checked immediately prior to a complete methane performance test. These performance checks were performed with the respective manufacturer's calibration gas and equipment, and are commonly referred to as 'bump tests'. The following tables summarize the results of these checks, and, where available, give the last calibration date as stored in the detector's memory.

Industrial Scientific Corporation M40•M

Exhibit No.	Serial No.	Last Calibration Date	Fresh Air Readings			Bump Test Readings			Date of Test
			Methane	CO	Oxygen	2.5% Methane	100 ppm CO	19 % Oxygen	
A-20	0701048-573	2010-03-03	0.0	0	20.7	2.4	107	18.8	Jul 8, 2010

CSE 102/102LD Detectors

Exhibit No.	Serial No.	Fresh Air Reading	Reading in 2.5% Methane	Date of Test
A7A	5277	0.0	0.4	Jul 8, 2010
		0.1	2.4	Nov 3, 2010
B18-c	88486	0.1	0.3	Jul 8, 2010
		0.1	1.6	Nov 4, 2010
		0.1	1.1	Nov 8, 2010
B26-d	7328	(erratic)	(erratic)	Jul 8, 2010
		0.1	2.2	Nov 4, 2010
		0.1	2.2	Nov 8, 2010
PE-0290	84403	0.0	2.2	Nov 4,2010
		0.1	2.2	Nov 8, 2010
PE-0292	4898	N/A	N/A	NO TESTING[1]
PE-0298	7811	N/A	N/A	NO TESTING[2]
PE-0314	79905	0.0	2.3	Nov 4, 2010
		0.0	2.3	Nov 8, 2010

1 Exhibit Number PE-0292 was damaged as-received and no performance testing was possible.
2 Exhibit Number PE-0298 was damaged as-received and no performance testing was possible.

MSA Solaris Multi-Gas Detectors

Exhibit No.	Serial No.	Last Calibration Date	Fresh Air Readings			Bump Test Readings			Date of Test
			Methane	CO	Oxygen	2.5% Methane	60 ppm CO	15 % Oxygen	
B15B[3]	A5-86223	3-18-2010	---	0	N/A	0.00	0	N/A	Jul 8, 2010
			---	9	N/A	---	15	N/A	Nov 3, 2011
PE-0074[4]	A5-104696	3-15-2010	---	N/A	19.6	0.00	N/A	14.0	Jul 8, 2010
			0.20	N/A	N/A	2.35	N/A	N/A	Nov 3, 2011
PE-0086	A5-58751	2-14-2010	0.00	Var. 8-11	20.8	2.00	48	14.7	Jul 28, 2010
			0.00	0	20.8	2.30	51	14.9	Nov 3, 2011
PE-0118[5]	A4-26051	3-17-2010	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PE-0323	A5-106631	4-1-2010	0.00	N/A	20.8	2.25	N/A	14.7	Nov 3, 2011

The detectors that passed the 'Bump Test' were considered to be accurate and not subjected to the performance test. Those detectors that gave readings outside the acceptable limits of the pass/fail criteria of the 'Bump Test' were subjected to performance testing (summarized below) both before and after calibration. The criteria for determining if a detector was outside the acceptable limits of the pass/fail criteria of the 'Bump Test' was based on the criteria developed for machine-mounted methane monitors, that describes that, when tested with 2.5% methane-in-air gas mixture, the allowable error is 2.5 ± 0.5.

The following detectors gave readings outside the acceptable limits of the pass/fail criteria of the 'Bump Test' when tested at the A&CC, as applied to methane performance: Exhibit Numbers A-20, A7a, B26-d, PE-0290, PE-0314, PE-0074, PE-0086, and PE-0323.

3 Oxygen cell in Exhibit Number B15B was greater than two years old when tested; it was most likely past the end of its useful life.

4 Oxygen cell in Exhibit Number PE-0074 was apparently bad when the unit was received at A&CC; by the time testing was conducted in November, the CO cell had apparently reached the end of its useful life.

5 No accuracy tests were performed on Exhibit Number PE-0118. Initially, the display was bad, and, before tests could be conducted, the unit stopped working properly.

No determination can be made of calibration accuracy and status of any detector at the time of the explosion.

Data Download

The data stored in all MSA Solaris and Industrial Scientific Corporation M40•M Multi-Gas Detectors was downloaded and provided to the Accident Investigation Team for further analysis. Additionally, the data downloaded from the MSA Solaris Multi-Gas Detectors was used to produce a document describing the contents of the data contained therein because such document was not available from the manufacturer. The downloaded data was also used in the time drift study discussed below.

Performance Testing

The operational detectors were subjected to testing in the methane-air mixtures specified in MSHA's test protocol for approval of portable methane detectors. The tables below summarize the results of the tests. The table entries in ***bold italic*** font were outside the allowable limits of error found in 30 CFR Part 22.7 for approval testing of a new, calibrated, methane detector.

CSE Corporation Methane Detectors

Exhibit No.	Model	Serial No.	Test Gas Mixture (% CH_4 in Air)								Source of Reading
			0.00	0.25	0.50	1.00	2.00	3.00	4.00	5.00	
A7A	102LD	5277	0.2	0.4	0.6	0.9	1.8	2.7	***3.4***	4.3	Detector
			0.00	0.24	0.51	1.02	2.03	3.03	4.02	5.01	IR Analyzer
B18-c[6]	102	88486	0.1	***0.0***	***0.1***	***0.3***	***0.9***	***1.4***	***1.9***	2.5	Detector
			0.00	0.24	0.51	1.02	2.03	3.03	4.02	5.01	IR Analyzer
B26-d	102LD	7328	0.1	0.1	***0.3***	***0.7***	***1.7***	***2.6***	***3.3***	4.2	Detector
			0.00	0.24	0.51	1.02	2.03	3.03	4.02	5.01	IR Analyzer
PE-0290	102	84403	0.0	0.2	0.4	0.8	***1.7***	***2.5***	***3.2***	4.1	Detector
			0.00	0.24	0.51	1.02	2.03	3.03	4.02	5.01	IR Analyzer
PE-0292	102LD	4898	NO TESTING[7]								
PE-0298	102LD	7811	NO TESTING[8]								
PE-0314	102	79905	0.1	0.3	0.5	1.0	1.8	2.7	***3.4***	3.9	Detector
			0.00	0.24	0.51	1.02	2.03	3.03	4.02	5.01	IR Analyzer

6 Exhibit Number B18-c could not be calibrated because the maximum reading with 2.5% cal. gas was 1.9.
7 Exhibit Number PE-0292 was damaged and no performance testing was possible.
8 Exhibit Number PE-0298 was damaged and no performance testing was possible.

MSA Solaris Multi-Gas Detectors

Exhibit No.	Serial No.	Test Gas Mixture (% CH_4 in Air)								Source of Reading
		0.00	0.25	0.50	1.00	2.00	3.00	4.00	5.00	
B15B[9]	A5-86223	NO PERFORMANCE TESTING								
PE-0074	A5-104696	0.10	0.40	0.55	1.00	1.95	2.90	4.05	5.00	Detector
		0.00	0.27	0.50	1.00	2.03	3.03	4.03	5.03	IR Analyzer
PE-0086	A5-58751	0.00	0.25	0.50	0.95	1.90	2.85	3.90	5.00	Detector
		0.00	0.27	0.50	1.00	2.03	3.03	4.03	5.03	IR Analyzer
PE-0118[10]	A4-26051	NO PERFORMANCE TESTING								
PE-0323	A5-106631	0.00	0.25	0.40	***0.75***	***1.70***	***2.60***	***3.40***	4.35	Detector
		0.01	0.27	0.52	1.00	2.04	3.02	4.05	5.00	IR Analyzer

The Solaris readings noted as "5.00" above were accompanied by an alternating message 'OVER' on the display, indicating an over range condition. All visual, audible and vibrating alarms were given as defined in each detector's setup.

Industrial Scientific Corporation M40•M Multi-Gas Detector

Exhibit No.	Serial No.	Test Gas Mixture (% CH_4 in Air)								Source of Reading
		0.00	0.25	0.50	1.00	2.00	3.00	4.00	5.00	
A-20	070148-573	0.0	0.0	0.4	0.9	1.8	2.8	3.7	4.5	Detector
		0.00	0.28	0.54	1.04	2.04	3.04	4.00	4.99	IR Analyzer

The M40•M gave all audible, visual, and vibrating alarms as expected.

9 When attempting to calibrate Exhibit Number B15B, the detector gave a 'span failed' message. No performance testing was conducted.

10 No accuracy tests were performed on Exhibit Number PE-0118. Initially, the display was bad. After replacement of the display, the operatiou of the detector was erratic. The detector stopped working properly before tests could be conducted.

Time Drift Study

The Industrial Scientific Corporation and MSA instruments featured internal clocks. The length of a time period measured by these internal clocks can deviate from the length of the same time period measured by more precise means; one second measured by a gas detector can differ from one second as measured by the National Institute of Standards and Technology (NIST).

In laboratory environmental conditions, it was noted that clocks in each detector did, indeed, differ from that obtained from external time verification sources. Given the tolerances of each time measurement, calculations were made to determine the minimum and maximum rates of drift of the detector's internal clock as compared to the time from external sources.

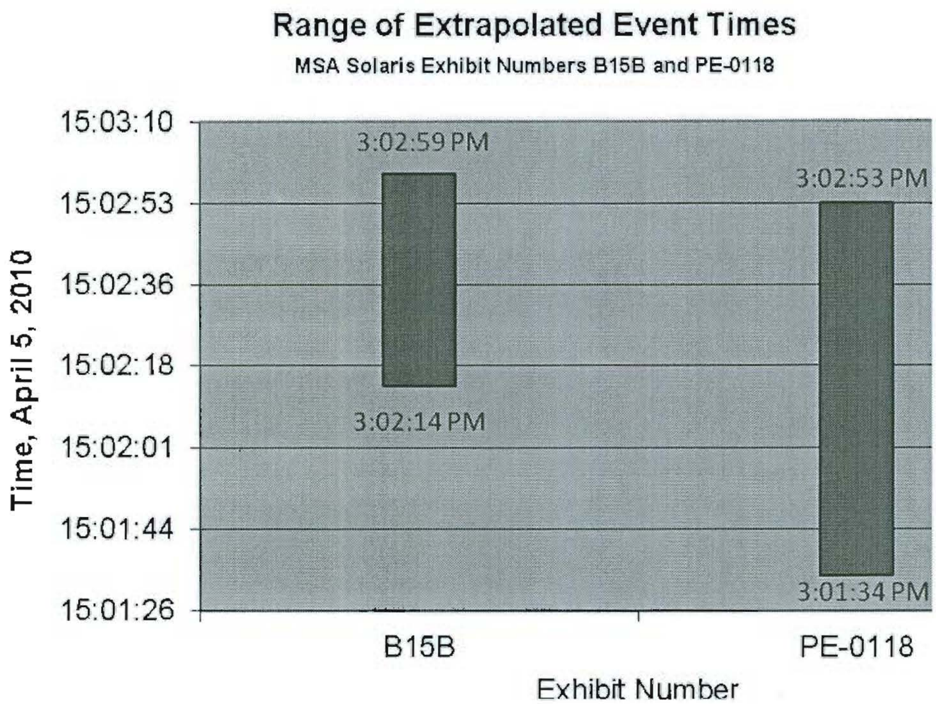
The downloaded data from the detectors was scrutinized to locate an entry on April 5, 2010 that might signify a significant event (over-range of a specific gas or gases). The minimum and maximum drift rates were then used to correlate the time for that entry to the expected time from external sources.

It was determined that the clock in the Industrial Scientific Corporation Model M40•M, Exhibit Number A-20, reset automatically when the battery was depleted. No correlation was possible, although the drift rate was calculated.

It was determined that the MSA Solaris Multi-Gas Detector, Exhibit Number PE-0086 was not energized on April 5, 2010.

When the MSA Solaris Multi-Gas Detector, Exhibit Number PE-0074 was initially reviewed in July 2010, the difference between its internal clock and the external time verification source was approximately 25 hours and 40 minutes. The drift rate was calculated as 6.294 seconds per day; this was insufficient to describe the wide variation noted. Also, the ambient temperature required to cause the drift to describe the difference would necessarily have deviated from normal ambient temperature by unreasonable amount (>496 °C higher or lower than normal room temperature). MSA, the manufacturer of the detector and Maxim, the manufacturer of the integrated circuit were consulted; the only reason that was postulated by either party was "human assistance." However, review of the downloaded data does not support that conclusion. The reason for the clock in Exhibit Number PE-0074 to have deviated from external time by such a wide margin could not be determined in this investigation.

The MSA Solaris Multi-Gas Detector, Exhibit Number B15B recorded an over-range event for combustible gas, oxygen, and carbon monoxide on April 5, 2010. Similarly, on the same date, the MSA Solaris, Exhibit Number PE-0118 recorded an over-range event for oxygen and carbon monoxide, followed by an over-range event for combustible gas at the next recording interval 15 seconds later; it should be noted that these events could have been within as little as 1 second, or as much as 29 seconds. If the drift was constant from April 5, 2010 until MSHA began taking time measurements, the actual expected time and date for the over-range events is as shown on the graph below.



The difference in the median of these two ranges is most likely due to the differences in the environment of the two detectors. Exhibit Number B15B was received on June 24, 2010, and kept in the climate-controlled MSHA building. Exhibit Number PE-0118 was not received until July 19, 2010. The environment before that date is not known, but has been anecdotally described as non-climate controlled.

<u>Intrinsic Safety</u>

The only tests conducted to determine the intrinsic safety of the detectors were thermal ignition tests. The testing was conducted on Exhibit Numbers A7A, A-20, B15B, B18-c, B26-d, PE-0074, PE-0086, PE-0290, PE-0314, and PE-0323. The damage to Exhibit Numbers PE-0292 and PE-0298 was too extensive to allow for testing. The test was conducted primarily to verify that the catalytic sensor was not reaching temperatures high enough to ignite methane. No ignitions of the test gas mixture were observed.

Additionally, for all the detectors (except those with Exhibit Numbers PE-0292 and PE-0298, because of the extent of damage), the preliminary inspection did not reveal any conditions that would suggest that any exhibit caused the explosion.

OTHER TESTS AND EVALUATIONS

The following are based on tests on exemplar detectors and similar detectors tested in previous investigations, manufacturer's documentation, and other public documentation.

The change in the reading associated with the combustible sensor in the MSA Solaris and Industrial Scientific Corporation M40•M is insignificant due to increases in barometric pressure. However, sudden increases in barometric pressure can cause both of these detectors to experience significant increases in the oxygen reading.

The MSA Solaris Multi-Gas Detector includes a temperature sensor inside the unit. The temperature is recorded every 15 minutes, and the data is contained in the periodic data log. As the temperature at the sensing detector inside the detector increases, the value recorded increases. However, the temperature sensor is somewhat insulated from the ambient temperature due its location; if the temperature outside the unit changes quickly, the temperature recorded by the unit will lag until the temperatures equalize.

The methane (catalytic) sensor used in the detectors is actually a combustible gas sensor. It will respond to other combustible gases. The following tables give the expected cross-sensitivity to other combustible gases, such as hexane, ethane, propane, butane, and pentane.

Expected Response of MSA Solaris to Selected Gases

Combustible Gas	Multiply %LEL Reading by	Column 2 Normalized to methane	Scaling Factor (Reciprocal of Column 3)	Lower Explosive Limit of Gas of Interest	Calculated Reading on Solaris at LEL of Gas of Interest	Displayed Value on Solaris at LEL of Gas of Interest.
n-Hexane	1.3	2.16666667	0.461538462	1.2	0.55	*0.55*
Ethane	0.7	1.16666667	0.857142857	3	2.57	*2.55*
Propane	0.8	1.33333333	0.75	2.1	1.58	*1.60*
Butane	1	1.66666667	0.6	1.8	1.08	*1.10*
Pentane	1	1.66666667	0.6	1.4	0.84	*0.85*
Methane	0.6	1	1	5	5.00	*5.00*

Expected Response of ISC M40•M to Selected Gases

Combustible Gas	Correlation Factor	Scaling Factor (Reciprocal of Column 2)	Lower Explosive Limit of Gas of Interest	Calculated Reading on M40-m at LEL of Gas of Interest	Displayed Value on M40-m at LEL of Gas of Interest.
n-Hexane	2.18	0.458715596	1.2	0.5505	*0.60*
Ethane	1.24	0.806451613	3	2.4194	*2.40*
Propane	1.51	0.662251656	2.1	1.3907	*1.40*
Butane	1.64	0.609756098	1.8	1.0976	*1.10*
Pentane	1.84	0.543478261	1.4	0.7609	*0.80*
Methane	0.6	1	1	5	*5.00*

A document was created that describes the contents of the data downloaded from the MSA Solaris. This is included in an Appendix B to the report. It should be noted that individual data points can become corrupted, and not be reported in the data log.

This report addresses the atmospheres or contaminants that can cause electrochemical oxygen and carbon monoxide sensors and catalytic combustible sensors to fail. For the electrochemical sensors, the most common cause for failure is time; they have a significantly shorter useful life than the catalytic combustible sensor. The most common poisoning agents for the catalytic combustible sensor are those containing silicon.

APPENDIX U-6

EXECUTIVE SUMMARY OF THE INVESTIGATION OF POWER SUPPLY, AMPLIFIER BATTERY, TRACKING TAG, AND TAG READER COMPONENTS ASSOCIATED WITH PYOTT-BOONE TRACKING BOSS TRACKER SYSTEM AND MINECOM UHF LEAKY FEEDER SYSTEM

APPENDIX U-6

EXECUTIVE SUMMARY OF THE INVESTIGATION OF POWER SUPPLY, AMPLIFIER BATTERY, TRACKING TAG, AND TAG READER COMPONENTS ASSOCIATED WITH PYOTT-BOONE TRACKING BOSS TRACKER SYSTEM AND MINECOM UHF LEAKY FEEDER SYSTEM

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of the Investigation of Power Supply, Amplifier Battery, Tracking Tag, and Tag Reader Components Associated with the Pyott-Boone Tracking Boss Tracker System and Minecom UHF Leaky Feeder System Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of power supply, amplifier battery, tracking tag, and tag reader components associated with the Pyott-Boone Tracking Boss Tracker System and Minecom UHF Leaky Feeder System recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The following components were examined. Their locations are as reported on the associated evidence identification tags and/or chain of custody forms, and the administrative file log and/or the physical evidence location map maintained by the accident investigation team:

1. Exhibit No. PE-0087, tracking tag 595, recovered between survey spads 22649 and 22625.
2. Exhibit No. 5-5-10-2, tracking tag 805, recovered off a miner's belt.
3. Exhibit No. PE-0239, tracking tag 584, recovered at the edges of shields 94 and 95.
4. Exhibit No. PE-0072, tracking tag 780, recovered near survey spad 19871, crosscut 102, 15 feet from the track.
5. Exhibit No. B-1-C, tracking tag, recovered from Exhibit No. B1, victim personal effects.
6. Exhibit No. A-23-A, tracking tag* 818, collected at the Ellis portal when victims were brought to the surface.

7. Exhibit No. A-23-B, tracking tag* 793, collected at the Ellis portal when victims were brought to the surface.
8. Exhibit No. A-23-C, tracking tag* 138, collected at the Ellis portal when victims were brought to the surface.
9. Exhibit No. A-23-D, tracking tag* 707, collected at the Ellis portal when victims were brought to the surface.
10. Exhibit No. A-23-E, tracking tag* 826, collected at the Ellis portal when victims were brought to the surface.
11. Exhibit No. A-23-F, tracking tag* 514, collected at the Ellis portal when victims were brought to the surface.
12. Exhibit No. A-23-G tracking tag* 807, collected at the Ellis portal when victims were brought to the surface.
13. Exhibit No. A-23-H, tracking tag* 625, collected at the Ellis portal when victims were brought to the surface.
14. Exhibit No. A-23-I, tracking tag* 569, collected at the Ellis portal when victims were brought to the surface.
15. Exhibit No. A-23-J, tracking tag* 288, collected at the Ellis portal when victims were brought to the surface.
16. Exhibit No. A-23-K, tracking tag* 503, collected at the Ellis portal when victims were brought to the surface.
17. Exhibit No. A-23-L, tracking tag* 810, collected at the Ellis portal when victims were brought to the surface.
18. Exhibit No. B-9-A, tracking tag 546, removed from Exhibit No. B9, victim personal effects.
19. Exhibit No. B-15-D, tracking tag 564, removed from Exhibit No. B15, victim personal effects.
20. Exhibit No. B-10-A, tracking tag 540, removed from Exhibit No. B-10 at the Ellis portal on 04/10/10.
21. Exhibit No. B-11-A, tracking tag 547, removed from Exhibit No. B11, victim personal effects.
22. Exhibit No. B-19-D, tracking tag 526 believed to be personal items.
23. Exhibit No. B-22-B, tracking tag 769, removed from Exhibit No. B22, believed to be personal items.
24. Exhibit No. PE-0196, power supply (initially identified as a tag reader on the Exhibit ID tag), recovered at survey spad 19895.
25. Exhibit No. PE-0196B, sample of dust removed from Exhibit No. PE-0196 at the A&CC intrinsic safety lab.

26. Exhibit No. PE-0138, tag reader recovered outby survey spad 19657 as indicated on the physical evidence location map.
27. Exhibit No. PE-0193, power supply (initially identified as a tag reader on the Exhibit ID tag) recovered at survey spad 20059.
28. Exhibit No. PE-0139, amplifier battery transferred to the A&CC on 11/01/10, recovered outby survey spad 19659 as indicated on the physical evidence location map.
29. Exhibit No. PE-0449, tag reader transferred to the A&CC on 03/02/11, recovered near survey spad 19882 as indicated by the Chain of Custody form.
30. Exhibit No. PE-0450, tag reader transferred to the A&CC on 03/02/11, recovered near survey spad 19643 as indicated by the Chain of Custody form.
31. Exhibit No. PE-0483, tracking tag 570 transferred to the A&CC on 05/09/11, recovered at shield 109.

*These 12 tracking tags were received at A&CC in one box identified as Exhibit No. A-23. To facilitate identification of the individual tag, they were arbitrarily assigned Exhibit Nos. A-23-A, A-23-B, A-23-C, A-23-D, A-23-E, A-23-F, A-23-G, A-23-H, A-23-I, A-23-J, A-23-K, and A-23-L. The administrative file log states that these tags were collected "on 4/9/10 at the Ellis portal when Victims were brought to the surface."

The investigation began with preliminary inspections of the exhibit items numbered 1 to 27 listed above on October 13, 2010. The preliminary inspections included decontamination of items that were considered hazardous material, documenting visual observations, and photographing as-received conditions of the components. The preliminary inspection of item 28 was conducted on November 2, 2010, and the preliminary inspection of items 29 and 30 was conducted on March 9, 2011. The preliminary inspection of item 31 was conducted on May 16, 2011.

Detailed inspections and performance tests were conducted after the preliminary inspections. Pyott-Boone representatives Adam Godsey and Gary Sergent witnessed some of the inspections and agreed to bring the equipment necessary to evaluate the operation the equipment recovered from Upper Big Branch. Performance testing of the first 27 exhibit items, with the exception of the dust sample identified as Exhibit No. PE-0196-B was conducted as part of the detailed inspections with the assistance of the Pyott-Boone representatives. One tracking tag was non-operational. A representative of Pyott-Boone returned on May 18, 2011, to conduct performance testing on the tracking tag identified as Exhibit No. PE-0483. This exhibit was transferred to the A&CC on May 9, 2011. It was found to be non-operational. After changing out the communications printed circuit board, the tag reader identified as Exhibit No. PE-0138 operated properly. Both power supplies operated properly.

Exhibit Nos. PE-0139, PE-0449, and PE-0450 were not performance tested. The condition of the amplifier battery identified as Exhibit No. PE-0139 precluded performance testing. The tag readers identified as Exhibit Nos. PE-0449 and PE-0450 were transferred to the A&CC in March 2011. Pyott-Boone was requested to recover any tracking data that may be stored in the tag reader memories. However, Pyott-Boone explained that any stored data is non-recoverable once all power is removed from the tag reader. Since any tracking data that might have been recorded post-accident was non-recoverable, performance testing of these two tag readers was deemed unnecessary.

The comparison to approval drawings was conducted following the detailed inspections. A few minor discrepancies between the exhibits and the respective approval documentation on file were noted.

No signs of arcing, sparking, or electrical heating were observed in inspections of any of the exhibits. There is no evidence that any of these exhibits were a source of spark or thermal ignition.

APPENDIX U-7

EXECUTIVE SUMMARY OF INVESTIGATION OF KOEHLER-BRIGHT STAR MODEL 5100 AND 5200 SERIES CAP LAMPS AND CAP LAMP COMPONENTS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Koehler-Bright Star Model 5100 and 5200 Series Cap Lamps and Cap Lamp Components Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation associated with respect to Koehler-Bright Star cap lamps and cap lamp components recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The cap lamps and cap lamp components received were:

1. Exhibit No. A-9 – Mark V, 5200 Series cap lamp with plastic battery cover with PTO.
2. Exhibit No. A-10 – Mark V, 5200 Series cap lamp with plastic battery cover.
3. Exhibit No. A-11 – Mark V, 5200 Series cap lamp with plastic battery cover.
4. Exhibit No. A-12 – Mark V, 5200 Series cap lamp with metal battery cover with PTO.
5. Exhibit No. A-13 – Mark V, 5200 Series cap lamp with plastic battery cover.
6. Exhibit No. A-14 – Mark V, 5200 Series cap lamp with plastic battery cover with PTO.
7. Exhibit No. A-15 – Mark V, 5200 Series cap lamp with plastic battery cover.
8. Exhibit No. B-1-B – Mark V, 5200 Series cap lamp with plastic battery cover with PTO in pouch.
9. Exhibit No. B5-A – Mark V, 5200 Series cap lamp with plastic battery cover with PTO.
10. Exhibit No. B7-A – Mark V, 5200 Series cap lamp with plastic battery cover.
11. Exhibit No. B-11-C – Mark V, 5200 Series cap lamp with plastic battery cover.
12. Exhibit No. B15-A – Mark II, 5100 Series cap lamp with plastic battery cover.

13. Exhibit No. B18-A – 5000 Series battery with plastic battery cover with PTO and cord.
14. Exhibit No. B19-A – Mark V, 5200 Series cap lamp with plastic battery cover.
15. Exhibit No. B-20-B – Mark V, 5200 Series cap lamp with plastic battery cover.
16. Exhibit No. B-22-A – 5000 Series battery with plastic battery cover and cord.
17. Exhibit No. B26-C – Mark V, 5200 Series cap lamp with plastic battery cover with PTO.
18. Exhibit No. 5-5-10-1 – Mark V, 5200 Series cap lamp with plastic battery cover.
19. Exhibit No. PE-0071 – Mark V, 5200 Series cap lamp with plastic battery cover (recovered from Survey Spad (S.S.) 19871 Crosscut 102).
20. Exhibit No. PE-0078 – 5000 Series battery (recovered 233' outby S.S. 22649).
21. Exhibit No. PE-0080 – Metal battery cover with PTO and cord (recovered outby S.S. 22649).
22. Exhibit No. PE-0081 – Mark V headpiece (recovered outby S.S. 22649).
23. Exhibit No. PE-0091 – Mark V, 5200 Series cap lamp with plastic battery cover with PTO (recovered Int. S.S. 22639).
24. Exhibit No. PE-0231 – Plastic battery cover and battery insulator and cord and Mark V headpiece (recovered from shield 112).
25. Exhibit No. PE-0231-A – Dirt and debris from Exhibit No. PE-0231.
26. Exhibit No. PE-0232 – 5000 Series battery (recovered from shield 109).
27. Exhibit No. PE-0236 – 5000 Series battery (recovered between pontoons of shields 108 and 109).
28. Exhibit No. PE-0240 – 5000 Series battery (recovered from edge of shields 94 and 95).
29. Exhibit No. PE-0241 – Plastic battery cover with PTO and cord and Mark V headpiece (recovered from shield 92).
30. Exhibit No. PE-0289 – 5000 Series battery and cord (battery recovered from mantrip outby S.S. 24401 inby end of operator's compartment and cord laying on outby end of operator's compartment).
31. Exhibit No. PE-0327 – 5000 Series battery (recovered Adj. to Stage Loader).
32. Exhibit No. PE-0350 – 5000 Series battery (recovered inby S.S. 24754).
33. Exhibit No. PE-0481-C – Components of a 5000 Series battery (recovered from shield 109).
34. Exhibit No. PE-0485 – Components of a 5000 Series battery (recovered from shield 107).

A broad assortment of cap lamp exhibits was recovered ranging from fully intact exhibits to individual cap lamp components. It is unclear if any of the individual components were at one time part of a fully intact cap lamp. Additionally, the exhibits ranged from a small amount of dirt and debris to being entirely covered and/or filled with dirt and debris. Several of the exhibits were considered hazardous material and required decontamination prior to any investigation activities.

Multiple exhibits showed evidence of damage from the explosion such as heat damage, charring, soot, missing pieces or severe physical damage. Some exhibits were not maintained in approved condition pre-explosion. Nearly all of the batteries had minimal to no detectable electrolyte fluid. Two of the exhibits battery covers were attached to the battery with electrical tape. Several of the exhibits had tape covering cuts in the cord casing. Several of the exhibits had cuts in the battery cover wiring exposing the conductors. Some of the exhibits had an excessive amount of corrosion on the battery cover wiring and battery terminals. Several of the exhibits had loose or missing hardware.

From the evaluations and tests conducted there was no evidence found that any of the exhibits had enough electrical energy to ignite a methane and air mixture or enough thermal energy to ignite coal dust.

The summary of the inspections, tests, and evaluations is below:

There were various inspections, tests, and actions conducted on the exhibits such as filling each battery with electrolyte and charging, flash current testing, measuring the inductance of each cord, spark testing, measuring the surface temperature of each bulb and one exhibit cord, verifying that bulb ejection mechanism of each headpiece operated properly, performing a detailed inspection, and comparing each exhibit to the approval documentation on file.

A total of 19 out of the 27 recovered batteries were able to be charged. Six batteries were damaged to the extent that they were not able to be filled with electrolyte. Two of the 21 batteries that were filled with electrolyte leaked and could not be charged.

There were 19 batteries that were flash current tested. One battery was flash current tested as a single cell due to the other cell being damaged. Results from the testing showed that Exhibit No. B15-A had the lowest internal resistance and Exhibit No. PE-0091 had the highest open circuit voltage.

The inductance was measured on 15 of 24 cap lamp cords. Six of the cords were damaged and were not able to be measured. Three of the cords were not able to be accurately measured. Results from the measurements showed that Exhibit No. A-12 had the highest inductance.

There were two spark ignition tests conducted. One test consisted of the battery of Exhibit No. B15-A and the cord of Exhibit No. A-12 and the second test consisted of the battery of Exhibit No. PE-0091 and the cord of Exhibit No. A-12. Results from the testing showed that neither combination had enough electrical energy to ignite a methane and air mixture.

Surface Temperature tests were conducted on 10 of 12 headpiece bulbs. Two of the bulbs were damaged and were not able to be tested. Results from the testing showed that the highest measured temperature was not enough thermal energy to ignite coal dust.

The Bulb Ejection Mechanism for 20 of 21 headpieces was tested. One of the headpieces was damaged to the extent that it was not able to be tested. Results from the testing showed that all bulb ejection mechanisms operated properly.

Detailed inspections and comparison to approval documentation for multiple exhibits showed evidence of damage from the explosion such as heat damage, charring, soot, missing pieces or severe physical damage. Some of the exhibits were found to have properties making it possible they were not maintained in permissible condition pre-explosion and perhaps considerable enough to affect the operation. Nearly all of the batteries had minimal to no detectable electrolyte fluid. Two of the exhibit's battery covers were attached to the battery with electrical tape. Several of the exhibits had tape covering cuts in the cord casing. Several of the exhibits had slices in the battery cover wiring exposing the conductors. Some of the exhibits had an excessive amount of corrosion on the battery cover wiring and battery terminals. Several of the exhibits had loose or missing hardware.

From the evaluations and tests conducted, there was no evidence found that any of the exhibits had enough electrical energy to ignite a methane and air mixture or enough thermal energy to ignite coal dust.

APPENDIX U-8

EXECUTIVE SUMMARY OF THE INVESTIGATION OF SEVEN POWER AIR PURIFYING RESPIRATORY (PAPR) HELMET BATTERY ASSEMBLIES AND PIECES

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of the Investigation of Seven Power Air Purifying Respiratory (PAPR) Helmet Battery Assemblies and Pieces Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of seven power air purifying respiratory (PAPR) helmet battery assemblies and pieces recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The components examined were:

1. Exhibit No. B11-B, Battery for longwall face helmet 3M (Minnesota Mining and Manufacturing) NiCad, recovered from the longwall face.
2. Exhibit No. PE-0205, Airstream helmet battery, recovered from Survey Spad # 22692 (SS# 22692).
3. Exhibit No. PE-0208, Airstream helmet battery, recovered from SS# 22701.
4. Exhibit No. PE-0270, Airstream helmet battery, recovered from longwall Shield 121.
5. Exhibit No. PE-0151, Airstream helmet battery case portion, recovered from between SS# 22738 and SS# 22759.
6. Exhibit No. PE-0152, Airstream helmet duct and cable, recovered from SS# 22759.
7. Exhibit No. PE-0481, Airstream helmet duct and cable, recovered from Longwall Shield 109.

The locations of the evidence were copied from the evidence ID tags.

The examination of these exhibits showed that:

- None of the electrical components or assembly materials of the exhibits showed signs of arcing, sparking or electrical heating.
- No ignition of methane gas occurred during a spark ignition test with the highest short circuit current and highest open circuit voltage that was measured from any of the exhibit batteries.
- All electrical components, assembly materials and assemblies were in accordance with approval documentation on file with MSHA under approval number 2G-3143-0 and its subsequent extension (-1).

APPENDIX U-9

EXECUTIVE SUMMARY OF INVESTIGATION OF LOW-ENERGY NON-PERMISSIBLE ELECTRICAL ITEMS (WATCHES AND CALCULATORS)

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Low-Energy Non-Permissible Electrical Items (Watches and Calculators) Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation associated with respect to low-energy non-permissible electrical items (watches and calculators) recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The components received were:

1. Exhibit No. B-15-G, a watch with missing one side of the band.
2. Exhibit No. B-21-A, a black rubber banded watch.
3. Exhibit No. B-1-D, a blackened watch attached to a clip and taped.
4. Exhibit No. B-15-F, a black calculator.
5. Exhibit No. B-4-B, a Le World calculator.
6. Exhibit No. PE-0172, a wrist watch with missing parts taken from Crosscut 69 Inby.
7. Exhibit No. PE-0245, a black wrist watch taken from Shield 59.
8. Exhibit No. PE-0244, a wrist watch with missing parts and a ink-pen taken from Shield 84.

The investigation began with a preliminary inspection of all the non-permissible watches and calculators received. The preliminary inspection included decontamination of items that were considered potentially biohazardous, documenting visual observations, and photographing as-received conditions of the components. All of the watches were functional except Exhibit Nos. PE-0172 and PE-0244. The battery and some other parts of the non-functional watches were missing. Some of the watches and calculators had bubbling and discoloration effects.

The next phase of the investigation included a detailed inspection of all the low-energy non-permissible watches and calculators. The detailed inspection involved determining whether the calculators could be energized and disassembling the equipment to address any signs of arcing, sparking, and electrical heating internal to the equipment. The Exhibit No. B-15-F, a black calculator, could not be energized. After disassembling and inspecting all the exhibits, no signs of arcing, sparking, or electrical heating were observed.

The watches and calculators are non-approved and non-permissible MSHA items, a comparison to approval drawings was not conducted.

APPENDIX U-10

EXECUTIVE SUMMARY OF INVESTIGATION OF MACHINE-MOUNTED METHANE MONITORS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 18, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Machine-Mounted Methane Monitors Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of machine-mounted methane monitoring systems and related components recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The investigation began with a preliminary inspection of all the exhibits. The preliminary inspection included documenting visual observations, and photographing as-received conditions of the methane monitoring systems. These inspections were followed by performance checks ('bump tests') and thermal ignition tests.

None of the methane monitoring systems had datalogging capabilities.

Where feasible, performance tests were conducted on operational methane monitoring systems to determine the operation of the systems when tested in the methane-air mixtures specified in 30 CFR 27.

A detailed inspection of each system was conducted. This included comparison with the certification documentation.

The results of the preliminary inspections, tests, and evaluations are summarized below.

CSE Model 140B LD IR Systems

1.1 Exhibit Number PE-0213 Control Unit and Power Supply; Exhibit Number PE-0169 Sensor Assembly, A CSE Model 140B LD IR Machine-Mounted Methane Monitoring System with Control Unit from longwall headgate and Sensor from longwall tailgate.

1.1.1 The system was tested with added laboratory resistors to simulate the long cable between the Sensor Assembly and the Control Unit. Without calibration, its power shut-off component operated when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air. The final display reading with this test gas mixture was 2.6.

1.1.2 There was no obvious evidence that suggested that the components of the system had been intentionally by-passed.

1.1.3 This sensor assembly did not cause an ignition of a 7.5% methane-in-air mixture when energized in that test gas. Additionally, the inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.1.4 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.2 Exhibit Number PE-0166, Control Unit; Exhibit Number PE-0167, Power Supply; and Exhibit Number PE-0170, Sensor Assembly. A CSE Model 140B LD IR Machine-Mounted Methane Monitoring Systems, Certification 32A-15/MS-8, System from longwall Shearing Machine.

1.2.1 Without calibration, the power shut-off component of this system operated when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air. The final display reading with this test gas mixture was 2.0.

1.2.2 There was no obvious evidence that suggested that the components of the system had been intentionally by-passed.

1.2.3 This sensor assembly did not cause an ignition of a 7.5% methane-in-air mixture when energized in that test gas. Additionally, the inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.2.4 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.2.5 There was minor damage to the polycarbonate lens of the control unit. The cause is unknown.

General Monitors Model S800 Systems

1.1 Exhibit Number PE-0256. A General Monitors Model S800 Machine Mounted Methane Monitoring System Components and Relay from Barrier Section Continuous Mining Machine, Serial Number JM5849.

1.1.1 Before the system was calibrated, its power shut-off component did not operate when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air. The final display reading with this test gas mixture was 1.4. The test gas concentration that caused the power shut-off component to operate was 3.00% methane-in-air.

1.1.2 After the system was calibrated, its power shut-off component operated when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air.

1.1.3 There was no evidence that suggested that the power shut-off components of the system were intentionally by-passed.

1.1.4 No thermal ignition testing was requested. The inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.1.5 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.2 Exhibit Number PE-0313, A General Monitors Model S800 Machine Mounted Methane Monitoring System Components from TG22 Section, Serial Number JM6053.

1.2.1 Before the system was calibrated, its power shut-off component did not operate when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air. The final display reading with this test gas mixture was 1.4. The test gas concentration that caused the power shut-off component to operate was 3.00% methane-in-air.

1.2.2 After the system was calibrated, its power shut-off component operated when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air.

1.2.3 The wires connected to terminals 4 and 8 of the 12 position connector included areas that were missing insulation; that area of the wire connected to terminal 4 was wrapped with electrical tape. That area of the wire connected to terminal 8 was bare and dirty with several wire strands broken, suggesting that the area had been manipulated. Terminal 4 is "+15V" and terminal 8 is "CR", or 'Contactor Return'. Under normal operation of the system, terminal 8 is connected to terminal 9 which is "CD", or 'Contactor Drive', which is 12 Vdc. This voltage energizes the coil of the power shut-off component, Relay K1.

Whenever the system initiates a 'trip', an internal relay operates, disconnecting the 12 Vdc from terminal 8. This causes the coil of the power shut-off component to be de-energized.

If the bare area of the wire connected to terminal 8 was in contact with the conductors under the tape on the wire connected to terminal 4, a short circuit of the +15 Vdc supply at terminal 4 to terminal 8 would exist. This would effectively bypass the methane monitoring system, causing the K1 Relay coil to be energized at all times that the system is energized. This short circuit was not present, however, when the system was received.

1.2.4 No thermal ignition testing was requested. The inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.2.5 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.3 <u>Exhibit Number PE-0316, A General Monitors Model S800 Machine Mounted Methane Monitoring System Components and Relay from TG22 Section, Right Miner, Serial Number JM6044.</u>

1.3.1 Before the system was calibrated, its power shut-off component did not operate when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air. The final display reading with this test gas mixture was 1.6. The test gas concentration that caused the power shut-off component to operate was 2.64% methane-in-air.

1.3.2 After the system was calibrated, its power shut-off component operated when the sensor assembly was presented with a test gas mixture of approximately 2.1% methane-in-air.

1.3.3 There was no evidence that suggested that the components of the system had been intentionally by-passed.

1.3.4 No thermal ignition testing was requested. The inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.3.5 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.4 <u>Exhibit Number PE-0342, A General Monitors Model S800 Machine Mounted Methane Monitoring System Components and Relay from HG22-002 Section, Left Joy Continuous Miner, Serial Number JM4918B</u>.

1.4.1 In the as-received condition, this system did not operate properly; the only indication given by the system was "FAULT" on the readout/display/control unit. The power shut-off component was in a position that would not allow a connected machine to operate. Substitution of components with known good components indicated that the as-received Electronics Assembly and the as-received Sensor Assembly were both not functioning properly. Additionally, the resistance of closed contacts of the RC Relay assembly was high in the as-received condition. Although the Power Supply Assembly provided the necessary dc voltage to the Electronics Assembly, and its K1 Relay power shut-off component seemed to operate properly, the K2 Relay for remote light operation did not.

1.4.2 The Sensor Assembly housing was partially filled with water in the as-received condition, and all other components included the appearance of water damage.

1.4.3 The wires connected to terminals 4 and 8 of the 12 position connector included areas that were missing insulation and were wrapped with electrical tape. Additionally, very short lengths of small wire were connected to these terminals. As noted above, if the bare areas of the wires connected to terminal 8 and terminal 4 were in contact, a short circuit of the +15 Vdc supply at terminal 4 to terminal 8 would exist. This would effectively bypass the methane monitoring system, causing the K1 Relay coil to be energized at all times that the system is energized. This short circuit was not present, however, when the system was received.

1.4.4 No thermal ignition testing was requested. The inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.4.5 No set screw was found at the cable entrance gland. One of the sensor cover bolts lock washers was missing.

1.4.6 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.5 Exhibit Number PE-0343, comprising General Monitors Model S800 Machine Mounted Methane Monitoring System Components and Relay From HG22-001 Section, Right Joy Continuous Miner, Serial Number JM5811.

1.5.1 In the as-received condition, the components of this system were wet. After drying, this system did not operate properly; the only indication given by the system was "FAULT" on display. The power shut-off component was in a position that would not allow a connected machine to operate. Substitution of a known good Electronics Assembly indicated that the as-received Electronics Assembly was not functioning properly. Additionally, RC Relay assembly contacts were not fully engaging and the relay was noisy.

1.5.2 The Sensor Assembly enclosure was partially filled with water in the as-received condition, and all other components included the appearance of water damage.

1.5.3 There was no evidence that suggested that the components of the system had been intentionally by-passed.

1.5.4 No thermal ignition testing was requested. The inspection did not reveal any conditions that would suggest that the components of this system caused an explosion.

1.5.5 No set screw was found at the cable entrance gland. One of the sensor cover bolts lock washers was missing.

1.5.6 None of the discrepancies found from comparing the components of the system to the certification documentation were considered significant or would have affected the performance or permissibility of the methane monitoring system.

1.6 Exhibit Number PE-0297, General Monitors Sensor Head. This was a sensor head assembly that was not mounted in a housing. It did not have the appearance that would indicate it was in a housing at the time of the explosion. No tests were requested or performed. There were no conditions that would indicate that this component caused an explosion.

APPENDIX U-11

EXECUTIVE SUMMARY OF INVESTIGATION OF HIGH-ENERGY NON-PERMISSIBLE ELECTRICAL ITEMS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 18, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of High-Energy Non-Permissible Electrical Items Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation associated with respect to high-energy non-permissible electrical items recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

Item No.	Exhibit No.	Description	Preliminary Inspection Date	Detailed Inspection Date
1	PE-0189	Battery Charger	10-13-2010	11-3-2010
2	PE-0202	Switch	10-13-2010	11-3-2010
3	PE-0203	Ten Unit Charging Station	10-13-2010	11-3-2010
4	PE-0271-A	28 In Lighting Cable	10-14-2010	11-2-2010
5	PE-0271-B	10 Ft Lighting Cable	10-14-2010	11-2-2010
6	PE-0275-A	Lighting Current Transformer (CT)	10-14-2010	11-2-2010
7	PE-0275-B	Lighting Relay	10-14-2010	11-2-2010
8	PE-0275-C	Lighting Ground Fault Relay (GFR)	10-14-2010	11-2-2010
9	PE-0308	Lighting Ground Wire Monitor (GWM)	10-14-2010	11-2-2010 & 11-22-2010
10	PE-0325	GWM Terminating Diode	11-2-2010	11-2-2010
11	PE-0175	Hand Tool Rechargeable Battery	11-3-2010	11-3-2010

Item No.	Exhibit No.	Description	Preliminary Inspection Date	Detailed Inspection Date
12	PE-0155	Hand Tool Rechargeable Battery	11-3-2010	11-3-2010
13	PE-0190	Hand Tool Rechargeable Battery	11-3-2010	11-3-2010
14	PE-0191	Hand Tool Rechargeable Battery	11-3-2010	11-3-2010
15	PE-0154	Hand Tool Rechargeable Battery	11-3-2010	11-3-2010
16	PE-0277	Electrical Contactor	11-3-2010	11-3-2010
17	PE-0278	Blasting Wire	11-3-2010	11-3-2010
18	PE-0181	Battery Charger	11-3-2010	11-3-2010
19	PE-0328	Blasting Machine Cover	11-3-2010	11-3-2010
20	PE-0201	Switch	11-4-2010	11-4-2010
21	PE-0185	Grease Gun	11-4-2010	11-4-2010
22	PE-0153	Impact Wrench	11-4-2010	11-4-2010
23	PE-0345	Lighting Circuit Breaker (CB)	11-16-2010	11-22-2010
24	PE-0158	120 Vac Hammer Drill	11-23-2010	11-23-2010
25	PE-0455	Cable Extension Cord	03-02-2011	03-02-2011

Note: Exhibit Nos. PE-0271(Reference slide 20 of Appendix B) and PE-0275 (Reference slide 45 of Appendix B), as received at the A&CC, included several components. The designation "-A" and "-B", and "-C" were assigned to the individual components in order to identify the individual components. The locations of the evidence were obtained from the evidence ID tags.

The investigation began with a preliminary inspection of the evidence. The preliminary inspection included documenting visual observations, and photographing as-received conditions of the components.

The next phase of the investigation included a detailed inspection of the evidence. The detailed inspection involved determining whether the evidence could be energized and disassembling the evidence to address any signs of arcing, sparking, and electrical heating internal to the evidence. The power cord of Exhibit No. PE-0189 (Reference slides 1-8 of Appendix B), a battery charger, showed heat damage. Exhibit No. PE-0328 (Reference slides 9 & 10 of Appendix B), the blasting machine cover, showed evidence of heating. The plastic tray that held the batteries was melted. The cover appeared to have been blown off or forcibly removed. Five of the six cover screws were broken. Exhibit No. PE-0203 (Reference slides 11-16 of Appendix B), a ten unit charging station, showed evidence of heating. The eight charging cords were melted together. Exhibit No. PE-0190 (Reference slides 17-19 of Appendix B), a hand tool rechargeable battery, showed evidence of heating. The battery had some melting of the case. For some components, a combined preliminary/detailed inspection was conducted.

Since all items are non-approved and non-permissible items, no comparison to drawings was conducted.

APPENDIX U-12

EXECUTIVE SUMMARY OF INVESTIGATION OF A NELSON-KELLERMAN ANEMOMETER

APPENDIX U-12

EXECUTIVE SUMMARY OF INVESTIGATION OF A NELSON-KELLERMAN ANEMOMETER

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17. 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of a Nelson-Kellerman Anemometer Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of a Nelson-Kellerman Anemometer recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The component received was:

1. Exhibit No. PE-0075 Nielsen-Kellerman Company PMA-2008 Pocket Mining Anemometer (Found in crosscut 102 adjacent to S.S. 19871) as documented by the Evidence Identification Tag.

The exhibit was initially documented and photographed during a Preliminary Inspection in the condition in which it was received. The Preliminary Inspection included documenting visual observations and photographing conditions of the exhibit. This inspection was conducted as the equipment was received by the Primary Investigator during the accident investigation.

After the Preliminary Inspection was completed, a Detailed Inspection was conducted. The Detailed Inspection included noting any obvious signs of arcing, sparking, or electrical heating on both the outside and inside of the equipment. This involved taking apart the equipment and performing any applicable testing as modified per ASOP2026, Investigative Procedures for Evaluating Equipment from Mine Explosions. At the conclusion of the Detailed Inspection, the anemometer was compared to approval documentation.

The anemometer appeared to be functional in its as received condition. There were no obvious signs of internal heating, arcing, or sparking.

The anemometer had several minor discrepancies when compared with the approval documentation. None of these discrepancies affected the intrinsic safety of the anemometer.

APPENDIX U-13

EXECUTIVE SUMMARY OF INVESTIGATION OF PORTABLE RADIOS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 18, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Portable Radios Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of portable radios recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The components received were:

- Exhibit Number A16, Radio #39.
- Exhibit Number A17, Radio #28.
- Exhibit Number A18, Radio #29.
- Exhibit Number B5B, Radio.
- Exhibit Number B-19-B, Radio #187.
- Exhibit Number B-20-A, Radio #181.
- Exhibit Number B-22-D, Radio #182.
- Exhibit Number B-26-A, Radio #188.
- Exhibit Number PE-0041, Radio #30.
- Exhibit Number PE-0042, Radio #32.
- Exhibit Number PE-0070, Battery for Radio.
- Exhibit Number PE-0079, Battery for Radio.
- Exhibit Number PE-0092, Radio w/o battery.
- Exhibit Number PE-0095, Radio #155.
- Exhibit Number PE-0176, Radio w/o battery.
- Exhibit Number PE-0187, Radio #162.
- Exhibit Number PE-0206, Radio.
- Exhibit Number PE-0215, Radio #134.
- Exhibit Number PE-0286, Radio frame and PCB.
- Exhibit Number PE-0299, Radio w/o battery.
- Exhibit Number PE-0340, Radio w/o battery.
- Exhibit Number PE-0349, Radio #230.

The investigation began with a preliminary inspection of all the exhibits. The preliminary inspection included decontamination of items that were considered hazardous material, documenting visual observations, and photographing as-received conditions of the components.

The next phase of the investigation included a detailed inspection of all the radios. The detailed inspection involved determining whether the radios could be energized and disassembling all the equipment to address any signs of arcing, sparking, and electrical heating internal to the equipment.

The inspection of the exhibits resulted, in part, in observation of the various settings of the radios. These are tabulated below. It should be noted that the settings were as-received at the A&CC; they may have been changed between the time of the accident and the time of receipt.

Exhibit Number	Radio Number	Channel	On/Off	Notes
A16	39	2	On	
A17	28	4	Off	
A18	29	1	On	
B5B	260	6	Off	Knob first noted in "on" position, but battery charge indicated that it was most likely 'off'
B19B	187	2	On	
B20A	181	2	On	
B22D	182	2	Off	
B-26-A	188	4	Off	
PE-0041	30	4	On	
PE-0042	32	7	On	
PE-0092	?	2	On	Handwritten "AM" and "(*illegible*)4" on front of radio.
PE-0095	155	5	On	

Exhibit Number	Radio Number	Channel	On/Off	Notes
PE-0176	?	1	?	Volume/on/off knob would not turn
PE-0187	162	1	Off	
PE-0206	?	7	Off	Channel selector knob missing
PE-0215	134	2	On	
PE-0286	?	?	?	Case, knobs and volume/on/off shaft missing
PE-0299	?	?	?	Knobs and volume/on/off shaft missing
PE-0340	274	2	On	
PE-0349	230	5	On	

There was a white dot on the push-to-talk button on several exhibits. The mine operator's representative indicated that this dot was placed by a technician after re-programming at the mine site.

Each complete exhibit that comprised a complete radio was tested to determine its functional status. The tests were conducted between radios with no base station. Two sets of tests were conducted: one set with the radios within approximately 20 feet of each other in a laboratory, and one set with the radios approximately 1 mile apart.

- The following radios were found to be functional: Exhibit Numbers A16, A17, A18, B19B, B20A, B22D, B26A, PE-0041, PE-0042, PE-0095, PE-0187, PE-0206, and PE-0215.
- The following radios were found to be non-functional: Exhibit Numbers B5B and PE-0349.
- The following exhibits represent the radios that were incomplete (did not include batteries, or were only batteries) and therefore were not tested: Exhibit Numbers PE-0070, PE-0079, PE-0092, PE-0176, PE-0286, PE-0299, and PE-0340.

Each exhibit was inspected and compared with the approval documentation. The voltage and short-circuit current available from each battery pack were measured. Additionally, each complete exhibit that comprised a complete radio was tested to determine if it was a thermal ignition hazard.

- As a result of these tests and evaluations, there was no evidence found that suggested the following exhibits caused an ignition: Exhibit Numbers A16, A17, A18, B5B, B19B, B20A, B22D, B26A, PE-0041, PE-0042, PE-0070, PE-0092, PE-0095, PE-0187, PE-0206, PE-0215, PE-0340, and PE-0349.

- There was no evidence that Exhibit Numbers PE-0079, PE-0176, PE-0286, and PE-0299 caused an ignition. However, due to missing components, a complete assessment of these exhibits was not possible.

The worst case parameters measured in the short-circuit current tests were simulated and a spark-ignition test using those parameters was conducted. There was no ignition of the methane-air test gas.

APPENDIX U-14

EXECUTIVE SUMMARY OF INVESTIGATION OF PYOTT BOONE CO MONITORS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Pyott Boone CO Monitors Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation associated with respect to Carbon Monoxide (CO) Monitors recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The components received were:

1. Exhibit No. PE-0207, Pyott Boone Model 2103 CO Monitor, MSHA Sensor Classification G Issue Number 113.
2. Exhibit No. PE-0178, Pyott Boone Model 1703 CO Monitor.
3. Exhibit No. PE-0482, Pyott Boone Model 2103 Partial Circuit Board, Unknown MSHA Approval Number.

The investigation began with preliminary inspection of Exhibit Nos. PE-0207 and PE-0178. The preliminary inspection included documenting visual observations, and photographing as-received conditions of the components. None of the exhibits were operated during the preliminary inspection. The exhibits both presented discoloration and were covered in a black dusty substance. The bottom lower half of the rear of the case was missing on Exhibit No. PE-0178. Exhibit No. PE-0482 was inspected and is a partial Smart Remote CPU Printed Circuit Board (PCB).

The next phase of the investigation included a detailed inspection and performance test of Exhibit Nos. PE-0207 and PE-0178. Both exhibits were able to be powered using a bench power supply. Both exhibits initially reported CO readings when no CO was provided. After calibration, both exhibits reported CO readings correctly at 0 ppm, 50 ppm and 100 ppm. After disassembling and inspecting all the exhibits, no signs of arcing, sparking, or electrical heating were observed.

Exhibit Nos. PE-0207 and PE-0482 were compared to the drawings on file with MSHA. Exhibit No. PE-0178 is a non-approved and non-permissible CO Monitor; as such, there are no drawings on file with MSHA.

APPENDIX U-15

EXECUTIVE SUMMARY OF INVESTIGATION OF PROGRAMMABLE LOGIC CONTROLLER COMPONENTS

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 28, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of Programmable Logic Controller Components Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, assisted the accident investigation team in the investigation of Programmable Logic Controller (PLC) components of the longwall mining system. These components were recovered from a fatal mine explosion at the Upper Big Branch Mine-South which occurred on April 5, 2010.

The components examined were:

1. Exhibit No. PE-0168 Allen-Bradley PanelView 600 recovered from the Automatic Chain Tensioner (ACT) controller enclosure located at the longwall tailgate. Note: The exhibit was placed into Exhibit No. PE-0250 protective case.
2. Exhibit No. PE-0214 Allen-Bradley PanelView Plus 1000 and PanelView Plus 24 Vdc power supply recovered from the longwall headgate master controller enclosure.
3. Exhibit No. PE-0222 which consisted of two pieces of evidence in the same protective case:
   a. Allen-Bradley PLC-5/20 processor module recovered from the longwall headgate master controller enclosure and;
   b. Allen-Bradley PanelView Plus 1000 recovered from the longwall power center.
4. Exhibit No. PE-0223 Allen-Bradley PLC-5/40 processor module recovered from the longwall starter.
5. Exhibit No. PE-0253 Allen-Bradley SLC 500 7-Slot Rack containing a SLC 5/04 processor module, power supply, three input modules and one output module recovered from the ACT controller enclosure located at the longwall tailgate.

6. Exhibit No. PE-0261 Allen-Bradley PanelView Plus 1000 recovered from the emulsion pump starter.
7. Exhibit No. PE-0262 consisted of two pieces of evidence in the same protective case:
    a. Allen-Bradley PLC-5/30 processor module recovered from the emulsion pump starter;
    b. Allen-Bradley Enhanced PLC-5 Controller (PLC-5/30 processor module) recovered from the longwall power center.
8. Exhibit No. PE-0274 consisted of two pieces of evidence in the same protective case:
    a. Allen-Bradley DL40 Dataliner Message Display recovered from the longwall starter;
    b. Allen-Bradley SLC 5/04 processor module recovered from the water pump starter.
9. Exhibit No. PE-0309 Allen-Bradley Enhanced PLC-5 Controller (PLC-5/20 processor module) recovered from the longwall headgate master controller enclosure. The exhibit was a spare processor module that was not installed.

The PLC components used on the longwall mining system consisted of six processor modules. Each processor controlled a different system. These processors were mounted in separate locations and were intended to operate on a network. The PLC components were not configured with any additional hardware (storage medium) or software code to allow for data logging; however, some of the components retained the last state of the PLC output registers.

Attempts were made to retrieve this information from these PLC components in order to find data relative to the operating status of the longwall mining system immediately prior to the mine explosion. The MSHA accident investigation team requested the assistance of the longwall electrical equipment supplier and contracted with the PLC component manufacturer.

The examinations and tests found:

- No PLC inputs or outputs were observed to be “forced” (no processors were found in a state where the software logic control was overridden).
- Due to conflicting data when examining the retained last state of the PLC output registers, no definitive conclusions of the operating status of the longwall mining system could be obtained.

APPENDIX V

VAISALA NATIONAL LIGHTNING DETECTION REPORT 258028

STRIKEnet®

[redacted]

Jun 9, 2010 05:16:59 PM

Thank you for using Vaisala's STRIKEnet¬Æ to validate the referenced claim. Your report was generated using data from Vaisala's National Lightning Detection Network¬Æ, the most comprehensive archive database in North America.

STRIKEnet Report 258028

Report Number:	SF Performance Coal Co
Claim Number:	(Claim # Not Provided)
Insured/Claimant Name:	Upper Big Branch Mine
Approx. Claim/Loss Value:	
Items Damaged/Loss Type:	
Search Period:	Apr 5, 2010 06:00:00 AM US/Eastern to Apr 6, 2010 06:00:00 AM US/Eastern
Search Radius:	10 mi/16 km around the given location.
Search Center Point:	37.943000° N (Latitude), 81.604000° W (Longitude)

Comments: 293 strikes were detected by the National Lightning Detection Network for the given time period and location.

Thank you again for selecting STRIKEnet. If you have any questions please contact us at 1 800 283 4557 or thunderstorm.support@vaisala.com.

Best Regards,

The Vaisala STRIKEnet Team

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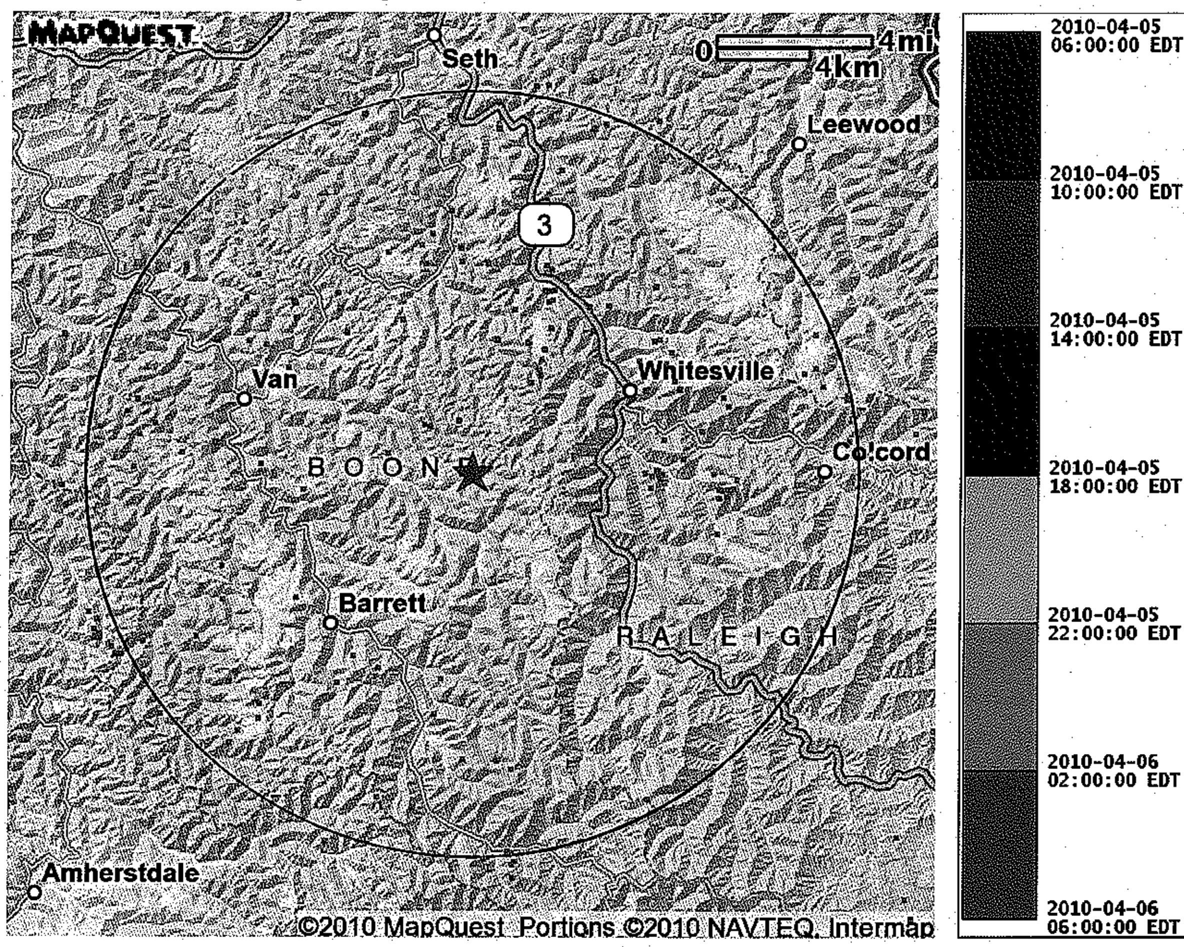
STRIKEnet Report 258028

Report Title: SF Performance Coal Co
Total Lightning Strokes Detected: 293
Lightning Strokes Detected within 10 mi/16 km radius: 195
Lightning Strokes Detected beyond 10 mi/16 km whose confidence ellipse overlaps the radius: 98
Search Radius: 10 mi/16 km
Time Span: Apr 5, 2010 06:00:00 AM US/Eastern to Apr 6, 2010 06:00:00 AM US/Eastern

Location Points For Lightning Strokes



Lightning data provided by Vaisala's NLDN¬Æ and/or Environment Canada's CLDN.

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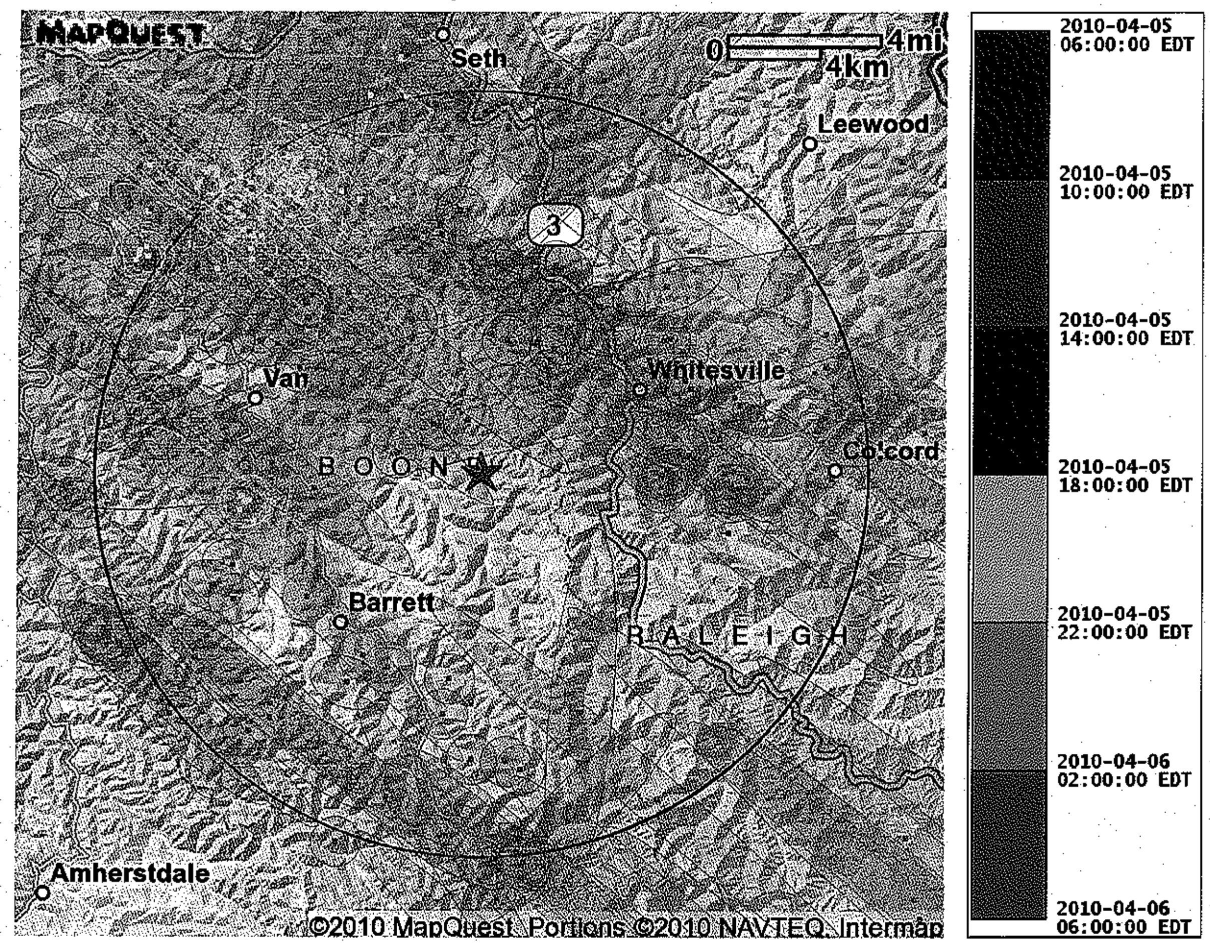
Search Radius: 10 mi/16 km
Time Span: Apr 5, 2010 06:00:00 AM US/Eastern to Apr 6, 2010 06:00:00 AM US/Eastern

Confidence Ellipses For Lightning Strokes



Lightning data provided by Vaisala's NLDN¬Æ and/or Environment Canada's CLDN. Note: These ellipses indicate a 99% certainty that the recorded lightning event contacted the ground within the bounds of the ellipse.

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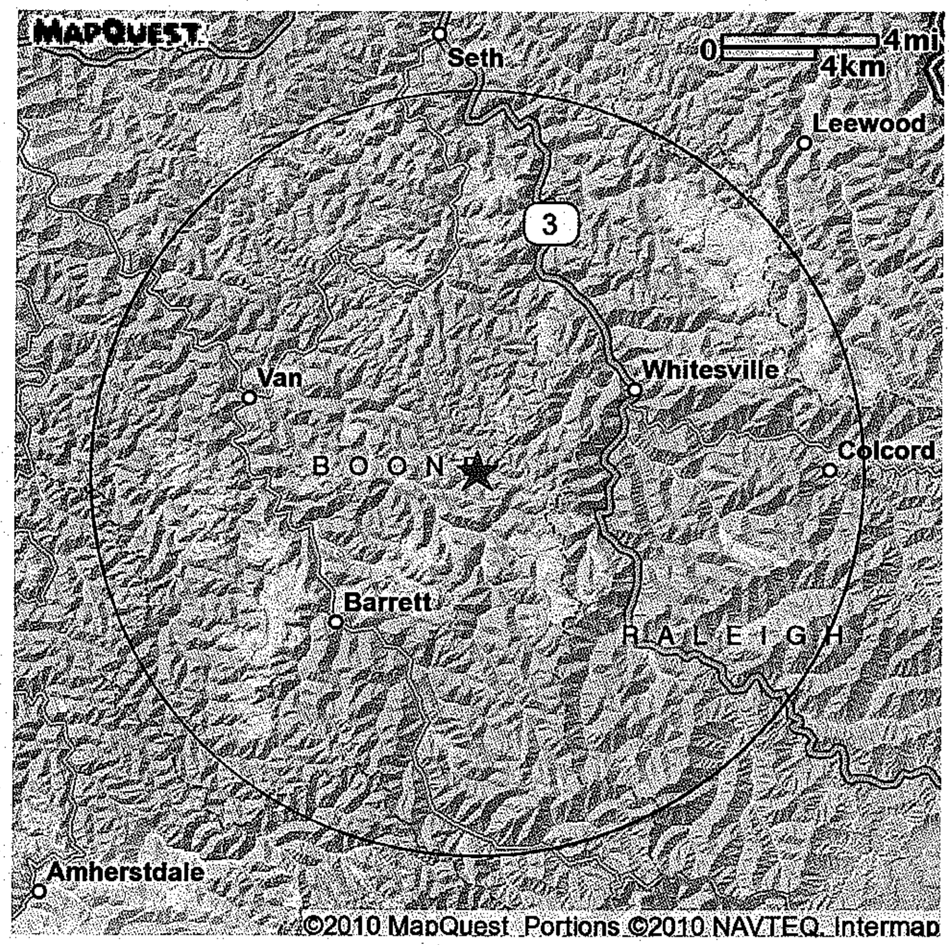
Area Of Study With Center Point



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Search Radius: 10 mi/16 km
Time Span: Apr 5, 2010 06:00:00 AM US/Eastern to Apr 6, 2010 06:00:00 AM US/Eastern

Lightning Stroke Table (Note: Earliest 50 events shown. Events ordered by time.)

Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	09:36:04 AM	-5.3	11.9/19.1	38.0000	-81.8098
Apr 5, 2010	09:36:05 AM	-7.4	11.1/17.9	37.9954	-81.7969
Apr 5, 2010	09:36:05 AM	-36.9	8.8/14.2	37.9710	-81.7618
Apr 5, 2010	09:40:34 AM	-32.6	7.4/11.9	37.9933	-81.7243
Apr 5, 2010	09:43:40 AM	-18.3	6.4/10.3	38.0079	-81.6885
Apr 5, 2010	09:45:11 AM	18.6	6.0/9.8	38.0015	-81.6868
Apr 5, 2010	09:45:11 AM	-53.8	7.5/12.1	38.0177	-81.7049
Apr 5, 2010	09:48:36 AM	-25.8	4.4/7.1	38.0010	-81.6376
Apr 5, 2010	09:50:13 AM	-16.3	3.5/5.7	37.9933	-81.5926
Apr 5, 2010	09:50:13 AM	-9.2	6.3/10.2	38.0071	-81.6873
Apr 5, 2010	09:50:13 AM	-2.2	5.8/9.4	38.0109	-81.6678
Apr 5, 2010	09:51:57 AM	-16.9	3.7/6.0	37.9899	-81.5700
Apr 5, 2010	09:51:57 AM	31.2	6.8/10.9	38.0133	-81.5173
Apr 5, 2010	09:51:57 AM	-9.7	4.3/6.9	37.9977	-81.5670
Apr 5, 2010	09:52:55 AM	-13.2	1.4/2.3	37.9631	-81.6107
Apr 5, 2010	09:54:34 AM	-15.9	5.3/8.5	38.0058	-81.5485
Apr 5, 2010	09:54:34 AM	-14.9	4.8/7.8	37.9966	-81.5469
Apr 5, 2010	09:54:35 AM	-25.4	6.8/11.0	38.0420	-81.6145
Apr 5, 2010	09:57:41 AM	-75.3	5.8/9.3	37.9747	-81.5057
Apr 5, 2010	09:57:41 AM	-19.3	5.7/9.2	37.9779	-81.5083
Apr 5, 2010	10:02:18 AM	-101.8	9.3/15.0	37.9759	-81.4381
Apr 5, 2010	10:02:18 AM	-12.7	8.9/14.4	37.9807	-81.4471
Apr 5, 2010	10:05:34 AM	-7.7	11.7/18.8	37.9658	-81.3911
Apr 5, 2010	10:05:34 AM	-2.3	9.5/15.4	37.9954	-81.4419
Apr 5, 2010	10:09:42 AM	-91.0	9.8/15.8	37.9709	-81.4270
Apr 5, 2010	10:09:42 AM	-19.3	10.4/16.8	37.9724	-81.4162
Apr 5, 2010	10:09:42 AM	-5.8	11.4/18.4	37.9582	-81.3949
Apr 5, 2010	10:09:42 AM	-24.2	10.3/16.7	37.9709	-81.4172
Apr 5, 2010	07:07:02 PM	-27.5	8.4/13.5	38.0274	-81.7143
Apr 5, 2010	07:07:14 PM	-14.7	10.0/16.2	38.0512	-81.7277
Apr 5, 2010	07:07:50 PM	-9.5	10.9/17.6	38.0413	-81.7618
Apr 5, 2010	07:07:50 PM	-5.3	8.6/13.9	38.0198	-81.7293
Apr 5, 2010	07:07:54 PM	-12.6	8.1/13.1	38.0236	-81.7132
Apr 5, 2010	07:08:16 PM	-11.0	10.4/16.8	38.0504	-81.7389
Apr 5, 2010	07:08:16 PM	-16.0	10.5/16.9	38.0526	-81.7379
Apr 5, 2010	07:08:44 PM	-34.8	9.3/14.9	38.0411	-81.7205
Apr 5, 2010	07:08:44 PM	-26.4	9.3/14.9	38.0385	-81.7239

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	07:08:44 PM	-37.6	9.4/15.2	38.0445	-81.7207
Apr 5, 2010	07:08:44 PM	-8.9	9.5/15.2	38.0425	-81.7237
Apr 5, 2010	07:08:44 PM	-32.4	9.4/15.1	38.0444	-81.7192
Apr 5, 2010	07:09:07 PM	-2.0	15.5/25.0	38.0994	-81.8094
Apr 5, 2010	07:09:49 PM	-8.5	8.4/13.5	38.0323	-81.7089
Apr 5, 2010	07:09:49 PM	-8.8	9.1/14.6	38.0396	-81.7174
Apr 5, 2010	07:10:11 PM	-7.9	9.0/14.5	37.9995	-81.7533
Apr 5, 2010	07:10:31 PM	-20.0	10.4/16.8	38.0570	-81.7301
Apr 5, 2010	07:10:31 PM	-15.2	10.3/16.6	38.0551	-81.7299
Apr 5, 2010	07:10:31 PM	-34.3	10.6/17.0	38.0573	-81.7333
Apr 5, 2010	07:10:31 PM	-3.5	10.6/17.0	38.0562	-81.7348
Apr 5, 2010	07:10:31 PM	-2.3	8.8/14.2	38.0344	-81.7177
Apr 5, 2010	07:10:32 PM	-11.6	10.5/17.0	38.0580	-81.7318

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STRIKEnet Report 258028

Report Title: SF Performance Coal Co
Total Lightning Strokes Detected: 293
Lightning Strokes Detected within 10 mi/16 km radius: 195
Lightning Strokes Detected beyond 10 mi/16 km whose confidence ellipse overlaps the radius: 98
Search Radius: 10 mi/16 km
Time Span: Apr 5, 2010 06:00:00 AM US/Eastern to Apr 6, 2010 06:00:00 AM US/Eastern

Lightning Stroke Table (Note: Closest 50 events shown. Events ordered by distance.)

Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	09:52:55 AM	-13.2	1.4/2.3	37.9631	-81.6107
Apr 5, 2010	10:51:39 PM	-16.4	1.7/2.7	37.9610	-81.6244
Apr 5, 2010	10:51:39 PM	-9.5	1.8/2.9	37.9615	-81.6271
Apr 5, 2010	10:24:44 PM	16.0	2.2/3.6	37.9507	-81.6441
Apr 5, 2010	10:47:30 PM	-9.6	2.8/4.5	37.9774	-81.5763
Apr 5, 2010	10:52:00 PM	-12.9	3.1/5.0	37.9801	-81.5720
Apr 5, 2010	08:14:12 PM	-2.0	3.1/5.0	37.9878	-81.6125
Apr 5, 2010	11:07:56 PM	-11.2	3.2/5.2	37.9821	-81.5725
Apr 5, 2010	10:53:58 PM	-3.3	3.5/5.6	37.9860	-81.5712
Apr 5, 2010	09:50:13 AM	-16.3	3.5/5.7	37.9933	-81.5926
Apr 5, 2010	11:01:41 PM	27.9	3.7/5.9	37.9922	-81.5778
Apr 5, 2010	09:51:57 AM	-16.9	3.7/6.0	37.9899	-81.5700
Apr 5, 2010	10:43:14 PM	-19.4	4.2/6.8	37.9901	-81.6530
Apr 5, 2010	09:51:57 AM	-9.7	4.3/6.9	37.9977	-81.5670
Apr 5, 2010	10:47:41 PM	-6.0	4.3/7.0	37.9372	-81.6835
Apr 5, 2010	10:52:46 PM	-8.9	4.4/7.1	38.0046	-81.5839
Apr 5, 2010	09:48:36 AM	-25.8	4.4/7.1	38.0010	-81.6376
Apr 5, 2010	10:55:39 PM	-6.2	4.4/7.1	37.9960	-81.5580
Apr 5, 2010	10:59:49 PM	-19.3	4.5/7.2	37.9434	-81.5220
Apr 5, 2010	11:02:01 PM	-2.8	4.5/7.3	37.9709	-81.5289
Apr 5, 2010	10:59:49 PM	-12.3	4.6/7.4	37.9380	-81.5194
Apr 5, 2010	10:59:07 PM	-38.9	4.6/7.5	37.9425	-81.5189
Apr 5, 2010	10:59:07 PM	-9.6	4.7/7.6	37.9445	-81.5168
Apr 5, 2010	10:59:49 PM	-9.2	4.8/7.7	37.9443	-81.5159
Apr 5, 2010	10:59:07 PM	-13.4	4.8/7.7	37.9428	-81.5158
Apr 5, 2010	09:54:34 AM	-14.9	4.8/7.8	37.9966	-81.5469
Apr 5, 2010	10:59:49 PM	-18.3	4.8/7.8	37.9415	-81.5148
Apr 5, 2010	10:56:21 PM	-8.4	4.9/7.8	38.0073	-81.5677
Apr 5, 2010	10:33:56 PM	-26.2	4.9/7.8	38.0115	-81.5835
Apr 5, 2010	10:43:14 PM	-8.7	4.9/7.9	37.9961	-81.6635
Apr 5, 2010	10:59:49 PM	-14.3	4.9/7.9	37.9431	-81.5139
Apr 5, 2010	10:33:56 PM	-48.0	4.9/8.0	38.0081	-81.5661
Apr 5, 2010	10:55:01 PM	-18.4	5.0/8.0	37.9745	-81.5217
Apr 5, 2010	11:01:41 PM	42.4	5.0/8.1	37.9560	-81.5130
Apr 5, 2010	10:55:39 PM	-12.8	5.1/8.2	38.0152	-81.5858
Apr 5, 2010	10:56:21 PM	-22.8	5.1/8.2	38.0121	-81.5699
Apr 5, 2010	10:56:21 PM	-11.8	5.1/8.3	38.0116	-81.5675

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	10:55:38 PM	-10.0	5.2/8.4	37.9857	-81.5251
Apr 5, 2010	10:55:38 PM	-12.3	5.2/8.4	38.0121	-81.5653
Apr 5, 2010	09:54:34 AM	-15.9	5.3/8.5	38.0058	-81.5485
Apr 5, 2010	11:06:51 PM	-14.1	5.4/8.6	37.8661	-81.6188
Apr 5, 2010	10:48:52 PM	-5.6	5.4/8.7	37.9466	-81.7034
Apr 5, 2010	11:29:48 PM	-19.7	5.4/8.8	38.0216	-81.5969
Apr 5, 2010	07:11:24 PM	-4.1	5.4/8.8	37.9171	-81.6984
Apr 5, 2010	10:29:49 PM	-14.0	5.4/8.8	37.9828	-81.6904
Apr 5, 2010	10:38:37 PM	-24.8	5.5/8.8	38.0051	-81.6662
Apr 5, 2010	10:45:21 PM	-7.9	5.5/8.8	37.9486	-81.5039
Apr 5, 2010	11:29:48 PM	-15.7	5.5/8.9	38.0225	-81.5972
Apr 5, 2010	11:29:48 PM	-40.3	5.5/8.9	38.0226	-81.6094
Apr 5, 2010	11:02:21 PM	-11.5	5.5/8.9	37.8968	-81.6864

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Lightning Stroke Table (Note: All events shown. Events ordered by time.)

Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	09:36:04 AM	-5.3	11.9/19.1	38.0000	-81.8098
Apr 5, 2010	09:36:05 AM	-7.4	11.1/17.9	37.9954	-81.7969
Apr 5, 2010	09:36:05 AM	-36.9	8.8/14.2	37.9710	-81.7618
Apr 5, 2010	09:40:34 AM	-32.6	7.4/11.9	37.9933	-81.7243
Apr 5, 2010	09:43:40 AM	-18.3	6.4/10.3	38.0079	-81.6885
Apr 5, 2010	09:45:11 AM	18.6	6.0/9.8	38.0015	-81.6868
Apr 5, 2010	09:45:11 AM	-53.8	7.5/12.1	38.0177	-81.7049
Apr 5, 2010	09:48:36 AM	-25.8	4.4/7.1	38.0010	-81.6376
Apr 5, 2010	09:50:13 AM	-16.3	3.5/5.7	37.9933	-81.5926
Apr 5, 2010	09:50:13 AM	-9.2	6.3/10.2	38.0071	-81.6873
Apr 5, 2010	09:50:13 AM	-2.2	5.8/9.4	38.0109	-81.6678
Apr 5, 2010	09:51:57 AM	-16.9	3.7/6.0	37.9899	-81.5700
Apr 5, 2010	09:51:57 AM	31.2	6.8/10.9	38.0133	-81.5173
Apr 5, 2010	09:51:57 AM	-9.7	4.3/6.9	37.9977	-81.5670
Apr 5, 2010	09:52:55 AM	-13.2	1.4/2.3	37.9631	-81.6107
Apr 5, 2010	09:54:34 AM	-15.9	5.3/8.5	38.0058	-81.5485
Apr 5, 2010	09:54:34 AM	-14.9	4.8/7.8	37.9966	-81.5469
Apr 5, 2010	09:54:35 AM	-25.4	6.8/11.0	38.0420	-81.6145
Apr 5, 2010	09:57:41 AM	-75.3	5.8/9.3	37.9747	-81.5057
Apr 5, 2010	09:57:41 AM	-19.3	5.7/9.2	37.9779	-81.5083
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Apr 5, 2010	10:02:18 AM	-12.7	8.9/14.4	37.9807	-81.4471
Apr 5, 2010	10:05:34 AM	-7.7	11.7/18.8	37.9658	-81.3911
Apr 5, 2010	10:05:34 AM	-2.3	9.5/15.4	37.9954	-81.4419
Apr 5, 2010	10:09:42 AM	-91.0	9.8/15.8	37.9709	-81.4270
Apr 5, 2010	10:09:42 AM	-19.3	10.4/16.8	37.9724	-81.4162
Apr 5, 2010	10:09:42 AM	-5.8	11.4/18.4	37.9582	-81.3949
Apr 5, 2010	10:09:42 AM	-24.2	10.3/16.7	37.9709	-81.4172
Apr 5, 2010	07:07:02 PM	-27.5	8.4/13.5	38.0274	-81.7143
Apr 5, 2010	07:07:14 PM	-14.7	10.0/16.2	38.0512	-81.7277
Apr 5, 2010	07:07:50 PM	-9.5	10.9/17.6	38.0413	-81.7618
Apr 5, 2010	07:07:50 PM	-5.3	8.6/13.9	38.0198	-81.7293
Apr 5, 2010	07:07:54 PM	-12.6	8.1/13.1	38.0236	-81.7132
Apr 5, 2010	07:08:16 PM	-11.0	10.4/16.8	38.0504	-81.7389
Apr 5, 2010	07:08:16 PM	-16.0	10.5/16.9	38.0526	-81.7379
Apr 5, 2010	07:08:44 PM	-34.8	9.3/14.9	38.0411	-81.7205
Apr 5, 2010	07:08:44 PM	-26.4	9.3/14.9	38.0385	-81.7239

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	07:08:44 PM	-37.6	9.4/15.2	38.0445	-81.7207
Apr 5, 2010	07:08:44 PM	-8.9	9.5/15.2	38.0425	-81.7237
Apr 5, 2010	07:08:44 PM	-32.4	9.4/15.1	38.0444	-81.7192
Apr 5, 2010	07:09:07 PM	-2.0	15.5/25.0	38.0994	-81.8094
Apr 5, 2010	07:09:49 PM	-8.5	8.4/13.5	38.0323	-81.7089
Apr 5, 2010	07:09:49 PM	-8.8	9.1/14.6	38.0396	-81.7174
Apr 5, 2010	07:10:11 PM	-7.9	9.0/14.5	37.9995	-81.7533
Apr 5, 2010	07:10:31 PM	-20.0	10.4/16.8	38.0570	-81.7301
Apr 5, 2010	07:10:31 PM	-15.2	10.3/16.6	38.0551	-81.7299
Apr 5, 2010	07:10:31 PM	-34.3	10.6/17.0	38.0573	-81.7333
Apr 5, 2010	07:10:31 PM	-3.5	10.6/17.0	38.0562	-81.7348
Apr 5, 2010	07:10:31 PM	-2.3	8.8/14.2	38.0344	-81.7177
Apr 5, 2010	07:10:32 PM	-11.6	10.5/17.0	38.0580	-81.7318
Apr 5, 2010	07:11:07 PM	-16.8	8.9/14.3	38.0492	-81.6960
Apr 5, 2010	07:11:07 PM	-5.4	7.8/12.6	38.0460	-81.6626
Apr 5, 2010	07:11:07 PM	-9.0	8.6/13.9	38.0462	-81.6928
Apr 5, 2010	07:11:07 PM	-5.6	8.5/13.8	38.0321	-81.7129
Apr 5, 2010	07:11:23 PM	-16.0	8.8/14.1	38.0387	-81.7098
Apr 5, 2010	07:11:24 PM	-27.0	6.3/10.2	37.9294	-81.7185
Apr 5, 2010	07:11:24 PM	-20.6	6.2/10.0	37.9346	-81.7177
Apr 5, 2010	07:11:24 PM	-10.6	6.1/9.9	37.9329	-81.7159
Apr 5, 2010	07:11:24 PM	-9.3	6.0/9.7	37.9326	-81.7143
Apr 5, 2010	07:11:24 PM	-7.9	6.2/9.9	37.9322	-81.7165
Apr 5, 2010	07:11:24 PM	-4.1	5.4/8.8	37.9171	-81.6984
Apr 5, 2010	07:11:24 PM	-5.0	6.0/9.7	37.9250	-81.7118
Apr 5, 2010	07:11:54 PM	-50.0	8.8/14.2	38.0477	-81.6961
Apr 5, 2010	07:11:54 PM	-3.3	9.4/15.2	38.0479	-81.7143
Apr 5, 2010	07:12:09 PM	-15.7	9.2/14.8	38.0525	-81.7006
Apr 5, 2010	07:12:34 PM	-65.1	8.3/13.4	38.0397	-81.6953
Apr 5, 2010	07:12:34 PM	-21.6	9.0/14.6	38.0544	-81.6920
Apr 5, 2010	07:12:34 PM	-2.8	8.7/14.1	38.0445	-81.7005
Apr 5, 2010	07:12:34 PM	-25.6	8.7/14.0	38.0480	-81.6915
Apr 5, 2010	07:12:34 PM	-22.1	8.4/13.6	38.0451	-81.6898
Apr 5, 2010	07:12:34 PM	-8.0	7.8/12.5	38.0388	-81.6790
Apr 5, 2010	07:12:34 PM	-42.6	8.5/13.6	38.0454	-81.6899
Apr 5, 2010	07:12:34 PM	-8.8	7.7/12.5	38.0388	-81.6785
Apr 5, 2010	07:12:34 PM	-11.1	8.6/13.9	38.0503	-81.6852
Apr 5, 2010	07:13:22 PM	-14.7	9.7/15.6	38.0568	-81.7088
Apr 5, 2010	07:13:22 PM	-14.0	9.7/15.6	38.0561	-81.7104
Apr 5, 2010	07:13:22 PM	-20.5	9.9/16.0	38.0543	-81.7192
Apr 5, 2010	07:14:08 PM	-21.2	9.6/15.6	38.0524	-81.7146
Apr 5, 2010	07:14:09 PM	-14.1	7.5/12.1	38.0465	-81.6466
Apr 5, 2010	07:14:42 PM	-84.0	9.4/15.2	38.0597	-81.6936
Apr 5, 2010	07:14:42 PM	-11.0	9.5/15.3	38.0612	-81.6932
Apr 5, 2010	07:14:42 PM	-19.0	9.4/15.2	38.0576	-81.6990
Apr 5, 2010	07:14:42 PM	-31.4	9.5/15.3	38.0620	-81.6908
Apr 5, 2010	07:14:42 PM	-19.4	9.6/15.5	38.0620	-81.6964
Apr 5, 2010	07:14:42 PM	-5.3	7.0/11.4	38.0366	-81.6561
Apr 5, 2010	07:14:42 PM	-15.5	8.9/14.3	38.0552	-81.6841
Apr 5, 2010	07:14:42 PM	-13.8	9.0/14.4	38.0565	-81.6842

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	07:14:43 PM	-8.4	8.2/13.2	38.0490	-81.6711
Apr 5, 2010	07:14:43 PM	-8.5	9.6/15.5	38.0625	-81.6951
Apr 5, 2010	07:17:35 PM	-41.4	10.1/16.3	38.0736	-81.6890
Apr 5, 2010	07:17:35 PM	-33.6	10.2/16.5	38.0854	-81.6578
Apr 5, 2010	07:19:06 PM	30.0	8.8/14.3	38.0303	-81.7233
Apr 5, 2010	07:24:10 PM	-55.9	10.2/16.4	38.0109	-81.7701
Apr 5, 2010	07:24:10 PM	-23.2	10.5/17.0	38.0269	-81.7656
Apr 5, 2010	07:24:10 PM	-13.2	10.4/16.8	38.0278	-81.7628
Apr 5, 2010	07:24:10 PM	-16.1	10.3/16.6	38.0245	-81.7620
Apr 5, 2010	07:24:10 PM	-29.8	10.5/16.9	38.0253	-81.7663
Apr 5, 2010	07:24:10 PM	-25.1	10.5/16.9	38.0231	-81.7676
Apr 5, 2010	07:25:15 PM	-7.8	24.6/39.6	38.1531	-81.9692
Apr 5, 2010	07:29:47 PM	-3.0	14.7/23.7	38.0753	-81.8157
Apr 5, 2010	07:29:48 PM	-2.0	13.4/21.6	37.9503	-81.8497
Apr 5, 2010	07:30:36 PM	-10.5	8.6/13.8	38.0642	-81.6383
Apr 5, 2010	07:31:23 PM	-11.6	15.2/24.6	38.1011	-81.8003
Apr 5, 2010	07:31:23 PM	-2.0	11.0/17.8	38.0595	-81.7432
Apr 5, 2010	07:32:21 PM	-5.4	10.4/16.8	38.0614	-81.7225
Apr 5, 2010	07:32:22 PM	-7.7	11.7/18.9	38.0589	-81.7616
Apr 5, 2010	07:34:43 PM	-2.2	8.9/14.4	38.0542	-81.6879
Apr 5, 2010	07:46:13 PM	-3.4	11.0/17.8	38.0997	-81.6437
Apr 5, 2010	07:46:13 PM	-4.8	11.3/18.3	38.1031	-81.6511
Apr 5, 2010	07:49:11 PM	-10.3	7.8/12.6	38.0561	-81.6062
Apr 5, 2010	08:08:28 PM	-7.4	10.0/16.1	38.0845	-81.6406
Apr 5, 2010	08:14:12 PM	-2.0	3.1/5.0	37.9878	-81.6125
Apr 5, 2010	08:31:30 PM	15.5	10.2/16.4	37.8947	-81.4271
Apr 5, 2010	08:31:30 PM	-51.1	10.0/16.2	37.8977	-81.4287
Apr 5, 2010	08:33:58 PM	-6.5	9.3/15.0	37.9243	-81.4349
Apr 5, 2010	08:39:19 PM	-3.2	10.2/16.5	37.9506	-81.4163
Apr 5, 2010	08:53:47 PM	-9.5	23.0/37.2	38.1389	-81.2600
Apr 5, 2010	09:05:46 PM	-8.6	13.3/21.5	38.1360	-81.6066
Apr 5, 2010	09:57:07 PM	-8.3	26.4/42.6	38.2417	-81.9087
Apr 5, 2010	10:00:09 PM	-8.1	21.6/34.8	38.2179	-81.7932
Apr 5, 2010	10:07:19 PM	-2.1	16.3/26.4	38.0754	-81.8536
Apr 5, 2010	10:13:19 PM	-2.2	14.1/22.8	38.1356	-81.6939
Apr 5, 2010	10:17:39 PM	-8.1	20.9/33.7	38.2459	-81.5829
Apr 5, 2010	10:23:11 PM	-8.4	16.5/26.6	38.1787	-81.6579
Apr 5, 2010	10:23:41 PM	-7.2	17.4/28.0	38.1938	-81.6337
Apr 5, 2010	10:24:18 PM	-30.1	12.8/20.6	38.1280	-81.6063
Apr 5, 2010	10:24:44 PM	16.0	2.2/3.6	37.9507	-81.6441
Apr 5, 2010	10:25:48 PM	-8.5	14.9/24.0	38.1404	-81.4917
Apr 5, 2010	10:25:57 PM	-2.3	14.5/23.4	38.0553	-81.8297
Apr 5, 2010	10:26:35 PM	32.3	12.9/20.8	38.1197	-81.6838
Apr 5, 2010	10:27:04 PM	-8.9	13.3/21.4	38.0992	-81.7473
Apr 5, 2010	10:27:49 PM	-2.8	13.6/21.9	38.1042	-81.7469
Apr 5, 2010	10:29:49 PM	-12.7	9.8/15.8	38.0108	-81.7624
Apr 5, 2010	10:29:49 PM	-14.0	5.4/8.8	37.9828	-81.6904
Apr 5, 2010	10:31:08 PM	-3.7	6.2/10.1	37.9916	-81.7009
Apr 5, 2010	10:31:20 PM	-2.1	6.9/11.2	38.0027	-81.7070
Apr 5, 2010	10:31:47 PM	-41.1	9.8/15.7	38.0784	-81.6560

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	10:33:28 PM	-4.5	9.7/15.6	38.0744	-81.5411
Apr 5, 2010	10:33:56 PM	-26.2	4.9/7.8	38.0115	-81.5835
Apr 5, 2010	10:33:56 PM	-48.0	4.9/8.0	38.0081	-81.5661
Apr 5, 2010	10:33:56 PM	-7.2	5.6/9.1	38.0195	-81.5667
Apr 5, 2010	10:36:31 PM	-8.6	19.1/30.7	38.2134	-81.5310
Apr 5, 2010	10:37:14 PM	-3.0	12.4/20.0	38.1066	-81.7003
Apr 5, 2010	10:37:14 PM	-16.7	9.3/15.0	38.0778	-81.6157
Apr 5, 2010	10:37:44 PM	-9.0	8.7/14.1	38.0691	-81.6192
Apr 5, 2010	10:38:37 PM	-24.8	5.5/8.8	38.0051	-81.6662
Apr 5, 2010	10:38:38 PM	-7.1	9.0/14.5	38.0728	-81.5918
Apr 5, 2010	10:40:19 PM	-11.1	10.5/17.0	37.9385	-81.7977
Apr 5, 2010	10:41:51 PM	-7.8	10.5/16.9	37.9315	-81.7962
Apr 5, 2010	10:42:39 PM	-28.9	10.3/16.5	38.0891	-81.5689
Apr 5, 2010	10:42:39 PM	-15.1	10.2/16.4	38.0888	-81.5743
Apr 5, 2010	10:43:02 PM	-12.9	9.5/15.3	38.0727	-81.5463
Apr 5, 2010	10:43:14 PM	-30.2	9.6/15.6	37.9606	-81.7799
Apr 5, 2010	10:43:14 PM	-19.4	8.6/13.9	37.9577	-81.7612
Apr 5, 2010	10:43:14 PM	-13.8	8.7/14.0	37.9457	-81.7636
Apr 5, 2010	10:43:14 PM	-8.4	8.2/13.3	37.9621	-81.7534
Apr 5, 2010	10:43:14 PM	-19.4	4.2/6.8	37.9901	-81.6530
Apr 5, 2010	10:43:14 PM	-8.7	4.9/7.9	37.9961	-81.6635
Apr 5, 2010	10:43:29 PM	-11.7	10.7/17.2	38.0908	-81.5468
Apr 5, 2010	10:44:17 PM	-7.7	23.7/38.2	38.2296	-81.3635
Apr 5, 2010	10:44:29 PM	-28.6	9.0/14.5	37.9664	-81.7666
Apr 5, 2010	10:44:29 PM	-16.2	7.5/12.0	37.9513	-81.7409
Apr 5, 2010	10:45:12 PM	-9.0	6.7/10.8	37.9929	-81.7091
Apr 5, 2010	10:45:12 PM	-6.7	7.4/11.9	38.0088	-81.7106
Apr 5, 2010	10:45:12 PM	-4.8	10.9/17.6	38.0421	-81.7603
Apr 5, 2010	10:45:18 PM	17.0	10.3/16.6	38.0759	-81.5163
Apr 5, 2010	10:45:21 PM	-7.9	5.5/8.8	37.9486	-81.5039
Apr 5, 2010	10:47:30 PM	-9.6	2.8/4.5	37.9774	-81.5763
Apr 5, 2010	10:47:41 PM	-6.0	4.3/7.0	37.9372	-81.6835
Apr 5, 2010	10:47:41 PM	-6.1	6.6/10.7	37.9549	-81.7252
Apr 5, 2010	10:48:03 PM	-10.7	6.8/11.0	37.9686	-81.4826
Apr 5, 2010	10:48:03 PM	-8.2	9.0/14.5	37.9408	-81.4389
Apr 5, 2010	10:48:52 PM	-5.6	5.4/8.7	37.9466	-81.7034
Apr 5, 2010	10:49:15 PM	-8.8	9.5/15.3	38.0772	-81.5673
Apr 5, 2010	10:51:39 PM	-16.4	1.7/2.7	37.9610	-81.6244
Apr 5, 2010	10:51:39 PM	-9.5	1.8/2.9	37.9615	-81.6271
Apr 5, 2010	10:52:00 PM	-12.9	3.1/5.0	37.9801	-81.5720
Apr 5, 2010	10:52:46 PM	-8.9	4.4/7.1	38.0046	-81.5839
Apr 5, 2010	10:53:58 PM	-3.3	3.5/5.6	37.9860	-81.5712
Apr 5, 2010	10:54:49 PM	-32.7	8.2/13.2	38.0570	-81.5623
Apr 5, 2010	10:55:01 PM	-12.0	5.9/9.6	37.9936	-81.5154
Apr 5, 2010	10:55:01 PM	-18.4	5.0/8.0	37.9745	-81.5217
Apr 5, 2010	10:55:01 PM	-3.4	5.8/9.4	38.0277	-81.6097
Apr 5, 2010	10:55:38 PM	-10.0	5.2/8.4	37.9857	-81.5251
Apr 5, 2010	10:55:38 PM	-12.3	5.2/8.4	38.0121	-81.5653
Apr 5, 2010	10:55:39 PM	-12.8	5.1/8.2	38.0152	-81.5858
Apr 5, 2010	10:55:39 PM	-6.2	4.4/7.1	37.9960	-81.5580

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Apr 5, 2010	10:55:45 PM	-11.0	20.3/32.7	38.0959	-81.2853
Apr 5, 2010	10:56:21 PM	-14.4	5.8/9.3	37.9927	-81.5181
Apr 5, 2010	10:56:21 PM	-15.4	5.6/9.0	38.0061	-81.5393
Apr 5, 2010	10:56:21 PM	-7.9	5.7/9.3	37.9844	-81.5124
Apr 5, 2010	10:56:21 PM	-17.2	6.0/9.7	37.9888	-81.5096
Apr 5, 2010	10:56:21 PM	-11.8	5.1/8.3	38.0116	-81.5675
Apr 5, 2010	10:56:21 PM	-22.8	5.1/8.2	38.0121	-81.5699
Apr 5, 2010	10:56:21 PM	-8.4	4.9/7.8	38.0073	-81.5677
Apr 5, 2010	10:56:32 PM	-26.7	10.3/16.6	37.8780	-81.7737
Apr 5, 2010	10:56:32 PM	-7.9	10.1/16.4	37.8751	-81.7694
Apr 5, 2010	10:57:16 PM	-7.8	9.5/15.3	37.8799	-81.7588
Apr 5, 2010	10:57:40 PM	-3.0	9.9/16.0	37.8674	-81.7588
Apr 5, 2010	10:57:40 PM	-13.4	10.5/16.9	37.8911	-81.7846
Apr 5, 2010	10:57:56 PM	-12.0	10.3/16.7	37.8884	-81.7808
Apr 5, 2010	10:57:56 PM	-14.5	10.5/16.9	37.8821	-81.7809
Apr 5, 2010	10:57:56 PM	-16.3	10.6/17.0	37.8813	-81.7815
Apr 5, 2010	10:57:56 PM	-14.6	10.5/17.0	37.8819	-81.7814
Apr 5, 2010	10:57:56 PM	-5.5	10.1/16.3	37.8527	-81.7503
Apr 5, 2010	10:57:56 PM	-14.9	10.4/16.8	37.8828	-81.7795
Apr 5, 2010	10:57:57 PM	-9.0	10.5/16.9	37.8844	-81.7819
Apr 5, 2010	10:57:57 PM	-14.7	10.4/16.8	37.8811	-81.7793
Apr 5, 2010	10:57:57 PM	-8.7	10.3/16.6	37.8750	-81.7720
Apr 5, 2010	10:58:35 PM	-11.7	13.4/21.7	38.0604	-81.4065
Apr 5, 2010	10:59:07 PM	-46.9	9.3/15.0	37.8419	-81.7176
Apr 5, 2010	10:59:07 PM	-9.6	4.7/7.6	37.9445	-81.5168
Apr 5, 2010	10:59:07 PM	-16.1	8.9/14.4	37.8465	-81.7137
Apr 5, 2010	10:59:07 PM	-13.4	4.8/7.7	37.9428	-81.5158
Apr 5, 2010	10:59:07 PM	-14.0	10.3/16.7	37.8303	-81.7296
Apr 5, 2010	10:59:07 PM	-38.9	4.6/7.5	37.9425	-81.5189
Apr 5, 2010	10:59:32 PM	-9.7	6.0/9.7	37.9593	-81.4952
Apr 5, 2010	10:59:49 PM	-18.3	4.8/7.8	37.9415	-81.5148
Apr 5, 2010	10:59:49 PM	-12.3	4.6/7.4	37.9380	-81.5194
Apr 5, 2010	10:59:49 PM	-19.3	4.5/7.2	37.9434	-81.5220
Apr 5, 2010	10:59:49 PM	-14.3	4.9/7.9	37.9431	-81.5139
Apr 5, 2010	10:59:49 PM	-9.2	4.8/7.7	37.9443	-81.5159
Apr 5, 2010	10:59:49 PM	-3.3	6.5/10.5	37.9206	-81.4877
Apr 5, 2010	10:59:52 PM	-7.6	8.2/13.2	37.8651	-81.7181
Apr 5, 2010	10:59:52 PM	-6.0	8.1/13.0	37.8565	-81.7037
Apr 5, 2010	10:59:52 PM	-17.1	7.1/11.5	37.8958	-81.7210
Apr 5, 2010	10:59:52 PM	-31.7	6.8/11.0	37.9083	-81.7214
Apr 5, 2010	10:59:52 PM	-8.9	7.5/12.1	37.9006	-81.7311
Apr 5, 2010	10:59:52 PM	-17.2	8.2/13.2	37.8820	-81.7335
Apr 5, 2010	11:01:05 PM	-8.6	6.2/10.1	37.9433	-81.4893
Apr 5, 2010	11:01:41 PM	-23.5	6.4/10.3	37.9374	-81.4867
Apr 5, 2010	11:01:41 PM	-15.4	6.6/10.6	37.9349	-81.4835
Apr 5, 2010	11:01:41 PM	-27.9	6.4/10.4	37.9370	-81.4857
Apr 5, 2010	11:01:41 PM	27.9	3.7/5.9	37.9922	-81.5778
Apr 5, 2010	11:01:41 PM	-11.5	6.6/10.6	37.9373	-81.4831
Apr 5, 2010	11:01:41 PM	-36.4	6.4/10.3	37.9342	-81.4866
Apr 5, 2010	11:01:41 PM	42.4	5.0/8.1	37.9560	-81.5130

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	11:02:01 PM	-13.0	6.8/11.0	37.9411	-81.4786
Apr 5, 2010	11:02:01 PM	-2.8	4.5/7.3	37.9709	-81.5289
Apr 5, 2010	11:02:21 PM	-11.5	5.5/8.9	37.8968	-81.6864
Apr 5, 2010	11:02:47 PM	-8.2	9.2/14.9	37.9828	-81.4416
Apr 5, 2010	11:03:20 PM	-11.3	5.6/9.0	37.8701	-81.6479
Apr 5, 2010	11:03:26 PM	-11.2	9.8/15.9	37.9726	-81.4269
Apr 5, 2010	11:04:44 PM	-17.1	10.2/16.5	37.8050	-81.6727
Apr 5, 2010	11:04:51 PM	-4.6	6.7/10.8	37.9377	-81.4804
Apr 5, 2010	11:05:06 PM	-6.2	8.4/13.5	37.8510	-81.7039
Apr 5, 2010	11:06:51 PM	-7.3	6.4/10.3	37.8647	-81.6674
Apr 5, 2010	11:06:51 PM	-10.0	5.6/9.0	37.8747	-81.6596
Apr 5, 2010	11:06:51 PM	-14.1	5.4/8.6	37.8661	-81.6188
Apr 5, 2010	11:06:51 PM	-13.3	6.3/10.2	37.8527	-81.6218
Apr 5, 2010	11:06:51 PM	-7.9	8.7/14.1	37.8214	-81.6483
Apr 5, 2010	11:07:56 PM	-11.2	3.2/5.2	37.9821	-81.5725
Apr 5, 2010	11:08:38 PM	-20.0	10.0/16.1	37.7983	-81.5979
Apr 5, 2010	11:09:56 PM	-30.7	9.8/15.8	37.8012	-81.5869
Apr 5, 2010	11:09:56 PM	-32.3	9.2/14.9	37.8130	-81.5624
Apr 5, 2010	11:09:56 PM	-26.0	9.9/15.9	37.8004	-81.5847
Apr 5, 2010	11:09:56 PM	-33.8	10.5/17.0	37.7913	-81.5839
Apr 5, 2010	11:09:57 PM	-17.1	10.1/16.3	37.7973	-81.5830
Apr 5, 2010	11:09:57 PM	-37.9	10.2/16.4	37.7963	-81.5846
Apr 5, 2010	11:09:57 PM	-8.7	8.8/14.1	37.8179	-81.6319
Apr 5, 2010	11:10:15 PM	-7.4	17.9/28.9	38.0697	-81.8915
Apr 5, 2010	11:11:38 PM	-12.2	7.5/12.1	37.8350	-81.5920
Apr 5, 2010	11:11:38 PM	-13.1	7.7/12.5	37.8319	-81.5849
Apr 5, 2010	11:11:38 PM	-12.2	7.4/11.9	37.8358	-81.6081
Apr 5, 2010	11:11:38 PM	-2.9	9.6/15.5	37.8208	-81.5201
Apr 5, 2010	11:12:23 PM	-2.2	7.9/12.8	37.8689	-81.7149
Apr 5, 2010	11:15:07 PM	-3.5	12.2/19.7	37.7713	-81.5485
Apr 5, 2010	11:19:36 PM	-15.1	9.1/14.7	38.0209	-81.7390
Apr 5, 2010	11:20:36 PM	-31.9	9.9/16.0	37.7993	-81.6150
Apr 5, 2010	11:23:02 PM	-4.4	12.3/19.9	37.9215	-81.3788
Apr 5, 2010	11:23:23 PM	-5.2	13.2/21.3	37.9143	-81.3638
Apr 5, 2010	11:25:49 PM	-2.8	16.2/26.0	37.7224	-81.5043
Apr 5, 2010	11:26:42 PM	-34.1	6.1/9.9	38.0261	-81.6441
Apr 5, 2010	11:26:42 PM	-18.2	6.1/9.8	38.0290	-81.6286
Apr 5, 2010	11:28:18 PM	-3.3	12.6/20.3	37.7681	-81.5371
Apr 5, 2010	11:28:19 PM	-3.8	14.8/23.9	37.7436	-81.5016
Apr 5, 2010	11:28:21 PM	-8.5	6.3/10.2	38.0331	-81.6236
Apr 5, 2010	11:29:45 PM	-3.4	14.7/23.8	37.7523	-81.4823
Apr 5, 2010	11:29:48 PM	-40.3	5.5/8.9	38.0226	-81.6094
Apr 5, 2010	11:29:48 PM	-19.7	5.4/8.8	38.0216	-81.5969
Apr 5, 2010	11:29:48 PM	-15.7	5.5/8.9	38.0225	-81.5972
Apr 5, 2010	11:30:37 PM	-12.9	5.6/9.0	38.0216	-81.6265
Apr 5, 2010	11:30:37 PM	-20.0	5.7/9.2	38.0214	-81.5693
Apr 5, 2010	11:32:09 PM	-2.3	15.7/25.3	37.7831	-81.3993
Apr 5, 2010	11:32:49 PM	-3.0	15.2/24.5	37.7262	-81.5556
Apr 5, 2010	11:37:27 PM	-18.6	6.8/10.9	37.9716	-81.4852
Apr 5, 2010	11:37:27 PM	28.5	6.7/10.8	37.8536	-81.5566

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	11:38:30 PM	-3.7	16.7/27.0	37.7744	-81.3832
Apr 5, 2010	11:41:31 PM	-3.6	16.2/26.1	37.7757	-81.3962
Apr 5, 2010	11:42:32 PM	-14.1	9.7/15.7	37.9553	-81.4259
Apr 5, 2010	11:43:41 PM	-2.9	19.7/31.7	37.7072	-81.4006
Apr 5, 2010	11:44:35 PM	-2.6	20.8/33.6	37.7614	-81.2982
Apr 5, 2010	11:45:04 PM	-3.1	14.4/23.3	37.8062	-81.4034

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STRIKEnet Report 258028

Report Title: SF Performance Coal Co
Total Lightning Strokes Detected: 293
Lightning Strokes Detected within 10 mi/16 km radius: 195
Lightning Strokes Detected beyond 10 mi/16 km whose confidence ellipse overlaps the radius: 98
Search Radius: 10 mi/16 km
Time Span: Apr 5, 2010 06:00:00 AM US/Eastern to Apr 6, 2010 06:00:00 AM US/Eastern

Lightning Stroke Table (Note: All events shown. Events ordered by distance.)

Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	09:52:55 AM	-13.2	1.4/2.3	37.9631	-81.6107
Apr 5, 2010	10:51:39 PM	-16.4	1.7/2.7	37.9610	-81.6244
Apr 5, 2010	10:51:39 PM	-9.5	1.8/2.9	37.9615	-81.6271
Apr 5, 2010	10:24:44 PM	16.0	2.2/3.6	37.9507	-81.6441
Apr 5, 2010	10:47:30 PM	-9.6	2.8/4.5	37.9774	-81.5763
Apr 5, 2010	10:52:00 PM	-12.9	3.1/5.0	37.9801	-81.5720
Apr 5, 2010	08:14:12 PM	-2.0	3.1/5.0	37.9878	-81.6125
Apr 5, 2010	11:07:56 PM	-11.2	3.2/5.2	37.9821	-81.5725
Apr 5, 2010	10:53:58 PM	-3.3	3.5/5.6	37.9860	-81.5712
Apr 5, 2010	09:50:13 AM	-16.3	3.5/5.7	37.9933	-81.5926
Apr 5, 2010	11:01:41 PM	27.9	3.7/5.9	37.9922	-81.5778
Apr 5, 2010	09:51:57 AM	-16.9	3.7/6.0	37.9899	-81.5700
Apr 5, 2010	10:43:14 PM	-19.4	4.2/6.8	37.9901	-81.6530
Apr 5, 2010	09:51:57 AM	-9.7	4.3/6.9	37.9977	-81.5670
Apr 5, 2010	10:47:41 PM	-6.0	4.3/7.0	37.9372	-81.6835
Apr 5, 2010	10:52:46 PM	-8.9	4.4/7.1	38.0046	-81.5839
Apr 5, 2010	09:48:36 AM	-25.8	4.4/7.1	38.0010	-81.6376
Apr 5, 2010	10:55:39 PM	-6.2	4.4/7.1	37.9960	-81.5580
Apr 5, 2010	10:59:49 PM	-19.3	4.5/7.2	37.9434	-81.5220
Apr 5, 2010	11:02:01 PM	-2.8	4.5/7.3	37.9709	-81.5289
Apr 5, 2010	10:59:49 PM	-12.3	4.6/7.4	37.9380	-81.5194
Apr 5, 2010	10:59:07 PM	-38.9	4.6/7.5	37.9425	-81.5189
Apr 5, 2010	10:59:07 PM	-9.6	4.7/7.6	37.9445	-81.5168
Apr 5, 2010	10:59:49 PM	-9.2	4.8/7.7	37.9443	-81.5159
Apr 5, 2010	10:59:07 PM	-13.4	4.8/7.7	37.9428	-81.5158
Apr 5, 2010	09:54:34 AM	-14.9	4.8/7.8	37.9966	-81.5469
Apr 5, 2010	10:59:49 PM	-18.3	4.8/7.8	37.9415	-81.5148
Apr 5, 2010	10:56:21 PM	-8.4	4.9/7.8	38.0073	-81.5677
Apr 5, 2010	10:33:56 PM	-26.2	4.9/7.8	38.0115	-81.5835
Apr 5, 2010	10:43:14 PM	-8.7	4.9/7.9	37.9961	-81.6635
Apr 5, 2010	10:59:49 PM	-14.3	4.9/7.9	37.9431	-81.5139
Apr 5, 2010	10:33:56 PM	-48.0	4.9/8.0	38.0081	-81.5661
Apr 5, 2010	10:55:01 PM	-18.4	5.0/8.0	37.9745	-81.5217
Apr 5, 2010	11:01:41 PM	42.4	5.0/8.1	37.9560	-81.5130
Apr 5, 2010	10:55:39 PM	-12.8	5.1/8.2	38.0152	-81.5858
Apr 5, 2010	10:56:21 PM	-22.8	5.1/8.2	38.0121	-81.5699
Apr 5, 2010	10:56:21 PM	-11.8	5.1/8.3	38.0116	-81.5675

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	10:55:38 PM	-10.0	5.2/8.4	37.9857	-81.5251
Apr 5, 2010	10:55:38 PM	-12.3	5.2/8.4	38.0121	-81.5653
Apr 5, 2010	09:54:34 AM	-15.9	5.3/8.5	38.0058	-81.5485
Apr 5, 2010	11:06:51 PM	-14.1	5.4/8.6	37.8661	-81.6188
Apr 5, 2010	10:48:52 PM	-5.6	5.4/8.7	37.9466	-81.7034
Apr 5, 2010	11:29:48 PM	-19.7	5.4/8.8	38.0216	-81.5969
Apr 5, 2010	07:11:24 PM	-4.1	5.4/8.8	37.9171	-81.6984
Apr 5, 2010	10:29:49 PM	-14.0	5.4/8.8	37.9828	-81.6904
Apr 5, 2010	10:38:37 PM	-24.8	5.5/8.8	38.0051	-81.6662
Apr 5, 2010	10:45:21 PM	-7.9	5.5/8.8	37.9486	-81.5039
Apr 5, 2010	11:29:48 PM	-15.7	5.5/8.9	38.0225	-81.5972
Apr 5, 2010	11:29:48 PM	-40.3	5.5/8.9	38.0226	-81.6094
Apr 5, 2010	11:02:21 PM	-11.5	5.5/8.9	37.8968	-81.6864
Apr 5, 2010	11:30:37 PM	-12.9	5.6/9.0	38.0216	-81.6265
Apr 5, 2010	11:03:20 PM	-11.3	5.6/9.0	37.8701	-81.6479
Apr 5, 2010	10:56:21 PM	-15.4	5.6/9.0	38.0061	-81.5393
Apr 5, 2010	11:06:51 PM	-10.0	5.6/9.0	37.8747	-81.6596
Apr 5, 2010	10:33:56 PM	-7.2	5.6/9.1	38.0195	-81.5667
Apr 5, 2010	11:30:37 PM	-20.0	5.7/9.2	38.0214	-81.5693
Apr 5, 2010	09:57:41 AM	-19.3	5.7/9.2	37.9779	-81.5083
Apr 5, 2010	10:56:21 PM	-7.9	5.7/9.3	37.9844	-81.5124
Apr 5, 2010	09:57:41 AM	-75.3	5.8/9.3	37.9747	-81.5057
Apr 5, 2010	10:56:21 PM	-14.4	5.8/9.3	37.9927	-81.5181
Apr 5, 2010	09:50:13 AM	-2.2	5.8/9.4	38.0109	-81.6678
Apr 5, 2010	10:55:01 PM	-3.4	5.8/9.4	38.0277	-81.6097
Apr 5, 2010	10:55:01 PM	-12.0	5.9/9.6	37.9936	-81.5154
Apr 5, 2010	07:11:24 PM	-5.0	6.0/9.7	37.9250	-81.7118
Apr 5, 2010	10:59:32 PM	-9.7	6.0/9.7	37.9593	-81.4952
Apr 5, 2010	10:56:21 PM	-17.2	6.0/9.7	37.9888	-81.5096
Apr 5, 2010	07:11:24 PM	-9.3	6.0/9.7	37.9326	-81.7143
Apr 5, 2010	09:45:11 AM	18.6	6.0/9.8	38.0015	-81.6868
Apr 5, 2010	11:26:42 PM	-18.2	6.1/9.8	38.0290	-81.6286
Apr 5, 2010	07:11:24 PM	-10.6	6.1/9.9	37.9329	-81.7159
Apr 5, 2010	11:26:42 PM	-34.1	6.1/9.9	38.0261	-81.6441
Apr 5, 2010	07:11:24 PM	-7.9	6.2/9.9	37.9322	-81.7165
Apr 5, 2010	07:11:24 PM	-20.6	6.2/10.0	37.9346	-81.7177
Apr 5, 2010	11:01:05 PM	-8.6	6.2/10.1	37.9433	-81.4893
Apr 5, 2010	10:31:08 PM	-3.7	6.2/10.1	37.9916	-81.7009
Apr 5, 2010	07:11:24 PM	-27.0	6.3/10.2	37.9294	-81.7185
Apr 5, 2010	11:06:51 PM	-13.3	6.3/10.2	37.8527	-81.6218
Apr 5, 2010	11:28:21 PM	-8.5	6.3/10.2	38.0331	-81.6236
Apr 5, 2010	09:50:13 AM	-9.2	6.3/10.2	38.0071	-81.6873
Apr 5, 2010	11:01:41 PM	-23.5	6.4/10.3	37.9374	-81.4867
Apr 5, 2010	11:06:51 PM	-7.3	6.4/10.3	37.8647	-81.6674
Apr 5, 2010	11:01:41 PM	-36.4	6.4/10.3	37.9342	-81.4866
Apr 5, 2010	09:43:40 AM	-18.3	6.4/10.3	38.0079	-81.6885
Apr 5, 2010	11:01:41 PM	-27.9	6.4/10.4	37.9370	-81.4857
Apr 5, 2010	10:59:49 PM	-3.3	6.5/10.5	37.9206	-81.4877
Apr 5, 2010	11:01:41 PM	-15.4	6.6/10.6	37.9349	-81.4835
Apr 5, 2010	11:01:41 PM	-11.5	6.6/10.6	37.9373	-81.4831

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	10:47:41 PM	-6.1	6.6/10.7	37.9549	-81.7252
Apr 5, 2010	10:45:12 PM	-9.0	6.7/10.8	37.9929	-81.7091
Apr 5, 2010	11:37:27 PM	28.5	6.7/10.8	37.8536	-81.5566
Apr 5, 2010	11:04:51 PM	-4.6	6.7/10.8	37.9377	-81.4804
Apr 5, 2010	11:37:27 PM	-18.6	6.8/10.9	37.9716	-81.4852
Apr 5, 2010	09:51:57 AM	31.2	6.8/10.9	38.0133	-81.5173
Apr 5, 2010	10:59:52 PM	-31.7	6.8/11.0	37.9083	-81.7214
Apr 5, 2010	11:02:01 PM	-13.0	6.8/11.0	37.9411	-81.4786
Apr 5, 2010	10:48:03 PM	-10.7	6.8/11.0	37.9686	-81.4826
Apr 5, 2010	09:54:35 AM	-25.4	6.8/11.0	38.0420	-81.6145
Apr 5, 2010	10:31:20 PM	-2.1	6.9/11.2	38.0027	-81.7070
Apr 5, 2010	07:14:42 PM	-5.3	7.0/11.4	38.0366	-81.6561
Apr 5, 2010	10:59:52 PM	-17.1	7.1/11.5	37.8958	-81.7210
Apr 5, 2010	10:45:12 PM	-6.7	7.4/11.9	38.0088	-81.7106
Apr 5, 2010	11:11:38 PM	-12.2	7.4/11.9	37.8358	-81.6081
Apr 5, 2010	09:40:34 AM	-32.6	7.4/11.9	37.9933	-81.7243
Apr 5, 2010	10:44:29 PM	-16.2	7.5/12.0	37.9513	-81.7409
Apr 5, 2010	11:11:38 PM	-12.2	7.5/12.1	37.8350	-81.5920
Apr 5, 2010	07:14:09 PM	-14.1	7.5/12.1	38.0465	-81.6466
Apr 5, 2010	10:59:52 PM	-8.9	7.5/12.1	37.9006	-81.7311
Apr 5, 2010	09:45:11 AM	-53.8	7.5/12.1	38.0177	-81.7049
Apr 5, 2010	11:11:38 PM	-13.1	7.7/12.5	37.8319	-81.5849
Apr 5, 2010	07:12:34 PM	-8.8	7.7/12.5	38.0388	-81.6785
Apr 5, 2010	07:12:34 PM	-8.0	7.8/12.5	38.0388	-81.6790
Apr 5, 2010	07:11:07 PM	-5.4	7.8/12.6	38.0460	-81.6626
Apr 5, 2010	07:49:11 PM	-10.3	7.8/12.6	38.0561	-81.6062
Apr 5, 2010	11:12:23 PM	-2.2	7.9/12.8	37.8689	-81.7149
Apr 5, 2010	10:59:52 PM	-6.0	8.1/13.0	37.8565	-81.7037
Apr 5, 2010	07:07:54 PM	-12.6	8.1/13.1	38.0236	-81.7132
Apr 5, 2010	07:14:43 PM	-8.4	8.2/13.2	38.0490	-81.6711
Apr 5, 2010	10:54:49 PM	-32.7	8.2/13.2	38.0570	-81.5623
Apr 5, 2010	10:59:52 PM	-17.2	8.2/13.2	37.8820	-81.7335
Apr 5, 2010	10:59:52 PM	-7.6	8.2/13.2	37.8651	-81.7181
Apr 5, 2010	10:43:14 PM	-8.4	8.2/13.3	37.9621	-81.7534
Apr 5, 2010	07:12:34 PM	-65.1	8.3/13.4	38.0397	-81.6953
Apr 5, 2010	07:07:02 PM	-27.5	8.4/13.5	38.0274	-81.7143
Apr 5, 2010	11:05:06 PM	-6.2	8.4/13.5	37.8510	-81.7039
Apr 5, 2010	07:09:49 PM	-8.5	8.4/13.5	38.0323	-81.7089
Apr 5, 2010	07:12:34 PM	-22.1	8.4/13.6	38.0451	-81.6898
Apr 5, 2010	07:12:34 PM	-42.6	8.5/13.6	38.0454	-81.6899
Apr 5, 2010	07:11:07 PM	-5.6	8.5/13.8	38.0321	-81.7129
Apr 5, 2010	07:30:36 PM	-10.5	8.6/13.8	38.0642	-81.6383
Apr 5, 2010	07:11:07 PM	-9.0	8.6/13.9	38.0462	-81.6928
Apr 5, 2010	10:43:14 PM	-19.4	8.6/13.9	37.9577	-81.7612
Apr 5, 2010	07:12:34 PM	-11.1	8.6/13.9	38.0503	-81.6852
Apr 5, 2010	07:07:50 PM	-5.3	8.6/13.9	38.0198	-81.7293
Apr 5, 2010	07:12:34 PM	-25.6	8.7/14.0	38.0480	-81.6915
Apr 5, 2010	10:43:14 PM	-13.8	8.7/14.0	37.9457	-81.7636
Apr 5, 2010	11:06:51 PM	-7.9	8.7/14.1	37.8214	-81.6483
Apr 5, 2010	10:37:44 PM	-9.0	8.7/14.1	38.0691	-81.6192

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	07:12:34 PM	-2.8	8.7/14.1	38.0445	-81.7005
Apr 5, 2010	07:11:23 PM	-16.0	8.8/14.1	38.0387	-81.7098
Apr 5, 2010	11:09:57 PM	-8.7	8.8/14.1	37.8179	-81.6319
Apr 5, 2010	07:11:54 PM	-50.0	8.8/14.2	38.0477	-81.6961
Apr 5, 2010	09:36:05 AM	-36.9	8.8/14.2	37.9710	-81.7618
Apr 5, 2010	07:10:31 PM	-2.3	8.8/14.2	38.0344	-81.7177
Apr 5, 2010	07:19:06 PM	30.0	8.8/14.3	38.0303	-81.7233
Apr 5, 2010	07:11:07 PM	-16.8	8.9/14.3	38.0492	-81.6960
Apr 5, 2010	07:14:42 PM	-15.5	8.9/14.3	38.0552	-81.6841
Apr 5, 2010	10:02:18 AM	-12.7	8.9/14.4	37.9807	-81.4471
Apr 5, 2010	07:34:43 PM	-2.2	8.9/14.4	38.0542	-81.6879
Apr 5, 2010	10:59:07 PM	-16.1	8.9/14.4	37.8465	-81.7137
Apr 5, 2010	07:14:42 PM	-13.8	9.0/14.4	38.0565	-81.6842
Apr 5, 2010	10:38:38 PM	-7.1	9.0/14.5	38.0728	-81.5918
Apr 5, 2010	10:48:03 PM	-8.2	9.0/14.5	37.9408	-81.4389
Apr 5, 2010	10:44:29 PM	-28.6	9.0/14.5	37.9664	-81.7666
Apr 5, 2010	07:10:11 PM	-7.9	9.0/14.5	37.9995	-81.7533
Apr 5, 2010	07:12:34 PM	-21.6	9.0/14.6	38.0544	-81.6920
Apr 5, 2010	07:09:49 PM	-8.8	9.1/14.6	38.0396	-81.7174
Apr 5, 2010	11:19:36 PM	-15.1	9.1/14.7	38.0209	-81.7390
Apr 5, 2010	07:12:09 PM	-15.7	9.2/14.8	38.0525	-81.7006
Apr 5, 2010	11:02:47 PM	-8.2	9.2/14.9	37.9828	-81.4416
Apr 5, 2010	11:09:56 PM	-32.3	9.2/14.9	37.8130	-81.5624
Apr 5, 2010	07:08:44 PM	-26.4	9.3/14.9	38.0385	-81.7239
Apr 5, 2010	07:08:44 PM	-34.8	9.3/14.9	38.0411	-81.7205
Apr 5, 2010	08:33:58 PM	-6.5	9.3/15.0	37.9243	-81.4349
Apr 5, 2010	10:02:18 AM	-101.8	9.3/15.0	37.9759	-81.4381
Apr 5, 2010	10:37:14 PM	-16.7	9.3/15.0	38.0778	-81.6157
Apr 5, 2010	10:59:07 PM	-46.9	9.3/15.0	37.8419	-81.7176
Apr 5, 2010	07:08:44 PM	-32.4	9.4/15.1	38.0444	-81.7192
Apr 5, 2010	07:11:54 PM	-3.3	9.4/15.2	38.0479	-81.7143
Apr 5, 2010	07:14:42 PM	-84.0	9.4/15.2	38.0597	-81.6936
Apr 5, 2010	07:14:42 PM	-19.0	9.4/15.2	38.0576	-81.6990
Apr 5, 2010	07:08:44 PM	-37.6	9.4/15.2	38.0445	-81.7207
Apr 5, 2010	07:08:44 PM	-8.9	9.5/15.2	38.0425	-81.7237
Apr 5, 2010	07:14:42 PM	-31.4	9.5/15.3	38.0620	-81.6908
Apr 5, 2010	10:49:15 PM	-8.8	9.5/15.3	38.0772	-81.5673
Apr 5, 2010	10:57:16 PM	-7.8	9.5/15.3	37.8799	-81.7588
Apr 5, 2010	10:43:02 PM	-12.9	9.5/15.3	38.0727	-81.5463
Apr 5, 2010	07:14:42 PM	-11.0	9.5/15.3	38.0612	-81.6932
Apr 5, 2010	10:05:34 AM	-2.3	9.5/15.4	37.9954	-81.4419
Apr 5, 2010	11:11:38 PM	-2.9	9.6/15.5	37.8208	-81.5201
Apr 5, 2010	07:14:43 PM	-8.5	9.6/15.5	38.0625	-81.6951
Apr 5, 2010	07:14:42 PM	-19.4	9.6/15.5	38.0620	-81.6964
Apr 5, 2010	10:43:14 PM	-30.2	9.6/15.6	37.9606	-81.7799
Apr 5, 2010	07:14:08 PM	-21.2	9.6/15.6	38.0524	-81.7146
Apr 5, 2010	10:33:28 PM	-4.5	9.7/15.6	38.0744	-81.5411
Apr 5, 2010	07:13:22 PM	-14.7	9.7/15.6	38.0568	-81.7088
Apr 5, 2010	07:13:22 PM	-14.0	9.7/15.6	38.0561	-81.7104
Apr 5, 2010	11:42:32 PM	-14.1	9.7/15.7	37.9553	-81.4259

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	10:31:47 PM	-41.1	9.8/15.7	38.0784	-81.6560
Apr 5, 2010	10:29:49 PM	-12.7	9.8/15.8	38.0108	-81.7624
Apr 5, 2010	10:09:42 AM	-91.0	9.8/15.8	37.9709	-81.4270
Apr 5, 2010	11:09:56 PM	-30.7	9.8/15.8	37.8012	-81.5869
Apr 5, 2010	11:03:26 PM	-11.2	9.8/15.9	37.9726	-81.4269
Apr 5, 2010	11:09:56 PM	-26.0	9.9/15.9	37.8004	-81.5847
Apr 5, 2010	10:57:40 PM	-3.0	9.9/16.0	37.8674	-81.7588
Apr 5, 2010	07:13:22 PM	-20.5	9.9/16.0	38.0543	-81.7192
Apr 5, 2010	11:20:36 PM	-31.9	9.9/16.0	37.7993	-81.6150
Apr 5, 2010	08:08:28 PM	-7.4	10.0/16.1	38.0845	-81.6406
Apr 5, 2010	11:08:38 PM	-20.0	10.0/16.1	37.7983	-81.5979
Apr 5, 2010	08:31:30 PM	-51.1	10.0/16.2	37.8977	-81.4287
Apr 5, 2010	07:07:14 PM	-14.7	10.0/16.2	38.0512	-81.7277
Apr 5, 2010	10:57:56 PM	-5.5	10.1/16.3	37.8527	-81.7503
Apr 5, 2010	11:09:57 PM	-17.1	10.1/16.3	37.7973	-81.5830
Apr 5, 2010	07:17:35 PM	-41.4	10.1/16.3	38.0736	-81.6890
Apr 5, 2010	10:56:32 PM	-7.9	10.1/16.4	37.8751	-81.7694
Apr 5, 2010	07:24:10 PM	-55.9	10.2/16.4	38.0109	-81.7701
Apr 5, 2010	11:09:57 PM	-37.9	10.2/16.4	37.7963	-81.5846
Apr 5, 2010	10:42:39 PM	-15.1	10.2/16.4	38.0888	-81.5743
Apr 5, 2010	08:31:30 PM	15.5	10.2/16.4	37.8947	-81.4271
Apr 5, 2010	08:39:19 PM	-3.2	10.2/16.5	37.9506	-81.4163
Apr 5, 2010	11:04:44 PM	-17.1	10.2/16.5	37.8050	-81.6727
Apr 5, 2010	07:17:35 PM	-33.6	10.2/16.5	38.0854	-81.6578
Apr 5, 2010	10:42:39 PM	-28.9	10.3/16.5	38.0891	-81.5689
Apr 5, 2010	07:24:10 PM	-16.1	10.3/16.6	38.0245	-81.7620
Apr 5, 2010	10:56:32 PM	-26.7	10.3/16.6	37.8780	-81.7737
Apr 5, 2010	10:57:57 PM	-8.7	10.3/16.6	37.8750	-81.7720
Apr 5, 2010	07:10:31 PM	-15.2	10.3/16.6	38.0551	-81.7299
Apr 5, 2010	10:45:18 PM	17.0	10.3/16.6	38.0759	-81.5163
Apr 5, 2010	10:57:56 PM	-12.0	10.3/16.7	37.8884	-81.7808
Apr 5, 2010	10:09:42 AM	-24.2	10.3/16.7	37.9709	-81.4172
Apr 5, 2010	10:59:07 PM	-14.0	10.3/16.7	37.8303	-81.7296
Apr 5, 2010	07:32:21 PM	-5.4	10.4/16.8	38.0614	-81.7225
Apr 5, 2010	10:57:56 PM	-14.9	10.4/16.8	37.8828	-81.7795
Apr 5, 2010	10:09:42 AM	-19.3	10.4/16.8	37.9724	-81.4162
Apr 5, 2010	07:08:16 PM	-11.0	10.4/16.8	38.0504	-81.7389
Apr 5, 2010	07:24:10 PM	-13.2	10.4/16.8	38.0278	-81.7628
Apr 5, 2010	07:10:31 PM	-20.0	10.4/16.8	38.0570	-81.7301
Apr 5, 2010	10:57:57 PM	-14.7	10.4/16.8	37.8811	-81.7793
Apr 5, 2010	10:57:40 PM	-13.4	10.5/16.9	37.8911	-81.7846
Apr 5, 2010	07:24:10 PM	-25.1	10.5/16.9	38.0231	-81.7676
Apr 5, 2010	10:41:51 PM	-7.8	10.5/16.9	37.9315	-81.7962
Apr 5, 2010	10:57:57 PM	-9.0	10.5/16.9	37.8844	-81.7819
Apr 5, 2010	07:24:10 PM	-29.8	10.5/16.9	38.0253	-81.7663
Apr 5, 2010	07:08:16 PM	-16.0	10.5/16.9	38.0526	-81.7379
Apr 5, 2010	10:57:56 PM	-14.5	10.5/16.9	37.8821	-81.7809
Apr 5, 2010	11:09:56 PM	-33.8	10.5/17.0	37.7913	-81.5839
Apr 5, 2010	07:24:10 PM	-23.2	10.5/17.0	38.0269	-81.7656
Apr 5, 2010	10:57:56 PM	-14.6	10.5/17.0	37.8819	-81.7814

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	07:10:32 PM	-11.6	10.5/17.0	38.0580	-81.7318
Apr 5, 2010	10:40:19 PM	-11.1	10.5/17.0	37.9385	-81.7977
Apr 5, 2010	10:57:56 PM	-16.3	10.6/17.0	37.8813	-81.7815
Apr 5, 2010	07:10:31 PM	-3.5	10.6/17.0	38.0562	-81.7348
Apr 5, 2010	07:10:31 PM	-34.3	10.6/17.0	38.0573	-81.7333
Apr 5, 2010	10:43:29 PM	-11.7	10.7/17.2	38.0908	-81.5468
Apr 5, 2010	10:45:12 PM	-4.8	10.9/17.6	38.0421	-81.7603
Apr 5, 2010	07:07:50 PM	-9.5	10.9/17.6	38.0413	-81.7618
Apr 5, 2010	07:46:13 PM	-3.4	11.0/17.8	38.0997	-81.6437
Apr 5, 2010	07:31:23 PM	-2.0	11.0/17.8	38.0595	-81.7432
Apr 5, 2010	09:36:05 AM	-7.4	11.1/17.9	37.9954	-81.7969
Apr 5, 2010	07:46:13 PM	-4.8	11.3/18.3	38.1031	-81.6511
Apr 5, 2010	10:09:42 AM	-5.8	11.4/18.4	37.9582	-81.3949
Apr 5, 2010	10:05:34 AM	-7.7	11.7/18.8	37.9658	-81.3911
Apr 5, 2010	07:32:22 PM	-7.7	11.7/18.9	38.0589	-81.7616
Apr 5, 2010	09:36:04 AM	-5.3	11.9/19.1	38.0000	-81.8098
Apr 5, 2010	11:15:07 PM	-3.5	12.2/19.7	37.7713	-81.5485
Apr 5, 2010	11:23:02 PM	-4.4	12.3/19.9	37.9215	-81.3788
Apr 5, 2010	10:37:14 PM	-3.0	12.4/20.0	38.1066	-81.7003
Apr 5, 2010	11:28:18 PM	-3.3	12.6/20.3	37.7681	-81.5371
Apr 5, 2010	10:24:18 PM	-30.1	12.8/20.6	38.1280	-81.6063
Apr 5, 2010	10:26:35 PM	32.3	12.9/20.8	38.1197	-81.6838
Apr 5, 2010	11:23:23 PM	-5.2	13.2/21.3	37.9143	-81.3638
Apr 5, 2010	10:27:04 PM	-8.9	13.3/21.4	38.0992	-81.7473
Apr 5, 2010	09:05:46 PM	-8.6	13.3/21.5	38.1360	-81.6066
Apr 5, 2010	07:29:48 PM	-2.0	13.4/21.6	37.9503	-81.8497
Apr 5, 2010	10:58:35 PM	-11.7	13.4/21.7	38.0604	-81.4065
Apr 5, 2010	10:27:49 PM	-2.8	13.6/21.9	38.1042	-81.7469
Apr 5, 2010	10:13:19 PM	-2.2	14.1/22.8	38.1356	-81.6939
Apr 5, 2010	11:45:04 PM	-3.1	14.4/23.3	37.8062	-81.4034
Apr 5, 2010	10:25:57 PM	-2.3	14.5/23.4	38.0553	-81.8297
Apr 5, 2010	07:29:47 PM	-3.0	14.7/23.7	38.0753	-81.8157
Apr 5, 2010	11:29:45 PM	-3.4	14.7/23.8	37.7523	-81.4823
Apr 5, 2010	11:28:19 PM	-3.8	14.8/23.9	37.7436	-81.5016
Apr 5, 2010	10:25:48 PM	-8.5	14.9/24.0	38.1404	-81.4917
Apr 5, 2010	11:32:49 PM	-3.0	15.2/24.5	37.7262	-81.5556
Apr 5, 2010	07:31:23 PM	-11.6	15.2/24.6	38.1011	-81.8003
Apr 5, 2010	07:09:07 PM	-2.0	15.5/25.0	38.0994	-81.8094
Apr 5, 2010	11:32:09 PM	-2.3	15.7/25.3	37.7831	-81.3993
Apr 5, 2010	11:25:49 PM	-2.8	16.2/26.0	37.7224	-81.5043
Apr 5, 2010	11:41:31 PM	-3.6	16.2/26.1	37.7757	-81.3962
Apr 5, 2010	10:07:19 PM	-2.1	16.3/26.4	38.0754	-81.8536
Apr 5, 2010	10:23:11 PM	-8.4	16.5/26.6	38.1787	-81.6579
Apr 5, 2010	11:38:30 PM	-3.7	16.7/27.0	37.7744	-81.3832
Apr 5, 2010	10:23:41 PM	-7.2	17.4/28.0	38.1938	-81.6337
Apr 5, 2010	11:10:15 PM	-7.4	17.9/28.9	38.0697	-81.8915
Apr 5, 2010	10:36:31 PM	-8.6	19.1/30.7	38.2134	-81.5310
Apr 5, 2010	11:43:41 PM	-2.9	19.7/31.7	37.7072	-81.4006
Apr 5, 2010	10:55:45 PM	-11.0	20.3/32.7	38.0959	-81.2853
Apr 5, 2010	11:44:35 PM	-2.6	20.8/33.6	37.7614	-81.2982

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Date	Time	Peak Current (kA)	Distance From Center (mi/km)	Latitude	Longitude
Apr 5, 2010	10:17:39 PM	-8.1	20.9/33.7	38.2459	-81.5829
Apr 5, 2010	10:00:09 PM	-8.1	21.6/34.8	38.2179	-81.7932
Apr 5, 2010	08:53:47 PM	-9.5	23.0/37.2	38.1389	-81.2600
Apr 5, 2010	10:44:17 PM	-7.7	23.7/38.2	38.2296	-81.3635
Apr 5, 2010	07:25:15 PM	-7.8	24.6/39.6	38.1531	-81.9692
Apr 5, 2010	09:57:07 PM	-8.3	26.4/42.6	38.2417	-81.9087

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APPENDIX W

MINE ELECTRICAL SYSTEM

Appendix W

Mine Electrical System

Electrical Power System

Power was supplied to the mine by a 46,000 volt alternating current (Vac) service drop from the American Electric Power utility company. The voltage was transformed from 46,000 Vac to 12,470 Vac by two 10 mega-volt amperes (MVA) three-phase transformers, located in the substation near the south portals. The secondary side of each transformer was grounded through 25 ampere grounding resistors. Gang-operated disconnect switches and lightning arrestors were installed on the primary and secondary side of each transformer.

Power was supplied from the substation to various underground locations by five separate 4/0 American Wire Gauge (AWG), 15 kilovolt (KV) shielded mine power cables (See Figures AC-1, AC-2 and AC-3). Each cable was protected by a vacuum circuit breaker (VCB) installed in the substation. A color code was used by the mine electricians to differentiate the five high-voltage distribution circuits used underground. According to electrical maps in use at the time of the accident, the "violet" circuit supplied power to the longwall section. The "red" circuit provided power for the HG 22 and TG 22 development sections, several conveyor belt drives, and areas of the mine near the Ellis Portal. The "blue" circuit supplied power to the Barrier Section and other loads located in the North Mains area of the mine. The "green" circuit provided power to various conveyor belt drives, pumps, and other assorted equipment, located outby the longwall section. The "orange" circuit supplied power to the south side of the mine. All of the high voltage circuits, except for the "orange" circuit, entered the underground area of the mine through the No.3 entry of the North Portal. The "orange" circuit entered the mine through the No.3 entry of the South Portal. Inspections made of all these circuits determined that each was equipped with devices that could provide short circuit protection, overload protection, grounded-phase protection, undervoltage protection, and ground wire monitoring.

The violet, red, and green 12,470 Vac circuits ran through a series of high voltage circuit breakers and feed-throughs (power boxes) prior to and after entering the explosion area. Several circuit breakers on each circuit tripped during the mine explosion. All three circuits were routed into the explosion area from the Old North Mains track entry into the North Glory Mains track entry. From there they were routed into Headgate 1 North, HG 22, and TG 22. All three circuits had damage at various locations. Damage was observed along the Headgate 1 North, HG 22, and TG 22 entries, but the first occurrence of damage was observed along the North Glory Mains, when traveling inby.

The "red" circuit served primarily as a power supply for the development section belt lines and for the continuous mining section equipment in the explosion area. This circuit made a final split at crosscut 7 of the HG 22 Panel. From there, it terminated at the 2,500 kilo-volt amperes (KVA) section power center for the HG 22 section and terminated at the 2,250 KVA section power center for TG 22 section. Both of these power centers supplied 995 Vac and 480 Vac power to mining equipment in the face areas.

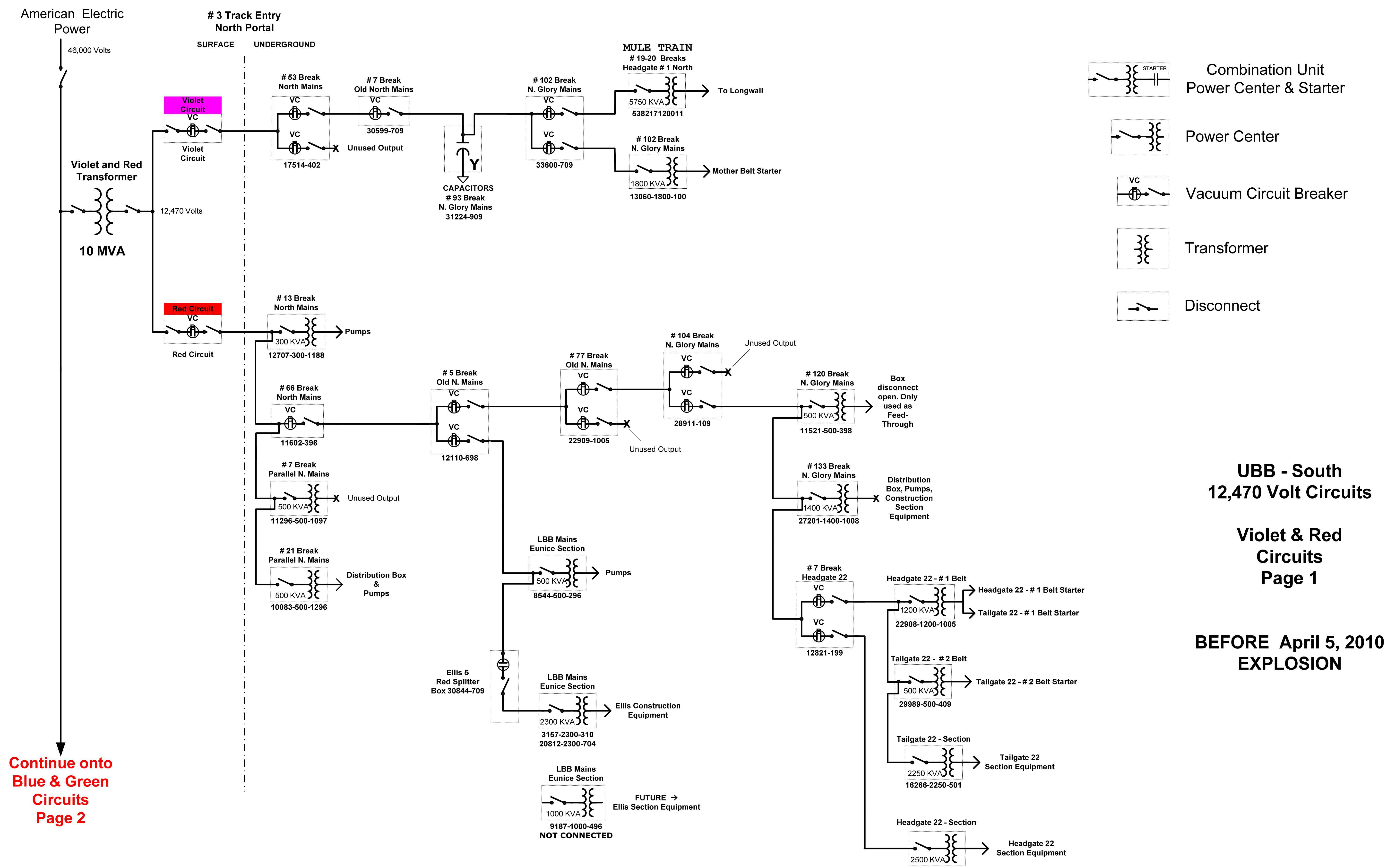
The “green” circuit served primarily as a power supply for the North Glory Mains conveyor belts inside the explosion area. This circuit ended at crosscut 105 of the North Glory Mains, where it supplied the No. 7 North belt conveyor.

The circuit providing power to Headgate 1 North was designated as the “violet” circuit. The “violet” circuit was dedicated totally for the longwall section equipment and the longwall conveyor belt. From the surface sub-station at the UBB Portal, 12,470 Vac was provided to the longwall section power center, located in the track entry outby the longwall face at the mule train. The 5,750 KVA longwall power center reduced the voltage to 4,160 Vac and 480 Vac for utilization on the longwall section. 4,160 Vac was provided from the power center to the longwall starter box located at the mule train.

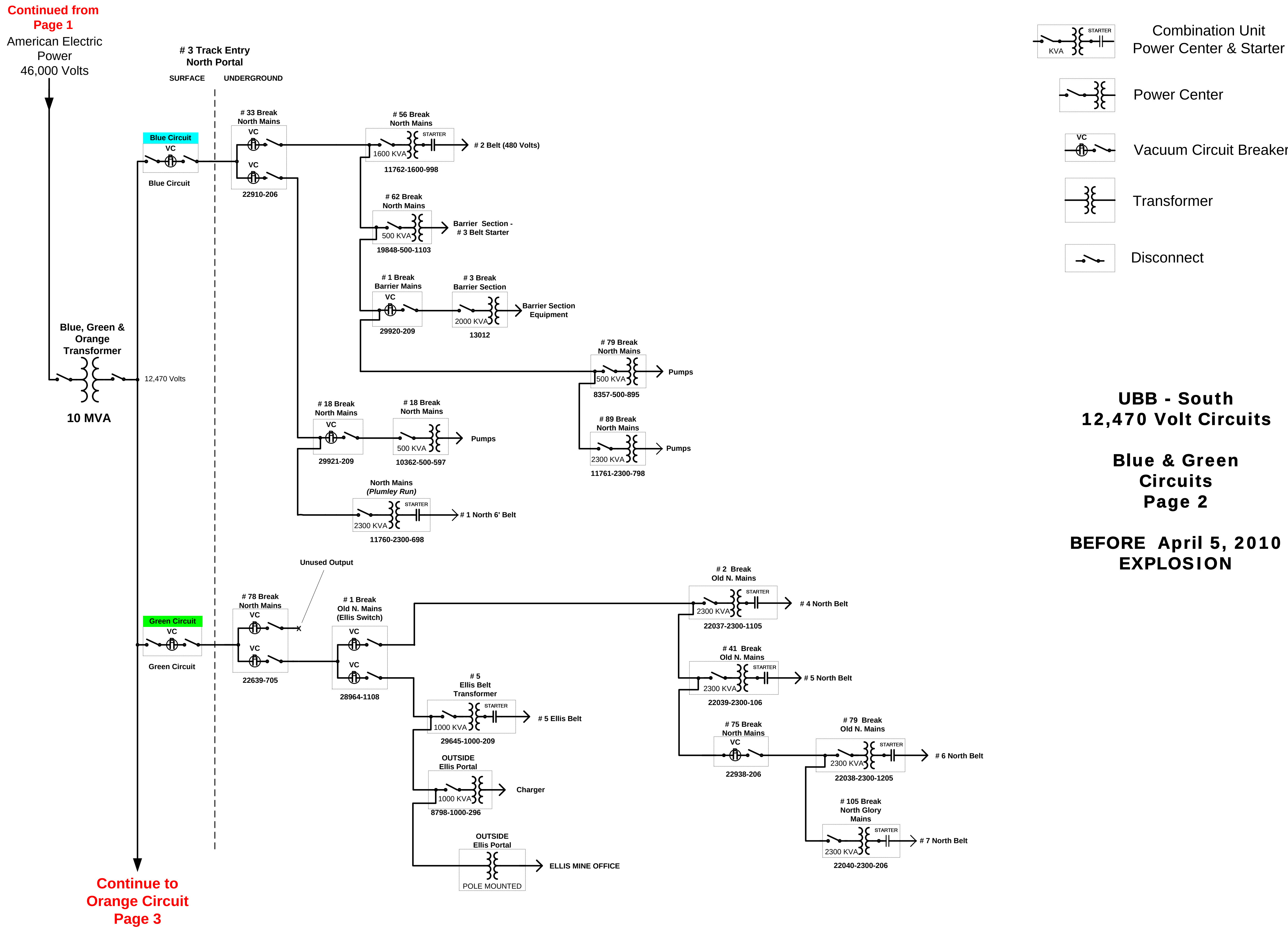
Longwall Section

The 4,160 Vac, longwall starter controlled power to the shearer, face conveyor motors, crusher motor, and stageloader motors. Power was delivered to these longwall components through cables, which were routed from the longwall starter along a monorail system in the belt entry. 480 Vac was provided from the section power center to the headgate controller (gate box). This cable was also routed along the monorail system. The monorail system and several of the cables suspended from it were damaged heavily during the explosion.

The cable supplying 480 Vac to the headgate controller was a #6 AWG 3-conductor, type G-GC, and entered the controller through a permissible plug and receptacle. The grounding conductors in the cable were attached to the frame of the controller. The approved drawings for the controller showed the pilot circuit for the ground monitor connected to a normally closed contact on the emergency stop (e-stop) switch. The pilot circuit then connected to a terminating diode which was attached to the controller frame, completing the ground monitor circuit. Operating the e-stop switch should have opened the ground monitor pilot circuit and caused the circuit breaker at the power center to trip, de-energizing the 480 Vac circuit. However, the circuit was not properly wired when inspected after the explosion. A terminating diode was installed between the pilot wire on the back of the receptacle and the frame of the controller. This rendered the e-stop switch ineffective for tripping the 480 Vac power to the controller, although it would have de-energized the 4,160 Vac circuits. When installed as approved, the e-stop would have de-energized all power on the longwall face when depressed; however, by the manner in which this e-stop was installed, only the high-voltage motor and shearer circuits would have been de-energized, while all other circuits (e.g. lighting, methane monitors, etc.) would have remained energized.



American Electric Power
46,000 Volts
3 Track Entry North Portal
SURFACE
UNDERGROUND
Violet and Red Transformer
12,470 Volts
10 MVA
Violet Circuit
VC
Violet Circuit
Red Circuit
VC
Red Circuit
53 Break North Mains
VC
VC
17514-402
7 Break Old North Mains
VC
30599-709
Unused Output
CAPACITORS
93 Break
N. Glory Mains
31224-909
102 Break N. Glory Mains
VC
VC
33600-709
MULE TRAIN
19-20 Breaks
Headgate # 1 North
5750 KVA
538217120011
To Longwall
102 Break N. Glory Mains
1800 KVA
13060-1800-100
Mother Belt Starter
13 Break North Mains
300 KVA
12707-300-1188
Pumps
66 Break North Mains
VC
11602-398
7 Break Parallel N. Mains
500 KVA
11296-500-1097
Unused Output
21 Break Parallel N. Mains
500 KVA
10083-500-1296
Distribution Box & Pumps
5 Break Old N. Mains
VC
VC
12110-698
77 Break Old N. Mains
VC
VC
22909-1005
Unused Output
104 Break N. Glory Mains
VC
VC
28911-109
Unused Output
120 Break N. Glory Mains
500 KVA
11521-500-398
Box disconnect open. Only used as Feed-Through
133 Break N. Glory Mains
1400 KVA
27201-1400-1008
Distribution Box, Pumps, Construction Section Equipment
LBB Mains Eunice Section
500 KVA
8544-500-296
Pumps
Ellis 5 Red Splitter Box 30844-709
LBB Mains Eunice Section
2300 KVA
3157-2300-310
20812-2300-704
Ellis Construction Equipment
LBB Mains Eunice Section
1000 KVA
9187-1000-496
NOT CONNECTED
FUTURE →
Ellis Section Equipment
7 Break Headgate 22
VC
VC
12821-199
Headgate 22 - # 1 Belt
1200 KVA
22908-1200-1005
Headgate 22 - # 1 Belt Starter
Tailgate 22 - # 1 Belt Starter
Tailgate 22 - # 2 Belt
500 KVA
29989-500-409
Tailgate 22 - # 2 Belt Starter
Tailgate 22 - Section
2250 KVA
16266-2250-501
Tailgate 22 Section Equipment
Headgate 22 - Section
2500 KVA
27011-2500-208
Headgate 22 Section Equipment
Continue onto Blue & Green Circuits Page 2
STARTER
Combination Unit Power Center & Starter
Power Center
VC
Vacuum Circuit Breaker
Transformer
Disconnect
UBB - South
12,470 Volt Circuits
Violet & Red Circuits
Page 1
BEFORE April 5, 2010 EXPLOSION

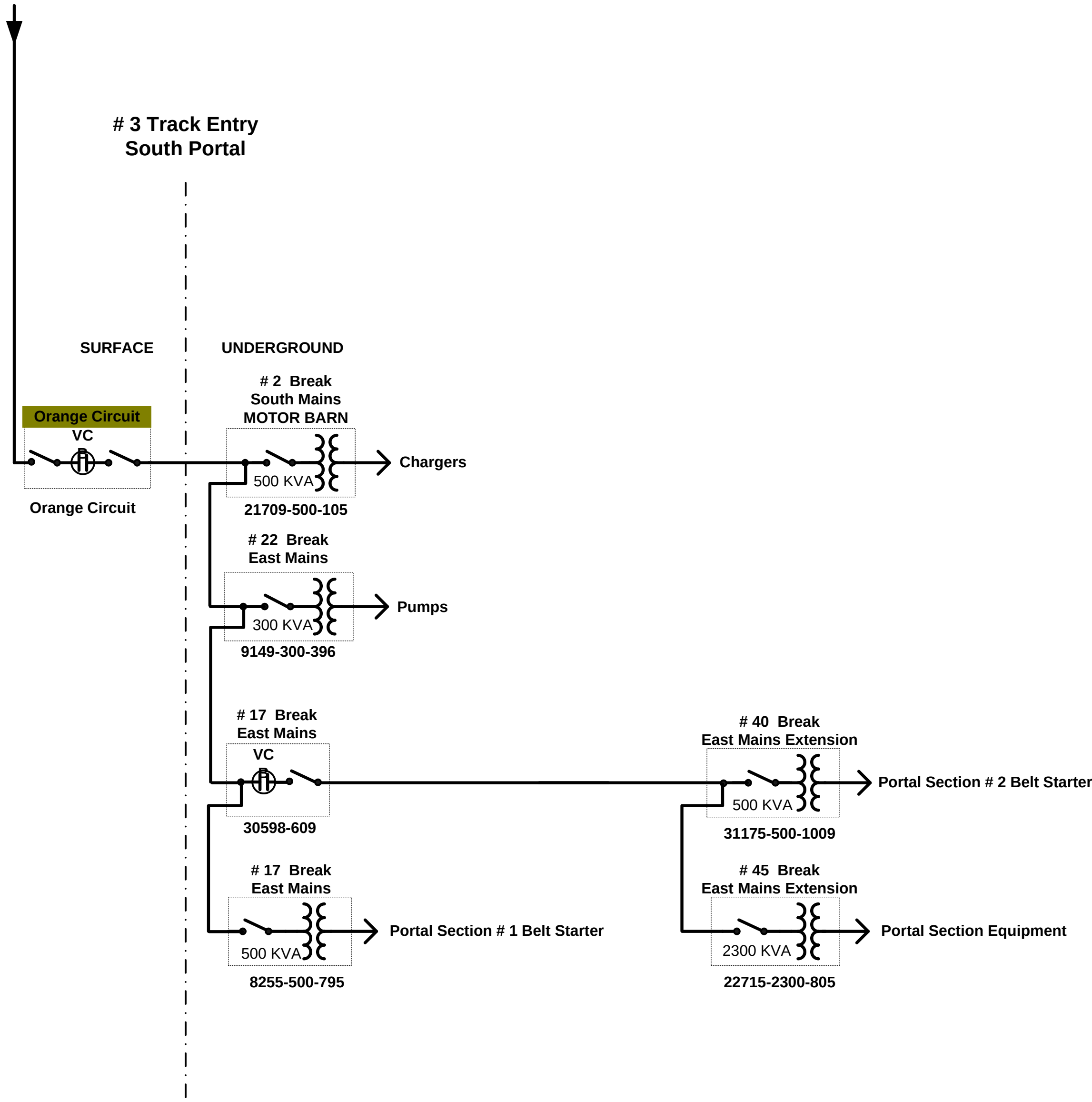


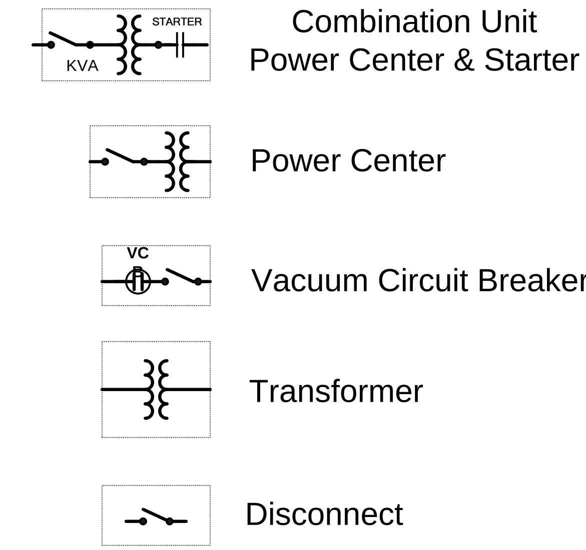
UBB - South
12,470 Volt Circuits

Blue & Green Circuits
Page 2

BEFORE April 5, 2010 EXPLOSION

Continued from
Blue, Green, Orange
Transformer
Page 2





UBB - South
12,470 Volt Circuits

Orange Circuit
Page 3

BEFORE April 5, 2010
EXPLOSION

APPENDIX X

EXAMINATION OF COMPONENTS OF JOY MINING MACHINERY JNA CONTROL SYSTEM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
TECHNICAL SUPPORT

INVESTIGATIVE REPORT

Examination of Components of Joy Mining Machinery JNA Control System
Recovered from a Mine Explosion at
Performance Coal Company
Upper Big Branch Mine-South (MSHA ID 46-08436)
Montcoal (Raleigh County), WV

April 5, 2010

PAR 98462

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November 23, 2011

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EXAMINATION OF COMPONENTS OF JOY MINING MACHINERY JNA CONTROL SYSTEM

1 ABSTRACT

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, assisted the accident investigation team in the examination of components of the Joy Mining Machinery Joy Network Architecture (JNA) Control System associated with the longwall shearing machine. These components were recovered from a fatal mine explosion at the Upper Big Branch Mine-South which occurred on April 5, 2010.

The components examined were:

1. Exhibit No. PE-0164, Joy Mining Machinery JNA0 control unit, S/N 56602AH003, Part No. 00572110-0020, recovered from the Joy longwall shearing machine installed at the mine.
2. Exhibit No. PE-0165, Joy Mining Machinery JNA1 control unit, S/N 100304AC006, Part No. 100133930, recovered from the Joy longwall shearing machine installed at the mine.
3. Exhibit No. PE-0173, Joy Mining Machinery, JNA1 control unit, S/N 113203AH002, Part No. 100133930, recovered in the area of survey spad 22699. The JNA1 recovered as Exhibit No. PE-0173 is reported to be a spare unit.
4. Exhibit No. PE-0204, Joy Mining Machinery JNA0 control unit, S/N 56605AC010, Part No. 00572110-0020, recovered in the area of survey spad 22701. The JNA0 recovered as Exhibit No. PE-0204 is reported to be a spare unit.
5. Exhibit No. PE-0269, Joy Mining Machinery, JNA0 control unit, S/N 50905T0002, Part No. 00572110-0020, recovered by the accident investigation team from the Joy facility in Bluefield, VA, on August 23, 2010.

For Exhibit No. PE-0164, JNA0 unit recovered from the longwall shearer, the electronic event log of April 5, 2010 was viewed. The last two recorded events on April 5, 2010 on the JNA0 unit were: “ERR Right Handheld Dataloss” and “STS Right Handheld Estop.” These records are an error message and a machine status code. No other events were recorded in the event log for approximately 43 minutes prior to the above listed events.

Events recorded in the JNA0 event log are time stamped. In order to determine the actual time that events on April 5, 2010 were recorded in the Exhibit No. PE-0164, JNA0 unit’s electronic event log, a time drift analysis was conducted on

the system clock of the JNA0 unit. At standard laboratory temperature of approximately 20 ºC, the system clock was drifting at a rate between 0.49971 and 0.4824 seconds per day. Assuming that the environmental conditions of the JNA0 unit before it was delivered to the A&CC were constant, the rate of drift of the system clock would remain constant. This means, if the drift was constant from April 5, 2010 until the measurements started, the actual expected time and date for the last “STS Right Handheld ESTOP” event, as recorded on the JNA0 event log, was between 2:59:32 PM and 2:59:38 PM on April 5, 2010.

Functional testing was conducted on Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1) on a Joy shearer test panel which mimicked the functionality of the shearer installed at the longwall. The purpose of this functional testing was to ensure that machine control system events monitored by the JNA system are properly interpreted by the JNA system, the proper actions were taken by the JNA system, and the appropriate events were properly recorded on the JNA0 event log. During the functional testing, machine functions were initiated by Exhibit No. PE-0238, Model TX1 remote control unit after being restored to working order. Events were stored in the Exhibit No. PE-0164 (JNA0) event log when expected. The functional testing indicated that Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1) functioned as expected.

Attempts were made to view the electronic event logs of additional JNA control units recovered during the accident investigation. No event logs were stored in Exhibit Nos. PE-0173, PE-0204, or PE-0269.

2 INTRODUCTION

2.1 Request. The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, assisted the accident investigation team in the examination of components of the Joy Mining Machinery JNA Control System associated with the longwall shearing machine. The examinations included recovering data stored in the memory of these units and comparing the internal time clocks of these units with presumed accurate time clocks. These components were recovered from a fatal mine explosion at the Upper Big Branch Mine-South which occurred on April 5, 2010.

2.2 Equipment. The longwall shearing machine installed at the Upper Big Branch Mine-South was a Joy Mining Machinery, Model 07LS1A shearer, serial number (S/N) LSW525C, MSHA Shearer Evaluation No. SE-18630-0. Components of the JNA control system were recovered from the shearer. In addition, the investigation team recovered spare JNA components located underground and at a repair facility.

2.3 Description of JNA control system. The JNA control system was the computer control center for the Joy shearing machine installed in the longwall shearer at the Upper Big Branch Mine-South Mine. The control system monitored the various machine functions and also contained the circuitry necessary for remote control operation. A display screen was provided to assist in operating or troubleshooting the machine. The display screen was viewed through a window of the main controller enclosure of the shearer. The JNA control system consisted of two components or units, referred to as JNA unit 0 and JNA unit 1, or also as the JNA0 and JNA1 units. The JNA0 unit performed various computer and control functions; it also contained the system display. The JNA1 unit contained the input and output interface to various circuits on the machine.

Some of the functions of the JNA system included:

- Controlling the machine's solenoid-operated hydraulic functions,
- Monitoring the remote control transmitter stations,
- Monitoring and controlling motor currents and motor temperatures,
- Providing motor overcurrent protection,
- Providing diagnostic data on the display, and
- Providing an electronic event log for reviewing machine performance. The event log is a listing of the machine status codes and error messages. The JNA event log is not designed to be downloaded; it can only be viewed on the JNA0 display.

The Machine Application Program (MAP) cartridge is a small cartridge that plugs into a socket on the JNA0 unit. The MAP is programmed at the manufacturer's facility specifically for a certain shearing machine. The MAP cartridge is used by the JNA system to customize the configuration settings, such as motor overload settings, based on the shearer components installed.

2.4 Recovering JNA0 and JNA1 units from Shearer. On July 20, 2010, the main controller enclosure on the longwall shearer at the Upper Big Branch Mine-South was opened, the connections to the JNA0 and JNA1 units were disconnected, and the JNA0 and JNA1 units were secured into protective storage cases. The JNA0 unit, S/N 56602AH003, part number (P/N) 00572110-0020, was designated as Exhibit No. PE-0164. The JNA1 unit, S/N 100304AC006, was designated as Exhibit No. PE-0165. For the purpose of preserving the data, the MAP cartridge, which was installed in the appropriate slot of the JNA0 unit, was not removed from the JNA0 unit during the investigation. The MAP installed in Exhibit No. PE-0164 was P/N 100173695-06. See Appendix A-1 for photographs of the recovery of the JNA units.

3 VIEWING EVENT LOG OF EXHIBIT NO. PE-0164 JNA0 UNIT

3.1 Procedure. Exhibit No. PE-0164, JNA0 unit, was taken to the Joy Mining Machinery facility in Franklin, PA, on July 23, 2010, for the purpose of viewing the event log. Joy personnel conducted the testing under the direction of the investigation team. The examinations were videotaped and photographed. See Appendix A-2 for photographs. An attempt was made to synchronize the timestamp of the video recording to the real time clock available at www.time.gov. A photograph of both the real time clock displayed on a laptop computer and the video recording's timestamp shows a one second difference (see Appendix A-2, slide 10).

3.2 Demonstration Unit. Joy personnel demonstrated how the JNA event log can be viewed on a JNA0 sample unit. The demonstration JNA0 sample unit was powered with a 120 Vac power cord and was controlled using a page turner device. After power was applied and the boot-up sequence finished, the demonstration JNA0 sample unit displayed the main menu. The JNA system's date and time are also displayed on the screen. The operator then toggled to the "Event Log" on the main menu. The JNA event log contained a chronological detail of the operation of the JNA system, and can include any errors, overload conditions, or status events. Approximately 4,000 of the latest events can be stored in the event log; the oldest event is overwritten by newer events being recorded. Each event contains the time stamp, or date and time, of the event's occurrence. The user can select an event's "help text" for more descriptive information explaining an event. It was demonstrated that the demonstration JNA0 sample event log was maintained in memory after powering down and re-starting the demonstration unit. Nine (9) events related to the boot-up sequence were stored in the event log every time the demonstration JNA0 sample unit was powered. As expected, some of these events were due to the demonstration JNA0 sample unit not being connected to a JNA1 unit and other sensors as it would be on a machine.

3.3 Exhibit No. PE-0164 JNA0 Unit. Exhibit No. PE-0164 was taken out of its protective storage case. The JNA0 unit was powered with a 120 Vac power cord and controlled using a page turner device. After the boot-up sequence finished, the JNA0 unit displayed the main menu. The JNA system's date and time were also displayed on the screen. The operator then toggled to the "Event Log" on the main menu. The nine (9) events that related to the boot-up sequence that had just initiated were recorded, beginning with the event "SYS Power Reset". Events recorded just prior to the JNA0 unit being powered on July 23, 2010, were dated April 5, 2010.

3.4 Viewing of Data. Every screen of the event log was recorded via still or video photography. Every screen of data consisted of 20 events, with the latest four events repeated from the previous screen. The date of the recorded events began on April 5, 2010, and continued until March 30, 2010. On the 57th screen, data recorded on March 30, 2010 was immediately preceded by data recorded on January 7, 2009. This data continued until January 3, 2009. It was believed that the January 2009 data was recorded while this JNA0 unit was installed on another shearing machine, since these dates are prior to the time when this particular shearing machine was delivered to the Upper Big Branch Mine-South.

The two last two recorded events on April 5, 2010 on the JNA0 unit were:

April 5, 2010	18:52:41	ERR Right Handheld Dataloss
April 5, 2010	18:52:39	STS Right Handheld Estop

No events were recorded in the event log for approximately 43 minutes prior to the above listed events.

A "STS Right Handheld Estop" event would occur if the data from the right handheld unit dropped out for 0.5 to 1.5 seconds. According to the manufacturer, examples of a radio communication dropout include:

- The operator pressed the "stop" button on the TX1 remote control unit,
- The radio communications to the receiver dropped out,
- The receiver to the JNA communications dropped out, or
- The internal battery of the TX1 remote control unit was dying.

Also, an "ERR Right Handheld Dataloss" event would occur if the data from the right handheld unit dropped out for more than 1.5 seconds.

3.5 Photographs of Event Log. Slides 12 through 141 of Appendix A-2 show the event log as displayed on the JNA0 unit. The entire procedure of viewing the event log was videotaped; however, not every screen of data of the event log of January 3, 2009 was photographed.

3.6 Event Log with Adjustments for Time Drift. Efforts were made to determine the actual time that events occurred in the event log (see Time Drift Study in Section 4 below). Based on the time drift analysis, the time of recorded events in the event log was calculated for a range of "earliest" and "latest" possible actual time. The resulting actual time range for the events recorded on April 5, 2010 is shown in Appendix B.

3.7 Event Log Help Text. "Help Text" information could be selected by the user for more descriptive information explaining an event. Joy provided a "JNA Event Dictionary File" which listed all events that are possible to record in the event log of the JNA system installed at the shearer used on the longwall. The help text information for this large list of events (machine status codes and error messages) recorded on April 5, 2010 is shown in Appendix C.

3.8 Exhibit No. PE-0164 JNA0 Parameter Screens. After viewing the event log of the JNA0, the parameter screens and other menus of the unit were viewed, videotaped and photographed. These screens are shown in Appendix A-2, slides 142 to 205. The power was then removed and the JNA0 unit was placed back into its protective storage case.

3.9 Questions asked of the manufacturer, Joy Mining Machinery. Questions regarding the JNA control system and its electronic event log were gathered from the representatives of parties of the accident investigation team. The questions and Joy's response, titled "Response to MSHA Questions for Joy", is filed in the folder for this investigation.

4 TIME DRIFT STUDY OF EXHIBIT NO. PE-0164 JNA0 UNIT

4.1 Background. An attempt was made to coordinate the recorded time data associated with selected events in the JNA0 electronic event log for Exhibit No. PE-0164 with time from established sources. The time and date recorded by the internal clock of the JNA0 unit was displayed and observed over a period of approximately fourteen months. This time was compared to presumed accurate time clocks. The rate of change was calculated from this data and used to extrapolate the JNA0 unit's time on April 5, 2010.

The JNA0 unit featured an internal clock. The length of a time period measured by these clocks can deviate from the length of the same time period measured by more precise means; one second measured by the JNA0 unit can differ from one second as measured by the National Institute of Standards and Technology (NIST).

In laboratory environmental conditions, it was noted that the clock did, indeed, differ in time from that obtained from external sources. Given the tolerances of each time measurement, calculations were made to determine the minimum and maximum rates of drift of the JNA0 unit's internal clocks as compared to the time from external sources.

The minimum and maximum rate of drift was compared to the events recorded in the event log which occurred on April 5, 2010.

The following were correlated: (a) the time from the JNA0 event log with (b) the actual Eastern Daylight Time when certain events in the data were recorded. The JNA0 unit uses clocks that rely on crystals or resonators connected to integrated circuits. The frequency of the crystal or the resonator determines the operation of the clock. Changes in the frequency of the crystal or resonator, or mismatches in impedance between the external circuitry and the internal circuitry of the integrated circuit, will have an effect on the clock, causing it to differ from the actual time. One major factor that can affect the frequency of a crystal is its temperature.

The manufacturer indicated that when the JNA0 unit is repaired at the Matric Limited rebuild facility, the clock is set to the UST format, according to their test procedure. The acronym "UST" stands for Universal Standard Time; it is analogous to the better-known Greenwich Mean Time (GMT). This means that during Eastern Daylight Time, the clock of the JNA0 unit is set four hours ahead of Matric Limited's network time, and during Eastern Standard Time, the clock of the JNA0 unit is set five hours ahead of the Matric Limited's network time. The manufacturer indicated that when the clock is reset, the event log is cleared.

4.2 Measurement Procedures. The JNA0 unit was energized and the displayed time and date were recorded. Simultaneously, the time and date displayed on a MSHA-owned personal computer, with the web browser directed to www.time.gov, were recorded. The data was recorded by handwritten notation in a record book and photographs were taken. The time and date of the JNA0 unit was displayed in the upper right hand corner of the JNA0 Main Menu. At the request of the State of West Virginia Office of Miners' Health, Safety & Training, measurements were also taken with a Garmin etrex Legend GPS Receiver.

4.3 Analysis Procedures.

4.3.1 Precision of measurements. The reference time readings in 2010 and 2011 were taken from the National Institute of Standards and Technology (NIST) website at www.time.gov and a Garmin etrex Legend GPS Receiver connected to at least four satellites.

4.3.2 WWW.TIME.GOV. Notes from this website indicate: "This public service is cooperatively provided by the two time agencies of the United States: a Department of Commerce agency, the National Institute of Standards and Technology (NIST), and its military counterpart, the U. S. Naval Observatory (USNO). Readings from the clocks of these agencies contribute to world time, called Coordinated Universal Time (UTC). Additionally, the website says "This web site is intended as a time-of-day service only. It should not be used to measure frequency or time interval, nor should it be used to establish traceability to NIST or the USNO." This time is synchronized with NIST every ten minutes."

Additionally, the website displays an accuracy statement. This is provided in the format "Accurate within X.X seconds" on a measurement of the round-trip network delay. This delay is measured using the local computer clock as a timer each time synchronization is made. Most measurements were displayed as less than 1 second, but informal observations, using the widget provided by NIST, indicated delay of up to 4 seconds.

4.3.3 Global Positioning System (GPS) Time. The GPS Navigation Message Words six through 10 of page 18 of subframe four of the GPS broadcast navigation message contain the values of Coordinated Universal Time (UTC) parameters that permit a GPS receiver to determine UTC corresponding to a particular instant of GPS Time. This page is transmitted once during the 12 ½-minute-long navigation message. The parameters include the current number of UTC leap seconds since January 1980, when GPS Time was set equal to UTC, as well as information on the most recent or announced future leap second. The navigation message also transmits the coefficients of a first-order polynomial describing the subsecond relationship between GPS Time and UTC. The parameters of this polynomial also provide data to allow the GPS receiver to accommodate leap seconds. An observation of the time observed on a GPS receiver indicated that the difference between the time displayed by the receiver and MSHA network time was approximately one second.

4.3.4 Calculations. When calculating the differences between the time displayed by the instruments and the reference time, the tolerances of the reference time were initially based on the information found above. E.g., when the MSHA network was used as a reference, it was considered to have a one second tolerance. However, based on the observations of the NIST time widget, and the statement by NIST that the www.time.gov time should not be used for interval measurements, the tolerance was widened.

Calculations were made to determine the largest and smallest differences between (a) the observed time on the instrument and (b) the observed reference time. This range for each time measurement was plotted on a linear-linear graph; there were therefore two y-data points (representing the smallest and largest differences) for each x-data point (representing the observation period, with the first observation at time=0). Because the duration of the observations was approximately 420 days, the variation of each data point in the horizontal (x) direction was insignificant. The same tolerance was used for each data point. Additionally, the time recordings were adjusted to allow for daylight savings time as appropriate.

Because a straight line would not fit between the upper and lower limits of all data points when these points were plotted, the tolerance was adjusted to nine seconds to allow this straight line to fit because a linear drift was expected. Then, based on observation, the minimum and maximum slopes of the straight lines that fit the points were measured. These slopes were then used to determine the maximum and minimum time drift of the JNA0 system clock. The time drift values were then used to extrapolate the data to recorded events of the event log on April 5, 2010.

4.4 RESULTS

4.4.1 Time recordings. The listing of time recordings can be found in Table 1 below. This data has been adjusted for Daylight Savings Time. The recordings made on July 23, 2010 and on November 19, 2010 were made from video taken at the Joy facility in Franklin, PA and Matric Limited in Seneca, PA, where the video recording's time was synchronized to www.time.gov. Recordings made from November 30, 2010 through February 9, 2011 were made by comparing the JNA0 unit time to www.time.gov displayed on a MSHA-owned personal computer. Recordings made from May 27, 2011 to September 15, 2011 were made by comparing the JNA0 time to GPS time.

Table 1. JNA0 Time Measurements

Date	Reference Time	Instrument Time
7/23/2010	10:43:59	14:36:17
7/23/2010	10:44:03	14:36:21
7/23/2010	12:16:43	16:09:00
7/23/2010	14:19:11	18:11:29
7/23/2010	15:23:50	19:16:07
7/23/2010	16:10:32	20:02:50
11/19/2010	10:20:00	14:11:13
11/30/2010	15:26:00	19:17:09
11/30/2010	15:27:00	19:18:09
11/30/2010	15:32:00	19:23:08
1/8/2011	11:31:57	15:22:46
1/8/2011	11:34:37	15:25:26
1/8/2011	11:35:00	15:25:50
1/8/2011	11:36:00	15:26:49
1/26/2011	15:49:05	19:39:43
1/26/2011	15:50:37	19:41:16
1/26/2011	15:55:10	19:45:50
1/27/2011	15:49:41	19:40:27
1/27/2011	15:50:55	19:41:41
1/27/2011	15:51:54	19:42:40
1/28/2011	15:40:38	19:31:18
1/28/2011	15:42:10	19:32:50
1/28/2011	15:43:38	19:34:18
1/31/2011	15:54:14	19:44:53
1/31/2011	15:55:47	19:46:26
1/31/2011	15:56:45	19:47:24
2/1/2011	15:42:25	19:33:03
2/1/2011	15:43:25	19:34:03
2/1/2011	15:44:34	19:35:12
2/3/2011	15:39:16	19:29:49

2/4/2011	16:16:36	20:07:12
2/4/2011	16:17:28	20:08:06
2/4/2011	16:18:35	20:09:12
2/7/2011	15:08:41	18:59:06
2/7/2011	15:11:02	19:01:27
2/7/2011	15:12:54	19:03:18
2/8/2011	15:28:19	19:18:53
2/8/2011	15:29:20	19:19:55
2/8/2011	15:30:06	19:20:41
2/9/2011	15:41:04	19:31:39
2/9/2011	15:42:03	19:32:38
2/9/2011	15:43:40	19:34:15
5/27/2011	16:23:27	20:13:13
5/27/2011	16:24:15	20:14:01
5/27/2011	16:26:57	20:16:43
5/27/2011	16:29:08	20:18:53
6/1/2011	16:06:49	19:56:33
6/1/2011	16:10:46	20:00:30
6/6/2011	17:11:17	21:00:57
6/6/2011	17:16:25	21:06:05
6/8/2011	15:37:59	19:27:40
6/8/2011	15:39:50	19:29:30
6/10/2011	15:41:30	19:31:08
6/10/2011	15:42:29	19:32:07
6/14/2011	16:19:42	20:09:19
6/14/2011	16:21:34	20:11:10
6/17/2011	18:08:49	21:58:23
6/17/2011	18:15:47	22:05:23
6/23/2011	13:59:36	17:49:09
6/23/2011	14:00:37	17:50:11
6/23/2011	14:01:57	17:51:31
6/24/2011	14:36:29	18:26:01
6/24/2011	14:37:13	18:26:45
6/24/2011	14:38:52	18:28:24
6/28/2011	15:39:08	19:28:38
6/28/2011	15:40:33	19:30:03
6/29/2011	11:39:40	15:29:09
6/29/2011	11:49:30	15:38:58
8/12/2011	16:34:41	20:23:48
8/12/2011	16:36:27	20:25:35
8/12/2011	16:37:07	20:26:14
8/23/2011	16:13:52	20:02:55
8/23/2011	16:19:05	20:08:08
8/25/2011	16:54:31	20:43:32
8/25/2011	16:56:28	20:45:29
8/25/2011	16:58:50	20:47:51
9/7/2011	9:01:32	12:50:27
9/7/2011	9:05:14	12:54:09
9/9/2011	17:04:30	20:53:24
9/9/2011	17:06:02	20:54:56

9/9/2011	17:08:30	20:57:25
9/15/2011	16:11:54	20:00:45
9/15/2011	16:12:51	20:01:42

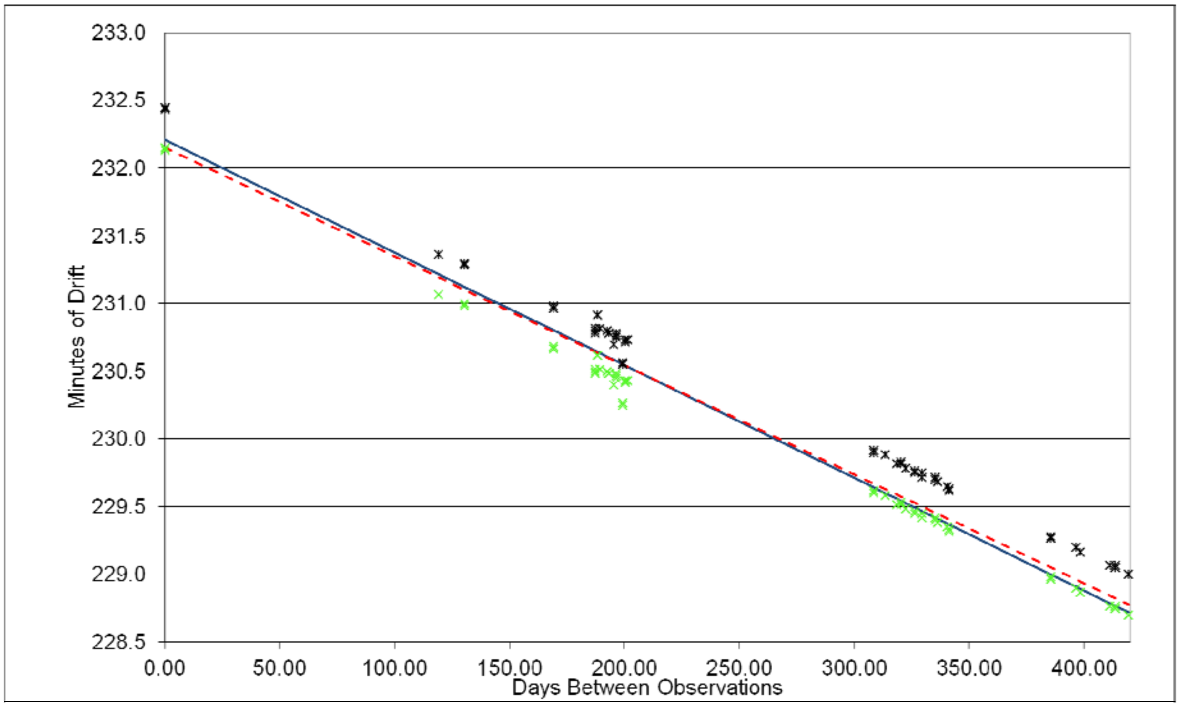
4.4.2 Analysis. The data from Table 1 was used to calculate the minimum and maximum deviation of the system clock of the JNA0 unit from Eastern Daylight Time. First, the number of days between the first observation and each subsequent observation was calculated and served as the horizontal axis of Figure 1. Then, through systematic trial and error, the tolerance on the reference time was determined. No tolerance on the JNA0 time observation was used.

The smallest tolerance on the time observed on the MSHA network and www.time.gov that would allow a straight line to fit all points, as shown on Figure 1 below, was the minimum allowable tolerance of ±9 seconds. This tolerance was then applied to the reference time, resulting in the points on Figure 1; the points represented by asterisks were the largest possible deviation, and those represented by X were the smallest possible deviation.

Once again, by systematic trial and error, straight lines were fit between the two sets of data (largest and smallest deviation) by adjusting the y-intercept and slope of the lines until the minimum and maximum possible slopes were obtained. These slopes were the minimum and maximum rates of drift of the JNA0 system clock.

The maximum and minimum slopes were 0.49971 and 0.4824 seconds per day. This means, if the drift was constant from April 5, 2010 until measurements started on July 23, 2010, the actual expected time and date for the last “STS Right Handheld ESTOP” event which was recorded at 6:52:39 PM on April 5, 2010 was between 2:59:32 PM and 2:59:38 PM on April 5, 2010.

Figure 1. Calculated Minimum and Maximum Clock Drift Rates, Exhibit No. PE-0164



5 FUNCTIONAL TESTING OF EXHIBIT NO. PE-0164 (JNA0), EXHIBIT NO. PE-0165 (JNA1) AND EXHIBIT NO. PE-0238 (TX1 REMOTE CONTROL)

5.1 <u>Procedure.</u> The Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1) were taken for functional testing at the Matric Limited facility in Seneca, PA, on November 19, 2010. The purpose of this functional testing was to ensure that machine control system events monitored by the JNA system are properly interpreted by the JNA system, the proper actions taken by the JNA system, and properly recorded on the JNA0 event log. A Joy shearer test panel was used to mimic the functionality of the shearer, with the JNA system connected to the test panel. Joy personnel conducted the testing under the direction of the investigation team.

Joy provided a “JNA event dictionary file” which listed all the events that could have been recorded in the event log of the JNA system installed at the shearer used on the longwall. Joy also provided a document titled “Response to MSHA Questions for Joy”, which included fifty (50) of those events from the dictionary file that the MSHA investigation team asked Joy to simulate during the functionality test of the JNA0 and JNA1 units recovered from the longwall shearer. Appendix D lists those events that the investigation team asked Joy to simulate. Joy indicated that some of the events were no longer used or the events could not be simulated on the Joy test panel. Therefore, some of the events in Appendix D are shaded. The events that are non-shaded or lightly shaded were those that were simulated during the functional test. The events that are darkly shaded could not be simulated during the functional test.

The functional testing was videotaped and photographed. See Appendix A-4, slides 1 through 174, for photographs of the functional testing.

5.2 Demonstration of Test Panel with sample JNA0 and JNA1 units. Joy personnel first demonstrated the functions of the Joy shearer test panel by connecting a Joy sample JNA0 unit and a sample JNA1 unit. It was necessary to prepare a replacement MAP cartridge for the Joy sample JNA0 unit. It was shown that the test panel was operating properly by energizing sample components such as relays and motors. Machine functions were initiated by a Joy-supplied umbilical (hard-wire connected) remote control device.

5.3 Functional testing of Exhibit No. PE-0165 (JNA1) with Joy sample JNA0 unit installed on test panel: Exhibit No. PE-0165 (JNA1) was taken out of its protective storage case and installed on the Joy test panel, with the Joy sample JNA0 unit still installed. Functional testing was conducted of the non-shaded and lightly shaded events shown in Appendix D. Machine functions were initiated by a Joy-supplied umbilical (hard-wire connected) remote control device. The Exhibit No. PE-0165 (JNA1) functioned as expected. Events were stored in the Joy sample JNA0 event log when expected.

5.4 Functional testing of Exhibit No. PE-0164 (JNA0) with Joy sample JNA1 unit installed on test panel: This testing was prescribed in the original functional testing protocol, but was not conducted. All parties present at the testing felt it was unnecessary and it was agreed to proceed to the next step of the functional testing.

5.5 Functional testing of Exhibit No. PE-0164 (JNA0) with Exhibit No. PE-0165 (JNA1) on test panel, using Exhibit No. PE-0238 (Model TX1) remote control unit: Exhibit No. PE-0164 (JNA0) was taken out of its protective case and installed on the Joy test panel, with Exhibit No. PE-0165 (JNA1) still installed from the previous step.

Joy personnel installed a Joy supplied sample 472 MHz receiver to the right-handheld input to the test panel. Exhibit No. PE-0238, Matric Limited TX1 remote control unit, recovered at Shield 100 of the longwall face, was then used during this step of the functional testing. This TX1 unit was repaired by a Matric Limited technician on November 19, 2010, and restored to working order. Refer to the report “Remote Control Units Recovered from a Mine Explosion at Performance Coal Company” for further information concerning Exhibit No. PE-0238.

Functional testing was conducted on the non-shaded and lightly shaded events shown in Appendix D, with machine functions being initiated by Exhibit No. PE-0238 (Model TX1) remote control unit. Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1) functioned as expected. Events were stored in the Exhibit No. PE-0164 (JNA0) event log when expected.

Special emphasis and additional tests were conducted to recreate the last two event data recordings for April 5, 2010 shown in Appendix B. Although these event data recordings can be created several ways, as noted earlier, investigators only recreated the last two event data recordings by activating the remote stop function of the TX1 unit at the Matric facility. Each time the remote stop function was actuated, a “ERR Right Handheld Dataloss” occurred within 2 seconds.

6 VIEWING OF EVENT LOGS OF ADDITIONAL JNA UNITS

6.1 Background. Additional JNA control units were recovered during the course of the investigation. These additional units were recovered both from the longwall section and from a repair facility. These additional units were kept as spares for the longwall section. Attempts were made to view any event logs stored on these spare JNA0 units.

6.2 Exhibit No. PE-0173. This exhibit was a JNA unit recovered in the area of survey spad 22699 along “headgate 21”. This unit was later examined at the Matric Limited facility in Seneca, PA, by the team on November 19, 2010. Upon inspection, the unit was a JNA1 unit, S/N 113203AH002, P/N 100133930. No event logs are stored on JNA1 units, so this unit was not powered. No further evaluation was conducted on this JNA1 unit.

6.3 Exhibit No. PE-0204. This exhibit was a plastic protective case containing a JNA0 unit, S/N 56605AC010, P/N 00572110-0020, recovered in the area of survey spad 22701. The case was taken to the Joy Mining Machinery facility in Franklin, PA, on August 11, 2010, for the purpose of viewing the event log on the JNA0 unit. See Appendix A-3 for photographs.

The exterior and interior of the protective case was covered in soot and dirt, as was the JNA0 unit located inside. Upon examination, there was dirt in the empty MAP cartridge slot and other connection slots and ports. Joy personnel cleaned the unit with a vacuum, and wiped the unit clean. Since the event log could not be viewed without a MAP cartridge, a replacement MAP cartridge was prepared to mimic the configuration of the shearer at the Upper Big Branch Mine-South. The MAP cartridge was inserted into the JNA0 unit, and the unit was powered. However, upon examination, the event log was empty. No further evaluation was conducted on this JNA0 unit.

6.4 Exhibit No. PE-0269: It was determined that a JNA unit was sent back to a Joy repair facility in Bluefield, VA near the date of April 5, 2010. A member of the MSHA accident investigation team recovered it on August 23, 2010. The unit was a JNA0 unit, S/N 50905T0002, P/N 00572110-0020. The unit was later examined at the Matric Limited facility in Seneca, PA, by the team on November 19, 2010. See Appendix A-4, slides 175 through 185, for photographs of this examination. Upon inspection, the unit appeared to have been processed at a repair facility. A Matric Limited tracking tag with the unit showed a received date of April 7, 2010, and a final inspection of April 21, 2010. No MAP cartridge was installed. The unit was powered, and no event log was stored.

The real-time clock of the JNA unit was examined. On November 19, 2010, the date and time were compared to UST time, and it was one minute and 37 seconds behind UST, as the JNA0 displayed time was '19:02:00' compared to '14:03:37' from a video timestamp synched to www.time.gov. The manufacturer stated that they serviced the unit on April 21, 2010; their service procedures are reported to include synchronization of the JNA clock to UST. Using these two data points, the rate of drift of the clock of Exhibit No. PE-0269 from April 21, 2010 to November 19, 2010 is comparable to the rate of drift observed on Exhibit No. PE-0164. No further evaluation was conducted on this JNA0 unit.

6.5 Service Reports: The service reports for each of the exhibits were provided by Matric Limited. No repairs relative to this investigation were noted. The service records show the date the unit was built and the last repair date for each of the exhibits:

Exhibit No.	New Date	Last Repair Date
PE-0164	03/01/2006	05/22/2008
PE-0165	04/27/2001	08/29/2008
PE-0173	(not stated)	05/13/2008
PE-0204	05/23/2001	05/14/2009
PE-0269	06/23/1995	04/21/2010

7 CONCLUSION

For Exhibit No. PE-0164, JNA0 unit recovered from the longwall shearer, the electronic event log of April 5, 2010 was viewed. The last two recorded events on April 5, 2010 on the JNA0 unit were: "ERR Right Handheld Dataloss" and "STS Right Handheld Estop." These records are an error message and a machine status code. No other events were recorded in the event log for approximately 43 minutes prior to the above listed events.

Events recorded in the JNA0 event log are time stamped. In order to determine the actual time that events on April 5, 2010 were recorded in the Exhibit No.

PE-0164, JNA0 unit's electronic event log, a time drift analysis was conducted on the system clock of the JNA0 unit. At standard laboratory temperature of approximately 20 ºC, the system clock was drifting at a rate between 0.49971 and 0.4824 seconds per day. Assuming that the environmental conditions of the JNA0 unit before it was delivered to the A&CC were constant, the rate of drift of the system clock would be constant. This means, if the drift was constant from April 5, 2010 until the measurements started, the actual expected time and date for the last "STS Right Handheld ESTOP" event, as recorded on the JNA0 event log, was between 2:59:32 PM and 2:59:38 PM on April 5, 2010.

Functional testing was conducted on Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1) on a Joy shearer test panel which mimicked the functionality of the shearer installed at the longwall. The purpose of this functional testing was to ensure that machine control system events monitored by the JNA system are properly interpreted by the JNA system, the proper actions were taken by the JNA system, and the appropriate events were properly recorded on the JNA0 event log. During the functional testing, machine functions were initiated by Exhibit No. PE-0238, Model TX1 remote control unit after being restored to working order. Events were stored in the Exhibit No. PE-0164 (JNA0) event log when expected. The functional testing indicated that Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1) functioned as expected.

Attempts were made to view the electronic event logs of additional JNA control units recovered during the accident investigation. No event logs were stored in Exhibit Nos. PE-0173, PE-0204, or PE-0269.

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APPENDIX A-1, PHOTOGRAPHS (JULY 20, 2010)

Photographs taken underground by the MSHA investigation team during the recovery of Exhibit Nos. PE-0164 (JNA0 unit) and PE-0165 (JNA1 unit) at the shearing machine installed at the mine.

1. Exhibit No. PE-0164, JNA0 unit display, as seen through window of middle bay of main controller
2. Exhibit No. PE-0164, JNA0 unit, middle bay of main controller enclosure (enclosure cover removed)
3. Foreground: Exhibit No. PE-0164, JNA0 unit, being removed from main controller enclosure; Background: Exhibit No. PE-0165, JNA1 unit
4. Exhibit No. PE-0164, JNA0 unit, without protective cover so that cable connectors may be removed
5. Exhibit No. PE-0164, JNA0 unit, being placed inside protective case
6. Exhibit No. PE-0164, JNA0 unit, inside protective case with connector cover installed
7. Exhibit No. PE-0165, JNA1 unit, inside enclosure with Exhibit No. PE-0164 (JNA0) unit removed
8. Exhibit No. PE-0165, JNA1 unit, with cables connected on reverse side of unit
9. Exhibit No. PE-0165, JNA1 unit, being placed inside protective case

APPENDIX A-2, PHOTOGRAPHS (JULY 23, 2010)

Photographs of the procedure of the viewing of data on Exhibit No. PE-0164, JNA0 unit, at the Joy facility in Franklin, PA, on July 23, 2010.

1. Exhibit No. PE-0164: Overall case of JNA0 Unit in Box
2. Exhibit No. PE-0164: Overall case of JNA0, Bottom
3. Exhibit No. PE-0164: Overall case of JNA0, Top
4. Exhibit No. PE-0164: Case opened of JNA0
5. Exhibit No. PE-0164: JNA0 Unit on Table (Removed from Box)
6. Exhibit No. PE-0164: Side view, showing MAP Cartridge still installed
7. Exhibit No. PE-0164: JNA0 Unit with Backplate Removed (Bottom Angle)
8. Exhibit No. PE-0164: JNA0 Unit with Backplate Removed (Top Angle)
9. Exhibit No. PE-0164: Back of Backplate (Removed from JNA0)
10. Exhibit No. PE-0164: Shot of Projector Screen and Laptop Screen (Showing the Official Time)
11. Exhibit No. PE-0164: JNA0 during boot-up

Slides 12 through 141: Exhibit No. PE-0164: JNA0 Event Log

142. Exhibit No. PE-0164: Parameters
143. Exhibit No. PE-0164: JNA System
144. Exhibit No. PE-0164: Parameters
145. Exhibit No. PE-0164: Optional Features
146. Exhibit No. PE-0164: Optional Features
147. Exhibit No. PE-0164: Optional Features
148. Exhibit No. PE-0164: Parameters
149. Exhibit No. PE-0164: Optional Features 2
150. Exhibit No. PE-0164: Parameters
151. Exhibit No. PE-0164: Overloads
152. Exhibit No. PE-0164: Overloads
153. Exhibit No. PE-0164: Parameters
154. Exhibit No. PE-0164: Motion
155. Exhibit No. PE-0164: Parameters
156. Exhibit No. PE-0164: Time Delays
157. Exhibit No. PE-0164: Time Delays
158. Exhibit No. PE-0164: Parameters
159. Exhibit No. PE-0164: Event Logger
160. Exhibit No. PE-0164: Parameters
161. Exhibit No. PE-0164: Machine Position
162. Exhibit No. PE-0164: Machine Position

163. Exhibit No. PE-0164: Parameters
164. Exhibit No. PE-0164: Parameters
165. Exhibit No. PE-0164: Speed Control
166. Exhibit No. PE-0164: Speed Control
167. Exhibit No. PE-0164: Speed Control
168. Exhibit No. PE-0164: Speed Control
169. Exhibit No. PE-0164: Parameters
170. Exhibit No. PE-0164: Speed Control 2
171. Exhibit No. PE-0164: Speed Control 2
172. Exhibit No. PE-0164: Parameters
173. Exhibit No. PE-0164: Transducers
174. Exhibit No. PE-0164: Main Menu
175. Exhibit No. PE-0164: Main Menu
176. Exhibit No. PE-0164: Histograms
177. Exhibit No. PE-0164: Left Haul Temp Histogram
178. Exhibit No. PE-0164: Main Menu
179. Exhibit No. PE-0164: Main Menu
180. Exhibit No. PE-0164: Meters
181. Exhibit No. PE-0164: Meters
182. Exhibit No. PE-0164: View Hourmeters
183. Exhibit No. PE-0164: Meters
184. Exhibit No. PE-0164: Main Menu
185. Exhibit No. PE-0164: Main Menu
186. Exhibit No. PE-0164: Overloads
187. Exhibit No. PE-0164: All Overloads
188. Exhibit No. PE-0164: Overloads
189. Exhibit No. PE-0164: LH Pump OL
190. Exhibit No. PE-0164: Main Menu
191. Exhibit No. PE-0164: Machine Switches
192. Exhibit No. PE-0164: Main Menu
193. Exhibit No. PE-0164: Motor Circuits
194. Exhibit No. PE-0164: Pump Logic
195. Exhibit No. PE-0164: Left Cutter Logic
196. Exhibit No. PE-0164: Right Cutter Logic
197. Exhibit No. PE-0164: Main Menu
198. Exhibit No. PE-0164: ESR Circuit
199. Exhibit No. PE-0164: Dataloss Logic
200. Exhibit No. PE-0164: ESR Circuit
201. Exhibit No. PE-0164: ESR Logic
202. Exhibit No. PE-0164: Main Menu

203. Exhibit No. PE-0164: Automatic Control
204. Exhibit No. PE-0164: Main Menu
205. Exhibit No. PE-0164: Remote Station Status Lights
206. Exhibit No. PE-0164: Picture of MAP intact with cover on JNA0
207. Exhibit No. PE-0164: Unit Back in Pelican Box
208. Exhibit No. PE-0164: JNA0 sealed in Pelican Box under Evidence tape

APPENDIX A-3, PHOTOGRAPHS (AUGUST 11, 2010)

Photographs of the procedure of the viewing of data on Exhibit No. PE-0204, JNA0 unit, at the Joy facility in Franklin, PA, on August 11, 2010.

1. Exhibit No. PE-0204: JNA0 Unit in protective case with original seal
2. Exhibit No. PE-0204: JNA0 Unit inside protective case
3. Exhibit No. PE-0204: connector side of JNA0 Unit with Matric repair tag
4. Exhibit No. PE-0204: close-up of MAP socket of JNA0 Unit
5. Exhibit No. PE-0204: close-up showing connectors of JNA0 Unit
6. Exhibit No. PE-0204: close-up showing connectors of JNA0 Unit
7. Exhibit No. PE-0204: connector side of JNA0 Unit, with additional repair tag
8. Exhibit No. PE-0204: connector side of JNA0 Unit; two Matric repair tags
9. Exhibit No. PE-0204: JNA0 Unit, initial start-up screen
10. Exhibit No. PE-0204: JNA0 Unit, start-up sequence
11. Exhibit No. PE-0204: JNA0 Unit, start-up sequence
12. Exhibit No. PE-0204: JNA0 Unit, start-up sequence
13. Exhibit No. PE-0204: JNA0 Unit, start-up sequence
14. Exhibit No. PE-0204: JNA0 Unit, start-up sequence
15. Exhibit No. PE-0204: JNA0 Unit, main menu
16. Exhibit No. PE-0204: JNA0 Unit event log
17. Exhibit No. PE-0204: JNA0 Unit event log
18. Exhibit No. PE-0204: JNA0 Unit event log
19. Exhibit No. PE-0204: JNA0 Unit main menu

APPENDIX A-4, PHOTOGRAPHS (NOVEMBER 19, 2010)

Photographs of the procedure of the functional testing of Exhibit Nos. PE-0164 (JNA0) and PE-0165 (JNA1), and the procedure of the viewing of data on Exhibit No. PE-0269 (JNA0) at the Matric Limited facility in Seneca, PA, on November 19, 2010.

1. JNA Test Set-up Area
2. Input-Output Layout Chart
3. Vertical Shot: Test Panel With Labels
4. Vertical Shot: Cables/Wiring Test Panel
5. Test Panel Components (JNA Test Set-up)
6. Test Area Shot
7. Joy Demo JNA0 Test Screen Joy Equipment Set-up (JNA Screens)
8. Joy Demo JNA0 Test Screen Joy Equipment Set-up (JNA Screens)
9. Joy Demo JNA0 Test Screen Joy Equipment Set-up (JNA Screens)
10. Panel Labels
11. Control Panel Labels/Buttons/Handles
12. Control Panel Labels
13. Vertical Shot Labels on Control Test Panel
14. Vertical Shot Labels on Control Test Panel
15. PE-0165 JNA Evidence Case (JNA1)
16. PE-0165 JNA Evidence Case Open
17. PE-0165 JNA1 – Tag/Serial #
18. PE-0165 JNA1 – Tag/Serial # Close-up JNA Unit Tag
19. PE-0165 JNA1 – Tag/Serial # Close-up JNA Unit Tag
20. PE-0165 JNA1 tested with Joy Sample JNA0: Screen – Start-up Joy Symbol
21. PE-0165 JNA1 tested with Joy Sample JNA0: Rt Trm VFD Communication Restored
22. PE-0165 JNA1 tested with Joy Sample JNA0: ESR ON – Screen
23. PE-0165 JNA1 tested with Joy Sample JNA0: Cutter Feedback (Screen)
24. PE-0165 JNA1 tested with Joy Sample JNA0: WRN LtVFD No Amps Reported (Screen)
25. PE-0165 JNA1 tested with Joy Sample JNA0: Screen Display SYS INBY LostComm
26. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor On Screen
27. PE-0165 JNA1 tested with Joy Sample JNA0: ERR LCutter Start False Amps Screen
28. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby Lost Comm With Outby Screen
29. PE-0165 JNA1 tested with Joy Sample JNA0: ERR Methane Monitor Interlck Screen
30. PE-0165 JNA1 tested with Joy Sample JNA0: ESR Off Screen
31. PE-0165 JNA1 tested with Joy Sample JNA0: ESR Off Screen

32. PE-0165 JNA1 tested with Joy Sample JNA0: ERR No 110VAC – Screen Display
33. PE-0165 JNA1 tested with Joy Sample JNA0: ERR No 110VAC – Screen Display
34. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor On Screen
35. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor On Screen
36. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm Screen
37. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm Screen
38. PE-0165 JNA1 tested with Joy Sample JNA0: ERR Left Handheld DataLoss Screen
39. PE-0165 JNA1 tested with Joy Sample JNA0: ESR OFF Screen
40. PE-0165 JNA1 tested with Joy Sample JNA0: ERR Left Handheld DataLoss Screen
41. PE-0165 JNA1 tested with Joy Sample JNA0: ERR Stuck Button Left Side Screen
42. PE-0165 JNA1 tested with Joy Sample JNA0: ESR OFF
43. PE-0165 JNA1 tested with Joy Sample JNA0: ERR Stuck Button Right Side
44. PE-0165 JNA1 tested with Joy Sample JNA0: ESR OFF
45. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor On Screen
46. PE-0165 JNA1 tested with Joy Sample JNA0: Data On DeSelected – Screen
47. PE-0165 JNA1 tested with Joy Sample JNA0: ERR Right Handheld DataLoss
48. PE-0165 JNA1 tested with Joy Sample JNA0: Both Stations Disconnected
49. PE-0165 JNA1 tested with Joy Sample JNA0: Right Cutter Jam Overload
50. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby Screen
51. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby Screen
52. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby Screen
53. PE-0165 JNA1 tested with Joy Sample JNA0: Tram Right – Screen
54. PE-0165 JNA1 tested with Joy Sample JNA0: Tram Right – Screen
55. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby – Screen
56. PE-0165 JNA1 tested with Joy Sample JNA0: Tram Left – Screen
57. PE-0165 JNA1 tested with Joy Sample JNA0: Rt Trm VFD Communication Restored Screen
58. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby
59. PE-0165 JNA1 tested with Joy Sample JNA0: ESR OFF – Screen
60. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby – Screen
61. PE-0165 JNA1 tested with Joy Sample JNA0: ESR ON – Screen
62. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor ON – Screen
63. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor ON – Screen

64. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor ON – Screen
65. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor ON – Screen
66. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby
67. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby
68. PE-0165 JNA1 tested with Joy Sample JNA0: Left Pump Overload Clear – Screen
69. PE-0165 JNA1 tested with Joy Sample JNA0: Left Pump Overload Clear – Screen
70. PE-0165 JNA1 tested with Joy Sample JNA0: ESR OFF – Screen
71. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor On
72. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby
73. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby
74. PE-0165 JNA1 tested with Joy Sample JNA0: Pump Motor On
75. PE-0165 JNA1 tested with Joy Sample JNA0: LH Cutter OL – Screen
76. PE-0165 JNA1 tested with Joy Sample JNA0: SYS Inby LostComm With Outby
77. PE-0165 JNA1 tested with Joy Sample JNA0: Left Cutter Ovrld Clear In 235
78. PE-0165 JNA1 tested with Joy Sample JNA0: Left Cutter Ovrld Clear In 220
79. PE-0164 Evidence Case – Closed
80. PE-0164 Evidence Case Open
81. PE-0164 Joy Tag – Metal Close-up S/N 56602AH003
82. PE-0164 JNA0 Unit In-Case
83. PE-0164 Joy Screen/JNA Unit
84. PE-0164 Start-up Screen
85. Joy Sample Remote Control Receiver Unit
86. Test Panel Controls
87. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF – Screen
88. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF – Screen
89. PE-0164 JNA0 tested with PE-0165 JNA1: ERR LCutt – Screen
90. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
91. PE-0164 JNA0 tested with PE-0165 JNA1: ERR LCutter Start – Screen
92. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
93. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF – Screen
94. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Methane Monitor Interlck (Screen)
95. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF
96. PE-0164 JNA0 tested with PE-0165 JNA1: Remote Motor Start – Screen
97. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON – Screen
98. PE-0164 JNA0 tested with PE-0165 JNA1: ERR No 110VAC ESR Feedback

99. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF – Screen
100. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
101. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor WRN LtVFD No Amps Reported Screen
102. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
103. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
104. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
105. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
106. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
107. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
108. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
109. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
110. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
111. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
112. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
113. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
114. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
115. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Left Handheld DataLoss – Screen
116. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Left Handheld DataLoss – Screen
117. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Left Handheld DataLoss – Screen
118. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
119. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss
120. PE-0164 JNA0 tested with PE-0165 JNA1: Data On Deselected – Screen
121. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss – Screen
122. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Left Handheld DataLoss – Screen
123. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Left Handheld DataLoss – Screen
124. PE-0164 JNA0 tested with PE-0165 JNA1: Data On Deselected Rite Side
125. PE-0164 JNA0 tested with PE-0165 JNA1: Both Stations Disconnected
126. PE-0164 JNA0 tested with PE-0165 JNA1: 3 Phase Ac Amp – Screen
127. PE-0164 JNA0 tested with PE-0165 JNA1: Right Cutter Jam Overload

128. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
129. PE-0164 JNA0 tested with PE-0165 JNA1: Remote Motor Start – Screen
130. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On – Screen
131. PE-0164 JNA0 tested with PE-0165 JNA1: WRN LtVFD No Amps Reported
132. PE-0164 JNA0 tested with PE-0165 JNA1: Tram Right – Screen
133. PE-0164 JNA0 tested with PE-0165 JNA1: Rt Tram VFD Off: Current Present
134. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON – Screen
135. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
136. PE-0164 JNA0 tested with PE-0165 JNA1: WRN LtVFD No Amps Reported
137. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
138. PE-0164 JNA0 tested with PE-0165 JNA1: Tram Right – Screen
139. PE-0164 JNA0 tested with PE-0165 JNA1: Tram Right – Screen
140. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON – Screen
141. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON – Screen
142. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON – Screen
143. PE-0164 JNA0 tested with PE-0165 JNA1: VFD Trip Cleared – Screen
144. PE-0164 JNA0 tested with PE-0165 JNA1: ESR On – Screen
145. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby Screen
146. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On Screen
147. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On Screen
148. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
149. PE-0164 JNA0 tested with PE-0165 JNA1: Left Pump Overload Clear In 226
150. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF
151. PE-0164 JNA0 tested with PE-0165 JNA1: Left Pump Jam Overload
152. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
153. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
154. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On
155. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
156. PE-0164 JNA0 tested with PE-0165 JNA1: Rt Pump Overload Clear In 225
157. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
158. PE-0164 JNA0 tested with PE-0165 JNA1: Rt Pump Overload Clear In 30
159. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF
160. PE-0164 JNA0 tested with PE-0165 JNA1: Left Cutter Ovrld Clear In 240
161. PE-0164 JNA0 tested with PE-0165 JNA1: Left Cutter Ovrld Clear In 225

162. PE-0164 JNA0 tested with PE-0165 JNA1: SYS Inby LostComm With Outby
163. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On
164. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON
165. PE-0164 JNA0 tested with PE-0165 JNA1: STS Right Handheld Estop
166. PE-0164 JNA0 tested with PE-0165 JNA1: ESR ON
167. PE-0164 JNA0 tested with PE-0165 JNA1: Pump Motor On
168. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF
169. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF – Screen
170. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss
171. PE-0164 JNA0 tested with PE-0165 JNA1: STS Right Handheld Estop
172. PE-0164 JNA0 tested with PE-0165 JNA1: ERR Right Handheld DataLoss
173. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF
174. PE-0164 JNA0 tested with PE-0165 JNA1: ESR OFF
175. PE-0269 Evidence Box: JNA Unit – Closed S/N 50905T002
176. PE-0269 Evidence Box: JNA Unit – Closed S/N 50905T002
177. PE-0269 Box Open – Showing – JNA Wrapped in Plastic Inside Box
178. PE-0269 JNA in Plastic Bag
179. PE-0269 JNA on Work Bench
180. PE-0269 JNA Joy Tag
181. PE-0269 JNA Unit Serial #'s
182. PE-0269 JNA Unit #'s Close-up
183. PE-0269 JNA Unit on Bench Table Top
184. PE-0269 Matric Tag - Close-up
185. PE-0269 Matric Tag - Close-up
186. PE-0164 Evidence Case
187. PE-0165 Top of Case – Evidence
188. PE-0165 Evidence Case – Different Angle

APPENDIX B - EXHIBIT NO. PE-0164 EVENT LOG

Event log of April 5, 2010 for JNA0 Unit, Exhibit No. PE-0164, with recorded event times corrected due to time drift analysis.

Recorded Time	Earliest	Latest	Event
4:53:03	0:59:56	1:00:01	Sys Power Reset
4:53:40	1:00:33	1:00:38	Testing Current Sensors…
4:53:40	1:00:33	1:00:38	Tram Cntl in Normal Ops Mode
4:53:45	1:00:38	1:00:43	Left Tram VFD Comm Restored
4:53:45	1:00:38	1:00:43	Right Tram VFD Comm Restored
4:53:45	1:00:38	1:00:43	SYS Inby Lost Comm with Outby
4:53:53	1:00:46	1:00:51	Current Sensor Test - Passed
4:53:53	1:00:46	1:00:51	Both Stations Disconnected
4:54:28	1:01:21	1:01:26	ERR Stuck Button Left Side
4:54:28	1:01:21	1:01:26	ERR Right Handheld Dataloss
6:18:51	2:25:44	2:25:49	ERR Left Handheld Dataloss
7:30:41	3:37:34	3:37:39	STS Left Handheld Estop
7:30:42	3:37:35	3:37:40	ERR Left Handheld Dataloss
9:24:05	5:30:58	5:31:03	STS Left Handheld Estop
9:24:07	5:31:00	5:31:05	ERR Left Handheld Dataloss
9:38:15	5:45:08	5:45:13	STS Left Handheld Estop
9:38:16	5:45:09	5:45:14	ERR Left Handheld Dataloss
9:50:59	5:57:52	5:57:57	STS Left Handheld Estop
9:51:00	5:57:53	5:57:58	ERR Left Handheld Dataloss
9:57:48	6:04:41	6:04:46	STS Left Handheld Estop
9:57:50	6:04:43	6:04:48	ERR Left Handheld Dataloss
9:57:53	6:04:46	6:04:51	Both Stations Disconnected
10:43:14	6:50:07	6:50:12	ERR Left Handheld Dataloss
10:43:38	6:50:31	6:50:36	Both Stations Disconnected
10:43:40	6:50:33	6:50:38	ERR Left Handheld Dataloss
10:43:44	6:50:37	6:50:42	Both Stations Disconnected
10:43:46	6:50:39	6:50:44	ERR Left Handheld Dataloss
10:47:36	6:54:29	6:54:34	Both Stations Disconnected
10:47:38	6:54:31	6:54:36	ERR Left Handheld Dataloss
10:50:40	6:57:33	6:57:38	Both Stations Disconnected
10:50:43	6:57:36	6:57:41	ERR Left Handheld Dataloss
10:51:17	6:58:10	6:58:15	Both Stations Disconnected
10:51:20	6:58:13	6:58:18	ERR Left Handheld Dataloss
10:51:21	6:58:14	6:58:19	Both Stations Disconnected
10:51:22	6:58:15	6:58:20	ERR Left Handheld Dataloss
10:51:22	6:58:15	6:58:20	Both Stations Disconnected
10:51:24	6:58:17	6:58:22	ERR Left Handheld Dataloss
10:51:24	6:58:17	6:58:22	Both Stations Disconnected
10:51:29	6:58:22	6:58:27	ERR Left Handheld Dataloss
10:51:36	6:58:29	6:58:34	Both Stations Disconnected
10:51:39	6:58:32	6:58:37	ERR Left Handheld Dataloss
10:51:48	6:58:41	6:58:46	Both Stations Disconnected

Recorded Time	Earliest	Latest	Event
10:51:50	6:58:43	6:58:48	ERR Left Handheld Dataloss
10:51:54	6:58:47	6:58:52	Both Stations Disconnected
10:51:59	6:58:52	6:58:57	ERR Left Handheld Dataloss
10:52:00	6:58:53	6:58:58	Both Stations Disconnected
10:52:06	6:58:59	6:59:04	ERR Left Handheld Dataloss
10:52:08	6:59:01	6:59:06	Both Stations Disconnected
10:52:10	6:59:03	6:59:08	ERR Left Handheld Dataloss
10:52:12	6:59:05	6:59:10	Both Stations Disconnected
10:52:17	6:59:10	6:59:15	ERR Left Handheld Dataloss
10:59:57	7:06:50	7:06:55	STS Right Handheld Estop
11:01:18	7:08:11	7:08:16	Data on Deselected Left Side
11:01:19	7:08:12	7:08:17	ERR No 110 VAC ESR Feedback
11:03:05	7:09:58	7:10:03	Left VFD Overcurrent Trip
11:03:06	7:09:59	7:10:04	VFD Trip Cleared
11:03:24	7:10:17	7:10:22	STS Right Handheld Estop
11:03:46	7:10:39	7:10:44	STS Right Handheld Estop
11:03:48	7:10:41	7:10:46	STS Right Handheld Estop
11:04:02	7:10:55	7:11:00	STS Right Handheld Estop
11:04:10	7:11:03	7:11:08	ERR Left Handheld Dataloss
11:04:14	7:11:07	7:11:12	Both Stations Disconnected
11:04:39	7:11:32	7:11:37	STS Right Handheld Estop
11:04:46	7:11:39	7:11:44	STS Right Handheld Estop
11:04:55	7:11:48	7:11:53	STS Right Handheld Estop
11:04:56	7:11:49	7:11:54	ERR Right Handheld Dataloss
11:05:44	7:12:37	7:12:42	STS Right Handheld Estop
11:07:03	7:13:56	7:14:01	STS Right Handheld Estop
11:19:00	7:25:53	7:25:58	Both Stations Disconnected
11:29:01	7:35:54	7:35:59	STS Right Handheld Estop
11:29:32	7:36:25	7:36:30	ERR Right Handheld Dataloss
11:29:53	7:36:46	7:36:51	STS Right Handheld Estop
11:30:00	7:36:53	7:36:58	STS Right Handheld Estop
11:30:33	7:37:26	7:37:31	STS Right Handheld Estop
11:30:39	7:37:32	7:37:37	STS Right Handheld Estop
11:30:42	7:37:35	7:37:40	STS Right Handheld Estop
11:30:44	7:37:37	7:37:42	STS Right Handheld Estop
11:30:47	7:37:40	7:37:45	STS Right Handheld Estop
11:30:49	7:37:42	7:37:47	STS Right Handheld Estop
11:30:51	7:37:44	7:37:49	STS Right Handheld Estop
11:30:53	7:37:46	7:37:51	STS Right Handheld Estop
11:30:54	7:37:47	7:37:52	STS Right Handheld Estop
11:31:10	7:38:03	7:38:08	STS Right Handheld Estop
11:31:11	7:38:04	7:38:09	Both Stations Disconnected
11:39:41	7:46:34	7:46:39	Both Stations Disconnected
11:39:42	7:46:35	7:46:40	STS Left Handheld Estop
11:40:02	7:46:55	7:47:00	ERR Left Handheld Dataloss
11:40:22	7:47:15	7:47:20	STS Left Handheld Estop
11:40:41	7:47:34	7:47:39	OVL JAM Warning - RH Cutt

Recorded Time	Earliest	Latest	Event
11:40:41	7:47:34	7:47:39	OVL JAM Trip - RH Cutt
11:42:56	7:49:49	7:49:54	STS Right Handheld Estop
11:42:57	7:49:50	7:49:55	ERR No 110 VAC ESR Feedback
11:44:14	7:51:07	7:51:12	Both Stations Disconnected
11:44:19	7:51:12	7:51:17	STS Right Handheld Estop
11:44:36	7:51:29	7:51:34	STS Right Handheld Estop
11:45:07	7:52:00	7:52:05	STS Right Handheld Estop
11:45:31	7:52:24	7:52:29	STS Right Handheld Estop
11:45:32	7:52:25	7:52:30	STS Right Handheld Estop
11:45:59	7:52:52	7:52:57	STS Right Handheld Estop
11:46:04	7:52:57	7:53:02	STS Right Handheld Estop
11:46:27	7:53:20	7:53:25	STS Right Handheld Estop
11:46:57	7:53:50	7:53:55	STS Right Handheld Estop
11:52:05	7:58:58	7:59:03	STS Right Handheld Estop
12:54:01	9:00:54	9:00:59	STS Left Handheld Estop
13:00:53	9:07:46	9:07:51	STS Right Handheld Estop
13:35:53	9:42:46	9:42:51	STS Right Handheld Estop
14:02:46	10:09:39	10:09:44	STS Right Handheld Estop
14:08:10	10:15:03	10:15:08	Both Stations Disconnected
14:08:34	10:15:27	10:15:32	Both Stations Disconnected
14:08:48	10:15:41	10:15:46	Both Stations Disconnected
14:08:50	10:15:43	10:15:48	STS Right Handheld Estop
14:09:13	10:16:06	10:16:11	STS Right Handheld Estop
14:09:33	10:16:26	10:16:31	STS Right Handheld Estop
14:10:43	10:17:36	10:17:41	Both Stations Disconnected
14:10:54	10:17:47	10:17:52	STS Right Handheld Estop
14:11:03	10:17:56	10:18:01	STS Right Handheld Estop
14:11:27	10:18:20	10:18:25	STS Right Handheld Estop
14:11:52	10:18:45	10:18:50	STS Right Handheld Estop
14:12:02	10:18:55	10:19:00	STS Right Handheld Estop
14:12:03	10:18:56	10:19:01	STS Right Handheld Estop
14:12:12	10:19:05	10:19:10	STS Right Handheld Estop
14:12:28	10:19:21	10:19:26	STS Right Handheld Estop
14:12:32	10:19:25	10:19:30	STS Right Handheld Estop
14:12:37	10:19:30	10:19:35	STS Right Handheld Estop
14:16:51	10:23:44	10:23:49	STS Right Handheld Estop
14:16:52	10:23:45	10:23:50	ERR Right Handheld Dataloss
14:17:05	10:23:58	10:24:03	Both Stations Disconnected
14:17:06	10:23:59	10:24:04	ERR Right Handheld Dataloss
14:17:06	10:23:59	10:24:04	Both Stations Disconnected
14:32:32	10:39:25	10:39:30	ERR Left Handheld Dataloss
14:45:18	10:52:11	10:52:16	STS Right Handheld Estop
14:45:20	10:52:13	10:52:18	ERR Right Handheld Dataloss
15:07:59	11:14:52	11:14:58	Both Stations Disconnected
15:18:47	11:25:40	11:25:46	ERR Right Handheld Dataloss
15:18:47	11:25:40	11:25:46	Data On Deselected Left Side
15:33:07	11:40:00	11:40:06	STS Left Handheld Estop

Recorded Time	Earliest	Latest	Event
15:33:08	11:40:01	11:40:07	ERR Left Handheld Dataloss
16:37:24	12:44:17	12:44:23	STS Left Handheld Estop
16:37:25	12:44:18	12:44:24	ERR Left Handheld Dataloss
17:25:56	13:32:49	13:32:55	Data On Deselected Rite Side
17:26:20	13:33:13	13:33:19	STS Left Handheld Estop
17:26:21	13:33:14	13:33:20	ERR Left Handheld Dataloss
17:30:43	13:37:36	13:37:42	ERR Right Handheld Dataloss
17:42:09	13:49:02	13:49:08	STS Right Handheld Estop
17:42:10	13:49:03	13:49:09	ERR Right Handheld Dataloss
17:50:52	13:57:45	13:57:51	STS Left Handheld Estop
17:50:54	13:57:47	13:57:53	ERR Left Handheld Dataloss
18:09:56	14:16:49	14:16:55	STS Right Handheld Estop
18:52:39	14:59:32	14:59:38	STS Right Handheld Estop
18:52:41	14:59:34	14:59:40	ERR Right Handheld Dataloss

APPENDIX C – JNA EVENTS HELP TEXT

Help text for events recorded in the electronic event log of April 5, 2010, Exhibit No. PE-0164, JNA0 unit. The event log consisted of a listing of machine status codes and error messages.

Event	Event Help Text	Additional Info
SYS Power Reset	EVENT 0001: The JNA System has had it's power reset. If this event seems to happen too often or at unexpected times, then the events are most likely caused by a problem with the wiring of the power to Unit 0. Check all wires and connectors in the circuit feeding power to the unit. It is also possible that Unit 0 has an internal power supply fault that would produce the same symptoms. ***** END *****	This event will always be the first event logged when the JNA system is powered on.
Testing Current Sensors	EVENT 3287: No Help Text	The JNA system induces a voltage through a test winding of the pump and cutter motor current sensor during JNA system power up. This event indicates that the test has been started.
Tram Cntl in Normal Ops Mode	EVENT 3436: The tram system is being controlled by normal operating parameters.	
Both Stations Disconnected	EVENT 3265: No Help Text	This event will not always occur on JNA system power up - it is dependent on the position of the station selector switch and if the left/right radio is powered.
OVL Sensor Failed - LH Pump	EVENT 3590: An unexpected reading from the Left Pump motor motor current sensor has occurred. Please check the current sensor's circuit. If connections seem to be correct, consider replacing the current sensor.	This event indicates the Left Pump motor has failed the current sensor test. The Left Pump will be disabled until the circuit is corrected.

Event	Event Help Text	Additional Info
OVL Sensor Failed - RH Pump	EVENT 3598: An unexpected reading from the Right Pump motor motor current sensor has occurred. Please check the current sensor's circuit. If connections seem to be correct, consider replacing the current sensor.	This event indicates the Right Pump motor has failed the current sensor test. The Right Pump will be disabled until the circuit is corrected.
OVL Sensor Failed - LH Cutt	EVENT 3606: An unexpected reading from the left cutter motor current sensor has occurred. Please check the current sensor's circuit. If connections seem to be correct, consider replacing the current sensor.	This event indicates the Left Cutter motor has failed the current sensor test. The Left Cutter will be disabled until the circuit is corrected.
OVL Sensor Failed - RH Cutt	EVENT 3614: An unexpected reading from the right cutter motor current sensor has occurred. Please check the current sensor's circuit. If connections seem to be correct, consider replacing the current sensor.	This event indicates the Right Cutter motor has failed the current sensor test. The Right Cutter will be disabled until the circuit is corrected.
Current Sensor Test - Failed	EVENT 3288: No Help Text	This event reports the results of the current sensor test. The JNA system has deteceted a problem with the current sensor, current sensor to JNA wiring or the JNA units. The failed motor current detection circuit will be identified by individual events.
Current Sensor Test - Passed	EVENT 3289: No Help Text	This event reports the results of the current sensor test. The JNA system has detected that all current sensor circuits are fully functional.
Left VFD Comm Restored	EVENT 3460: The communication link from the left tram inverter to the JNA control system has been restored. All possible causes for the loss of communication have been cleared.	This event indicates the initial comms link to the Left VFD has been established.
Right VFD Comm Restored	EVENT 3461: The communication link from the right tram inverter to the JNA control system has been restored. All possible causes for the loss of communication have been cleared.	This event indicates the initial comms link to the Right VFD has been established.

Event	Event Help Text	Additional Info
SYS Inby LostComm with Outby	The Inby JNA System has lost communications with the Outby JNA System. If this event seems to happen too often or at unexpected times, then the events are most likely caused by a problem with the wiring of the Line Coupler. Check all wires and connectors in the circuit between the JNA Unit and the Line Coupler and between the Line Coupler and the high voltage 3 phase lines and ground. It is also possible that there is an internal failure in the JNA Unit that contains the interface to the Line Coupler.	This event will always be shown when the JNA system is powered on if outby comms are down.
Data on Deselected Left Side	EVENT 3263: No Help Text	Indicates left radio detected when station selector is set to right only.
Data on Deselected Rite Side	EVENT 3264: No Help Text	Indicates right radio detected when station selector is set to left only.
STS Left Handheld Estop	EVENT 3252: The data from the Left Handheld dropped out for 0.5 to 1.5 seconds. It is assumed that estop caused this data dropout	
STS Right Handheld Estop	EVENT 3256: The data from the Right Handheld dropped out for 0.5 to 1.5 seconds. It is assumed that estop caused this data dropout.	
ERR Left Handheld Dataloss	EVENT 3253: The data from the Left Handheld dropped out for more than 1.5 seconds. This is assumed to be a dataloss.	
ERR Right Handheld Dataloss	EVENT 3257: The data from the Right Handheld dropped out for more than 1.5 seconds. This is assumed to be a dataloss.	

Event	Event Help Text	Additional Info
OVL Jam Warning - RH Cutt	EVENT 3613: The right cutter motor is nearing a jam trip. Be aware that a jam trip may soon occur. For more information, check the pages in the OVERLOADS menu.	
OVL Jam Trip - RH Cutt	EVENT 3611: The right cutter motor jam overload has tripped.	
OVL Jam Warning - RH Tram	EVENT 3637: The right haulage motor is nearing a jam trip. Be aware that a jam trip may soon occur. For more information, check the pages in the OVERLOADS menu.	
OVL Jam Trip - RH Tram	EVENT 3635: The right haulage motor jam overload has tripped.	
ERR No 110 VAC ESR Feedback	EVENT 3180: The 110 volt AC signal supplied by the ESR relay has not been received by the JNA control system. The ESROn command has been turned off. Check the wiring from the ESR relay to the JNA control system. Also check the ESR relay to ensure that it is not faulty.	
Left VFD Overcurrent Trip	EVENT 3480: The left variable frequency drive has tripped due to an overcurrent condition.	This condition is reported by the VFD - JNA receives a trip bit from the drive and will simply display this message.
VFD Trip Cleared	EVENT 3483: No Help Text	This message indicates that a VFD trip bit is no longer being receive from the VFD.
ERR Stuck Button Left Side	EVENT 3254: A Button press was detected while the left station was powering up.	

APPENDIX D – EVENTS USED FOR FUNCTIONAL TESTING OF EXHIBIT NOS. PE-0164 AND PE-0165

The events listed below are those that the investigation team asked Joy to simulate. Joy indicated that some of the events were no longer used or the events could not be simulated on the Joy test panel. Therefore, some of the events listed are shaded. The events that are non- shaded or lightly shaded were those that were simulated during the functional test; events that are darkly shaded could not be simulated during the functional test.

Event can be generated on Joy test panel
Event is no longer used and has been replaced by another event
Event is no longer used and has no replacement or event cannot be simulated on Joy test panel

Item	EVENT #	STATUS TEXT	Reply To MSHA
1	3072	ERR PUMP RUN NO ESR	Not used in 100173695-05 Replaced by 3180 - SEE ITEM 9
2	3079	ERR PUMP STARTNOESR	Not used in 100173695-05
3	3096	ERR LEFT CUTTER RUN NO PUMP	Not used in 100173695-05
4	3100	ERR LCUTT RUN NO MOTOR AMPS	1. Energize left cutter motor 2. Use left cutter current pot to reduce simulated motor amps to 0
5	3101	ERR LCUTTER START NO PUMP	Not used in 100173695-05
6	3105	ERR LCUTTER START FALSE AMPS	1. Begin motor start process 2. Simulate motor current before start delay expires
7	3106	ERR RIGHT CUTTER RUN NO PUMP	Not used in 100173695-05
8	3174	ERR METHANE MONITOR INTERLCK	1. Energize pump, cutter and haulage motors 2. Use Methane Monitor switch on panel to generate methane fault
9	3180	ERR NO 110 V AC ESR FEEDBACK	1. Energize ESR 2. Remove ESR relay from socket
10	3200	ERR LEFT HAULAGE MOTOR RTD	Replaced by 3511 1. Energize pump and haulage motors 2. Use left haulage motor RTD pot to increase temp to >180 deg C
11	3201	ERR RIGHT HAULAGE MOTOR RTD	Replaced by 3511 1. Energize pump and haulage motors 2. Use left haulage motor RTD pot to increase temp to >180 deg C

Item	EVENT #	STATUS TEXT	Reply To MSHA
12	3203	ERR PUMP START NO ESR	Not used in 100173695-05
13	3251	ERR LEFT HANDHELD DROPOUT	No way to force dropout
14	3252	STS LEFT HANDHELD ESTOP	1. With radio powered on press the estop button
15	3253	ERR LEFT HANDHELD DATALOSS	1. With radio powered on disconnect the radio from cable
16	3254	ERR STUCK BUTTON LEFT SIDE	1. With radio off, press and hold any button except 2nd/On 2. Power radio on while continuing to hold "stuck" button
17	3255	ERR RIGHT HANDHELD DROPOUT	No way to force dropout
18	3256	STS RIGHT HANDHELD ESTOP	1. With radio powered on press the estop button
19	3257	ERR RIGHT HANDHELD DATALOSS	1. With radio powered on disconnect the radio from cable
20	3258	ERR STUCK BUTTON RIGHT SIDE	1. With radio off, press and hold any button except 2nd/On 2. Power radio on while continuing to hold "stuck" button
21	3259	PUMP MOTOR ON	Not recorded in event log 1. Start pump motor
22	3263	DATA ON DESELECTED LEFT SIDE	1. Place station selector switch in Right Only position 2. Turn on left radio
23	3264	DATA ON DESELECTED RITE SIDE	1. Place station selector switch in Left Only position 2. Turn on right radio
24	3265	BOTH STATIONS DISCONNECTED	1. Place station selector switch in Both position 2. Turn on left and right radios 3. Turn off left or right radio 4. Turn off the remaining radio
25	3279	LEFT PUMP JAM OVERLOAD	Not used in 100173695-05 Replaced by 3587 - SEE ITEM 42
26	3280	RIGHT PUMP JAM OVERLOAD	Not used in 100173695-05 Replaced by 3595 - SEE ITEM 46
27	3281	LEFT CUTTER JAM OVERLOAD	Not used in 100173695-05 Replaced by 3603 - SEE ITEM 49
28	3282	RIGHT CUTTER JAM OVERLAOD	Not used in 100173695-05 Replaced by 3611 1. Start Pump and cutter motors 2. Increase simulated motor current to 282 amps
29	3284	LEFT HAULAGE JAM OVERLOAD	Not used in 100173695-05 Replaced by 3627 Not setup to simulate 3627 on panel
30	3285	RIGHT HAULAGE JAM OVERLOAD	Not used in 100173695-05 Replaced by 3635 Not setup to simulate 3635 on panel
31	3327	REMOTE MOTOR START DISABLED	Not recorded in event log 1. Set Optional Features.Remote Motor Start to 0 2. Energize ESR 3. Press and hold 2nd + Halt buttons to attempt remote start

Item	EVENT #	STATUS TEXT	Reply To MSHA
32	3425	LEFT TRM MTRTRQ SHAFT BREAK	1. Energize pump and haulage motors 2. Verify that haulage motor freq is greater than Speed Control 2.Breakage Low Frequency (default = 25) 3. Set the left haulage motor current greater than 10 amps and less than Speed Control 2.Shaft Break Lo Setpt (default = 50) 4. Set the right haulage motor current greater than Speed Control 2.Shaft Break Hi Setpt (default = 70) 5. Maintain the above for the duration of Speed Control 2.Shaft Break Timer (default = 20)
33	3426	RGHT TRM MTR TRQ SHAFT BREAK	1. Energize pump and haulage motors 2. Verify that haulage motor freq is greater than Speed Control 2.Breakage Low Frequency (default = 25) 3. Set the right haulage motor current greater than 10 amps and less than Speed Control 2.Shaft Break Lo Setpt (default = 50) 4. Set the left haulage motor current greater than Speed Control 2.Shaft Break Hi Setpt (default = 70) 5. Maintain the above for the duration of Speed Control 2.Shaft Break Timer (default = 20)
34	3450	LT TRAM VFD IN CURRENT LIMIT	Not setup to simulate on panel
35	3451	RT TRAM VFD IN CURRENT LIMIT	Not setup to simulate on panel
36	3475	LEFT VFD OVERVOLTAGE TRIP	With power off. Connect negative of 9 V battery to X3/pin 2 (negative bus) and positive to TP19 through NO switch. With power on, momentarily close switch. NOTE: battery circuit at bus potential.
37	3476	RIGHT VFD OVERVOLTAGE TRIP	With power off. Connect negative of 9 V battery to X3/pin 2 (negative bus) and positive to TP19 through NO switch. With power on, momentarily close switch. NOTE: battery circuit at bus potential.
38	3480	LEFT VFD OVERCURRENT TRIP	Prepare jumper with 33 R resistor. Apply momentarily from center pin of TPX10 or TPX12 (CT inputs) to TP6 (+15 V) or TP7 (-15 V). NOTE: resistor will get hot.
39	3481	RIGHT VFD OVERCURRENT TRIP	Prepare jumper with 33 R resistor. Apply momentarily from center pin of TPX10 or TPX12 (CT inputs) to TP6 (+15 V) or TP7 (-15 V). NOTE: resistor will get hot.
40	3483	VFD TRIP CLEARED	Will be generate when above events 3475/3476/3480/3481 clear
41	3586	OVL THERMAL WARN. - LH PUMP	1. Start Pump motor 2. Increase simulated motor current to 45 amps 3. When Thermal OL meter reaches 90% warning will be generated
42	3587	OVL JAM TRIP - LH PUMP	1. Start Pump motor 2. Increase simulated motor current to 48 amps

Item	EVENT #	STATUS TEXT	Reply To MSHA
43	3589	OVL JAM WARNING - LHPUMP	Note: This event is hard to generate on the panel without generating a 3587 1. Start Pump motor 2. Increase simulated motor current to just below 48 amps
44	3592	OVL THERMALTRIP-RHPUMP	1. Start Pump motor 2. Increase simulated motor current to 45 amps 3. Thermal OL meter will begin to increase over several minutes Thermal OL will take 4 minutes to clear before pumps can be started again
45	3594	OVL THERMAL WARN. - RHPUMP	1. Start Pump motor 2. Increase simulated motor current to 45 amps 3. When Thermal OL meter reaches 90% warning will be generated
46	3595	OVL JAM TRIP - RH PUMP	1. Start Pump motor 2. Increase simulated motor current to 48 amps
47	3600	OVL THERMAL TRIP - LH CUTT	1. Start Pump and cutter motors 2. Increase simulated motor current to 270 amps 3. Thermal OL meter will begin to increase over several minutes Thermal OL will take 4 minutes to clear before cutters can be started again
48	3602	OVL THERMAL WARN - LH CUTT	1. Start Pump and cutter motors 2. Increase simulated motor current to 270 amps 3. When Thermal OL meter reaches 90% warning will be generated
49	3603	OVL JAM TRIP - LH CUTT	1. Start Pump and cutter motors 2. Increase simulated motor current to 282 amps
50	3605	OVL JAM WARNING -LH CUTT	Note: This event is hard to generate on the panel without generating a 3603 1. Start Pump motor 2. Increase simulated motor current to just below 282 amps

APPENDIX E - MSHA PERSONNEL INVOLVED IN THE INVESTIGATION

Mine Safety and Health Administration

Dean Cripps
Kenneth Darby
Kevin Hedrick
Robert Holubeck
Matthew Heightland
Charles J. Maggard

APPENDIX Y

EXECUTIVE SUMMARY OF INVESTIGATION OF A DIGITAL VIDEO RECORDER (DVR)

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 17, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Investigation of a Digital Video Recorder (DVR) Recovered from Performance Coal Company's Upper Big Branch – South Mine

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted a laboratory investigation of a 3xLogic Vigil Model DVR-8WM-1000 Digital Video Recorder (DVR) recovered from a fatal mine explosion at the Upper Big Branch Mine-South on April 5, 2010.

The investigation began with a brief inspection of the DVR assigned the Exhibit Number PE-0004A. The time and date recorded by the internal clock of the DVR was displayed and observed over a period of approximately seven months. This time was compared to presumed accurate time clocks. The rate of change was calculated from this data; and used to extrapolate the DVR's time on April 5, 2010.

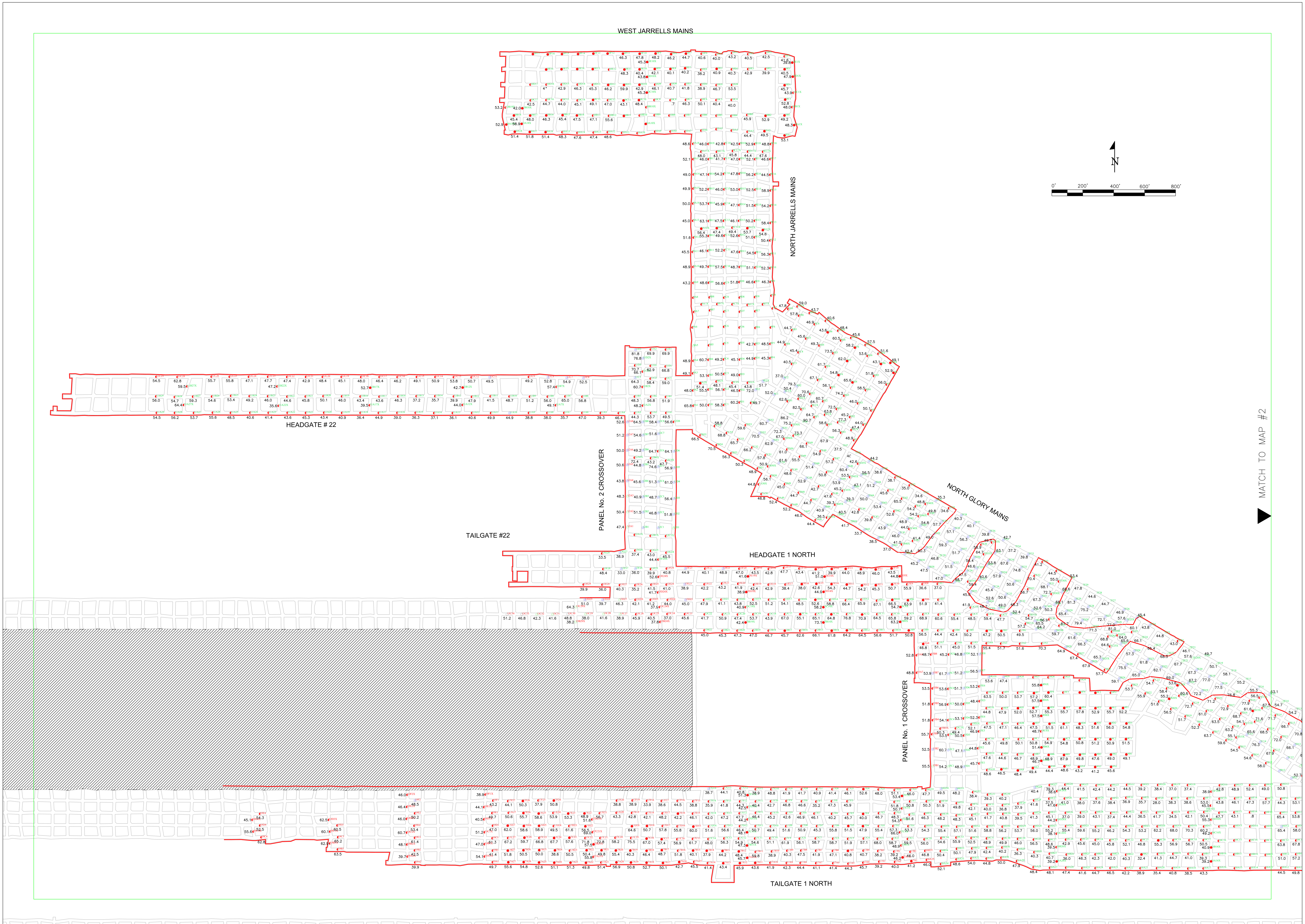
This DVR was essentially a personal computer using the Windows XP Embedded environment running specialized DVR software. The DVR featured an internal clock. The length of a time period measured by these clocks can deviate from the length of the same time period measured by more precise means; one second measured by the DVR can differ from one second as measured by the National Institute of Standards and Technology (NIST).

In laboratory environmental conditions, it was noted that the clock did, indeed, differ from that obtained from external sources. Given the tolerances of each time measurement, calculations were made to determine the minimum and maximum rates of drift of the instruments' internal clocks as compared to the time from external sources.

The hard drives in the DVR were scrutinized to find the file with the last recorded file time prior to an extended period of inactivity leading to approximately 10:00 PM on

April 5, 2010. The inactivity period would indicate that power was removed from the DVR. It was reported that power was removed from the DVR circuitry by the explosion and was not re-established until after 10:00 PM on April 5, 2010. The minimum and maximum drift rates were then used to correlate the time for that file time to presumed accurate time from external sources.

The latest file time was found to be 2:57:00 PM. It should be noted that this was the last file time to be recorded. Due to the method used by the DVR to write files to the disk, the power may have been lost at any time in the one minute period immediately following that time. If the drift was constant from April 5, 2010, until MSHA began taking measurements, the actual expected time and date for the over-range events is 3:01:34 PM to 3:02:50 PM.



EXTENT OF FLAME
53.6 INCOMBUSTIBLE CONTENT (PERCENT)
17E14 SAMPLE NUMBER (INTAKE AIR COURSE)
13F18 SAMPLE NUMBER (RETURN AIR COURSE)

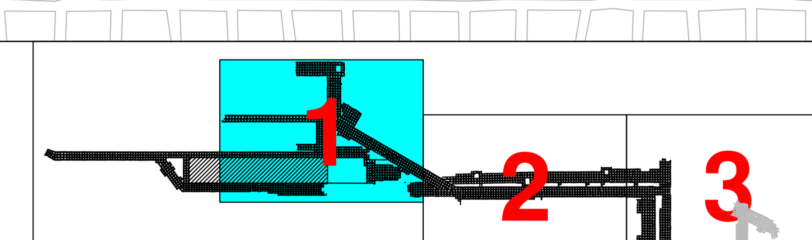
AMOUNT OF COKING

- NONE
- TRACE
- SMALL
- LARGE
- EXTRA LARGE

LEGEND
Scale 1"=200'

MAPPING NOTES

LOCATION OF COLLECTED MINE DUST SURVEY SAMPLES, AND RESULTS OF COKING AND INCOMBUSTIBLE CONTENT ANALYSIS.



APPENDIX Z–1
Mine Map Showing Extent of Flame, Incombustible Content, and Coke
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46–08436

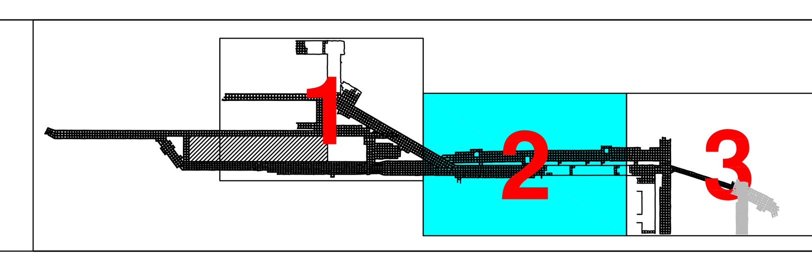
EXTENT OF FLAME
53.6 INCOMBUSTIBLE CONTENT (PERCENT)
17E14 SAMPLE NUMBER (INTAKE AIR COURSE)
13F18 SAMPLE NUMBER (RETURN AIR COURSE)

AMOUNT OF COKING
- NONE
- TRACE
- SMALL
- LARGE
- EXTRA LARGE

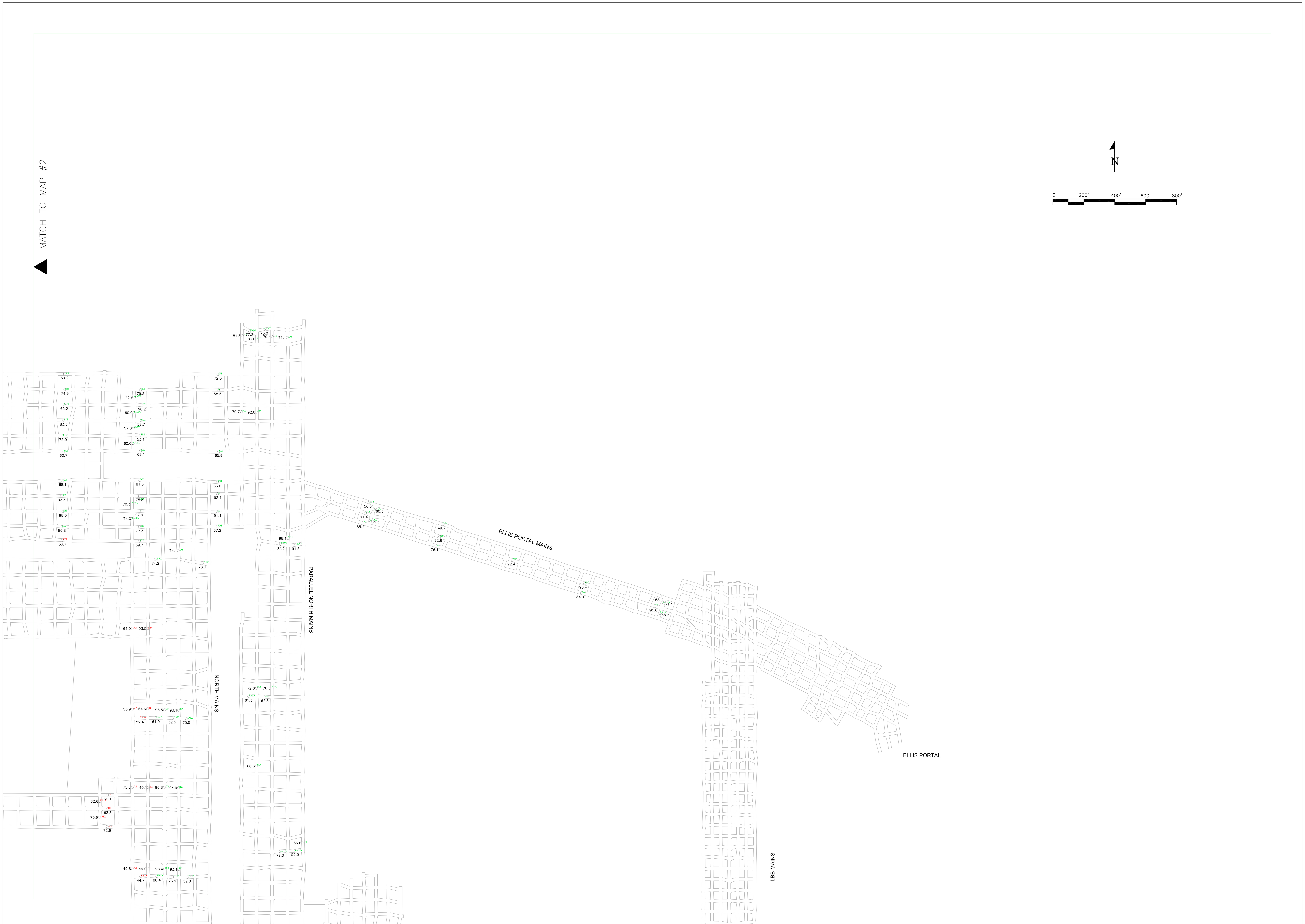
LEGEND
Scale 1"=200'

MAPPING NOTES

LOCATION OF COLLECTED MINE DUST SURVEY SAMPLES, AND RESULTS OF COKING AND INCOMBUSTIBLE CONTENT ANALYSIS.



APPENDIX Z–2
Mine Map Showing Extent of Flame, Incombustible Content, and Coke
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46–08436



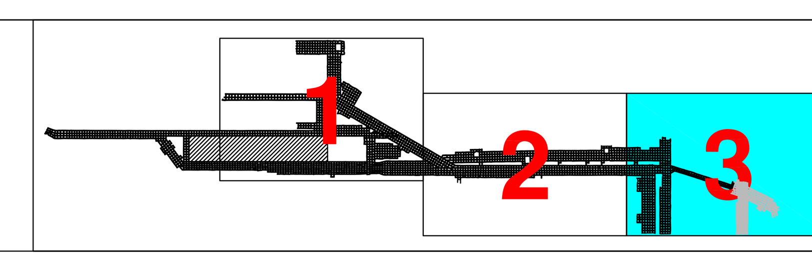
EXTENT OF FLAME
53.6 INCOMBUSTIBLE CONTENT (PERCENT)
17E14 SAMPLE NUMBER (INTAKE AIR COURSE)
13F18 SAMPLE NUMBER (RETURN AIR COURSE)

AMOUNT OF COKING
NONE
TRACE
SMALL
LARGE
EXTRA LARGE

LEGEND
Scale 1"=200'

MAPPING NOTES

LOCATION OF COLLECTED MINE DUST SURVEY SAMPLES, AND RESULTS OF COKING AND INCOMBUSTIBLE CONTENT ANALYSIS.



APPENDIX Z-3
Mine Map Showing Extent of Flame, Incombustible Content, and Coke
Upper Big Branch Mine – South
Performance Coal Company
MSHA ID No. 46-08436

APPENDIX AA

RESULTS OF PROXIMATE ANALYSIS TESTING

Lab No : 201101053-001

Date Rec'd : 4/14/2011

Date Sampled : 8/20/2010 to 8/20/2010

Sampled By: CLIENT

STANDARD LABORATORIES, INC.

8451 River King Drive
Freeburg, IL 62243

Date : 4/18/2011 12:08:52 PM

MINE SAFTY AND HEALTH ADMINISTRATION
DEPT OF LABOR
1100 WILSON BLVD ROOM 2432
ARLINGTON, VA 22209
ATTN: CLETE STEPHAN

P.O.# :

Sample Identification

SAMPLE FROM GLORY HOLE SEAL
SAVE ALL UNUSED REMAINING SAMPLE TO BE RETURNED TO CUSTOMER

LBS SO2 / MMBTU 1.21

	% Moisture	% Ash	% Volatile	% Fixed Carbon	BTU / LB.	% Sulfur
As Rec'd	1.62	26.55	29.43	42.40	10854	0.66
Dry Basis	--------	26.99	29.91	43.10	11033	0.67
M-A-Free					15112	
Method	D3302	D3174	D3175	D3172	D5865	D4239

FREE SWELLING INDEX (D720) : ******

ASH FUSION TEMP. OF ASH (DEG F)	Reducing	Oxidizing	D1857
INITIAL	******	******	
SOFTENING	******	******	
HEMISPHERICAL	******	******	
FLUID	******	******	

HARDGROVE GRINDABILITY INDEX (D409) ****** @ ****** % Moist.

Chlorine D6721 Dry Basis ug/g = ******

Mercury D6722 Dry Basis ug/g = ******

Note: ***** INDICATES ANALYSIS WAS NOT PERFORMED

Respectfully Submitted, S.A. Wilshire

Lab No : 201101053-002

Date Rec'd : 4/14/2011

Date Sampled : 4/14/2011 to 4/14/2011

Sampled By: CLIENT

STANDARD LABORATORIES, INC.

8451 River King Drive
Freeburg, IL 62243

Date : 4/18/2011 12:08:52 PM

MINE SAFTY AND HEALTH ADMINISTRATION
DEPT OF LABOR
1100 WILSON BLVD ROOM 2432
ARLINGTON, VA 22209
ATTN: CLETE STEPHAN

P.O.# :

Sample Identification

TAILGATE CHANNEL SAMPLE
- 80' OUT BY THE SHEARER BETWEEN CROSSCUT 46 AND 47
SAVE ALL UNUSED REMAINING SAMPLE TO BE RETURNED TO CUSTOMER

LBS SO2 / MMBTU 1.25

	% Moisture	% Ash	% Volatile	% Fixed Carbon	BTU / LB.	% Sulfur
As Rec'd	2.23	6.82	32.81	58.13	14010	0.88
Dry Basis	---------	6.98	33.56	59.46	14330	0.90
M-A-Free					15405	
Method	D3302	D3174	D3175	D3172	D5865	D4239

FREE SWELLING INDEX (D720) : ******

ASH FUSION TEMP. OF ASH (DEG F)	Reducing	Oxidizing	D1857
INITIAL	******	******	
SOFTENING	******	******	
HEMISPHERICAL	******	******	
FLUID	******	******	

HARDGROVE GRINDABILITY INDEX (D409) ****** @ ****** % Moist.

Chlorine D6721 Dry Basis ug/g = ******

Mercury D6722 Dry Basis ug/g = ******

Note: ***** INDICATES ANALYSIS WAS NOT PERFORMED

Respectfully Submitted, S.A. Wilshire

Lab No : 201101053-003

Date Rec'd : 4/14/2011

Date Sampled : 4/14/2011 to 4/14/2011

Sampled By: CLIENT

STANDARD LABORATORIES, INC.

8451 River King Drive
Freeburg, IL 62243

Date : 4/18/2011 12:08:52 PM

MINE SAFTY AND HEALTH ADMINISTRATION
DEPT OF LABOR
1100 WILSON BLVD ROOM 2432
ARLINGTON, VA 22209
ATTN: CLETE STEPHAN

P.O.# :

Sample Identification

HEADGATE CHANNEL SAMPLE
TAKEN NEAR MINE DUST SURVEY LOCATION 11EI
SAVE ALL UNUSED REMAINING SAMPLE TO BE RETURNED TO CUSTOMER

LBS SO2 / MMBTU 1.19

	% Moisture	% Ash	% Volatile	% Fixed Carbon	BTU / LB.	% Sulfur
As Rec'd	1.77	7.98	32.77	57.48	13890	0.83
Dry Basis	--------	8.12	33.36	58.52	14140	0.84
M-A-Free					15390	
Method	D3302	D3174	D3175	D3172	D5865	D4239

FREE SWELLING INDEX (D720) : ******

ASH FUSION TEMP. OF ASH (DEG F)	Reducing	Oxidizing	D1857
INITIAL	******	******	
SOFTENING	******	******	
HEMISPHERICAL	******	******	
FLUID	******	******	

HARDGROVE GRINDABILITY INDEX (D409) ****** @ ****** % Moist.

Chlorine D6721 Dry Basis ug/g = ******

Mercury D6722 Dry Basis ug/g = ******

Note: ***** INDICATES ANALYSIS WAS NOT PERFORMED

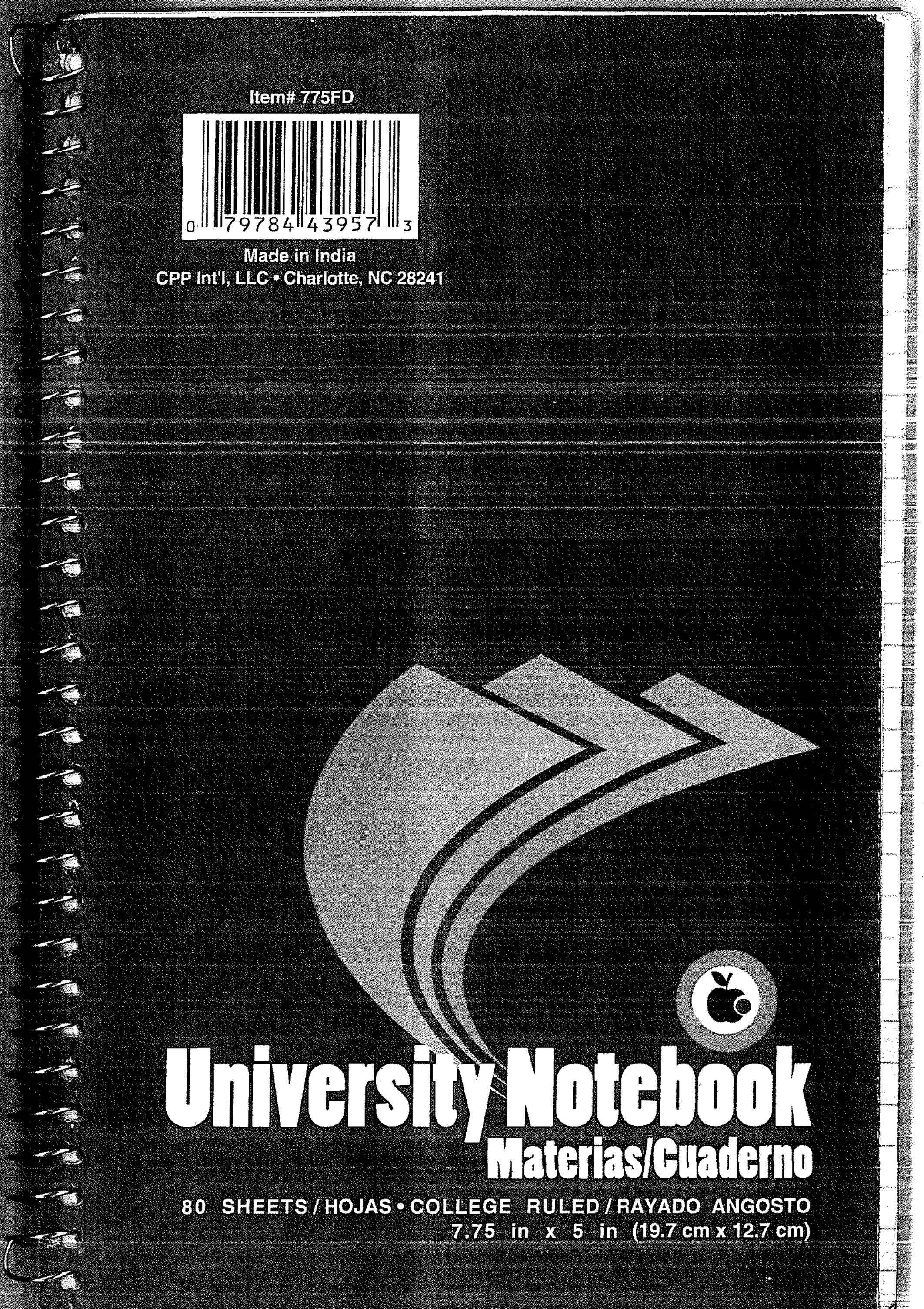
Respectfully Submitted, S.A. Wilshire

APPENDIX AB

ROCK DUST CREW NOTEBOOK

APPENDIX AB

ROCK DUST CREW NOTEBOOK


Item# 775FD
0 79784 43957 3
Made in India
CPP Int'l, LLC • Charlotte, NC 28241
University Notebook
Materias/Cuaderno
80 SHEETS / HOJAS • COLLEGE RULED / RAYADO ANGOSTO
7.75 in x 5 in (19.7 cm x 12.7 cm)

Gary Young ~~[illegible]~~

575-7736-

894-

Clifton Stover

934-~~[illegible]~~5360

2/9/10
Dusted 3 sec. #1 belt, and some other side of tracks. breaks as well. fixed third door on way in. (put jacks back in, changed receptacle. #3 rec. not working.

2/10/10
Everything broke/malfunction, worked on hoses + duster.

2/11/10
got Duster mostly Empty, breaks, track from 25-34, 35.

2/18/10.
Took Duster to 1 North, got 2 breaks & Belt Dusted, Duster went Down AGAIN, got cleaned off & ready to install new seal on back pod. need (2) 2" brass ball valves, (2) crescent wrenches, (2) pipe wrenches, & some pen. oil. should be able to get running from there, til the rest can be repaired. Also cleaned All the filters for the comp. (wouldn't hurt to change them as well.)

2/24/10

Dusted from 1-2 breaks up from power center Down to track.
hand dusted

3/1/10

Dusted 2N + 3N, Track + breaks from 52. helped drag some cable, switched out several times. had to unclog hose (discharge) and change fill hose before starting.

3/4/10

Dust from Ellis to 25 break, from 3-4 brk to around 18. (Ellis 5)

3/8/10

Dusted from 133 to 98. Duster ran out.

3/9/10

Had no motor to run Duster. Shawn sent his men over to get a motor, called told him needed it, they said there was another one up there →

left with it. went up to get the other motor, had no pigtail. nothing Dusted.

3/11/10

Had no motor Again ~~[illegible]~~ no ride either. moved some cars around on track, got number 1 motor, filled the Duster up & spurred it back up ready for tonight. hand dusted up At 1 south, still needs hit with the duster though. wet up there.

3/15/10

Dusted with hose, made it from 78 brk to 45-46 (33 brks!), ran out time. Dust Dust, Dust, Dust, looks good

3/16/10

46 to 30 somethin, put whole pod At head (42)

3/17/10 ~~38 brk~~

38 brk to App. 9 brk

→

3/18/10
From Mother drive up to 78th brk. Done with hose.

3/20/10
LW Belt + Motherdrive
GARY

3-22-10
Shoveled 6N Head + Dusted
" 5N Head + Dusted
" 4N Head + Dusted
Clifton

3-23-10
NO RIDE NO Help No spotter
I'll CALL you today. I'm set up to fail here. Gary
[redacted]

→ Sick
3-24-10 NO Help. Went to 78 + Pickup up Alvis + talk outside
Finished Hand Dusting 4 N Belt from 7 Brk to Ellis switch.
Shoveled 4 Head + Hand Dusted
" 5 " + " "
Greased Duster + changed Filter Clifton

CONFIDENTIAL PCC-MSHA00070923

3-25-10
Dusted from 50 Brk to 119 Brk
on mainLine
clifton

3-26-10
mainLine
Re Dusted from LBB-68 Brk
to 119 Brk Did not Look to Good.
Looks Good Now. Dusted from 119
Brk to Ellis switch. Dusted
mainLine from 4 Head to 5 Brk
Filled up Duster
clifton

3-29-10
DusteD 2 north 3 north DusteD
DusteD track 63-115
Dustiry

3-30-10
Got All track DusteD 3 section
and 10 Breaks on Belt Ran out of
Dust

3-31-10
Dusted Barrier section
Ellis 5, 4 track then
ran out of Dust

4-1-10
Dusted 1 sec. Belt

4-5-10
Dusted longwall Belt

APPENDIX AC

BELT EXAMINATION BOOK
(4/1/2010 TO 4/5/2010)

STARTED
4-1-10

EXAMINATION OF BELT CONVEYORS

COMPANY Performance Coal

MINE UBB

LOCATION Naoma Raleigh WV
Post Office County State

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-1-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Bickford/Mike Elswick Time 2:30 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs Spot cleaned 10 to 3 brk, Needs Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs Additional cleaning Drive to Discharge / Tail need add. cleaning	RG	✓		
NORTH NO. 5	Needs Spot Cleaned 60-flowthru, Takeup Needs Cleaned	SH	✓		
NORTH NO. 6	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 7	Needs Dusted	ME	✓		
Longwall	Needs Dusted	ME	✓		
GLORY HOLE	D-Box + Pump OK	ME	✓		
TG-22 NO. 1	Needs spot cleaned + Dusted	JAB	✓		
TG-22 NO. 2	Needs Dusted, Tail needs Add. cleaning	JAB	✓		
HG-22 #1	Needs add. cleaning + Dusted (working on dusting)	JAB	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO at time of exam

Travelways, Power Centers, D-Boxes, chargers OK at time of exam

Visual check of CO monitors OK at time of exam

[signature] 1539A [signature] 32476

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567

Belt Examiners and Certificate Numbers

John A. Bickford 26176 Michael Elswick 31521

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore [signature] 33359 ______ ______

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-1-10 SHIFT: DAY 6:00 AM OR PM TO 3:00 AM OR PM — ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM — PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by: ________________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	RG
Ellis 5	Shoveled V-plow	RG
NORTH 2		
NORTH 3		
NORTH 4	cleaned on Tail, Ran dusters at Tail+Drive, (Spot cleaned Bobby on Drive-Head)	RG
NORTH 5	cleaned on tail, Cleaned V-Plow at flowthru Ran Duster	SH
NORTH 6	cleaned V-Plow, cleaned at Tail SAB	SH
NORTH 7	cleaned on offside of Tailpiece	MG
Longwall	Cleaned Spillage at Head, Set pump Behind Drive	SH
GLORY HOLE		
TG-22 NO. 1		
TG-22 NO. 2		
HG-22 #1		

Refuge chambers 89,6,8 OK + phones working at time of exam

SIGNED BY: Russell Gunnoe 1536-A — Scott Halstead 37567
Belt Examiners and Certificate Numbers
John R. Bickford — Michael Elswick 31521
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-1-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM 800 AM OR PM TO 1100 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Broughtout Time________ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH NO. 1~~ Ellis 4	~~none~~ none observed	GU	—		
~~NORTH NO. 1~~ Ellis 5	needs spot cleaned & Dusted	GU	—		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs Addi Cleaning Drive - Discharge	GU	—		
NORTH NO. 5	needs spot cleaned 60-Fowtra	GU	—		
NORTH NO. 6	needs spot cleaned & Dusted	GU	—		
NORTH NO. 7	needs Dusted	JS	—		
~~NORTH NO. 8~~ L wall	needs Dusted	JS	—		
GLORY HOLE	D-Box Pump OK	JS	—		
~~EBB~~ 1622 NO. 1	needs spot cleaned & dusted	JS	—		
~~EBB~~ 1622 NO. 2	needs Dusted Tail needs Add Cleaning	JS	—		
H622 #1	needs Add cleaning & Dusted	JS	—		

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

06 CH4 02 CO 20.8 O2

PC's, Chargers, D Boxes, Travelways OK

SIGNED BY: [signature] 15394
Belt Examiners and Certificate Numbers

[signature] 32476.
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33309 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-1-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom______________ Time________ AM or PM

Report received by: ______________________

Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4	Cleaned Tail	GU
NORTH 5	Cleaned Flow thrrew	GU
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked outby Refuges 6-8-890K

SIGNED BY: [signature] 1592

Belt Examiners and Certificate Numbers

____

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33307 ______ ______

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 4-2-10 SHIFT: a/d ______ AM OR PM TO ______ AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom______________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH NO. 1~~ Ellis 4	none observed	GU	—		
~~NORTH NO. 1~~ Ellis 5	needs spot cleaned & dusted	GU	—		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Drive to Discharge needs spot cleaned	GU	✓		
NORTH NO. 5	needs spot cleaned 60-Fountain	GU	✓		
NORTH NO. 6	needs spot cleaned & dusted	GU	—		
NORTH NO. 7	NEEDS DUSTED	JS	✓		
NORTH NO. 8					
GLORY HOLE	D-BOX OK.	JS	✓		
LBB NO. 1					
LBB NO. 2					
HG #22 #1	NEEDS Add DUSTING	JS	✓		
LONGWALL	NEEDS DUSTED	JS	✓		
TG22 #1	NEED SPOT CLEAN & DUSTED	JS	✓		
TG22 #2	NEED SPOT CLEAN & DUSTED	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O6CH4 O2 CO 20.8 O2

PC'S Chargers Pumps Travelways OK

SIGNED BY: [signature] 15347
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Russell Gunnoe 1536-A Michael Elswick 31521 Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-2-10 SHIFT: owl 1100 AM OR PM TO 300 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom______________ Time________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1 F/li54	change roll LC fix chain 100 B/C LC	
NORTH 1 F/li3	change roll LC fix chain 11 Bk LC	
NORTH 2		
NORTH 3		
NORTH 4	Cleaned on Tail change roll 5 LC fix chain dam 13 LC	GC
NORTH 5	Cleaned Flow Tran	GC
NORTH 6	Cleaned Flow Tran change roll tail impact LC	GC
NORTH 7	CLEAN ON HEAD RUN DUSTER	JS
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
TG 28* 1	CLEANED ON WALKWAY RIB ROLL	JS

Checked out by Refuges 6-8-89 OK

SIGNED BY: [signature] 1597
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. [signature] 33359 ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-27-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom Mike Elswick Time 2:20 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	None Observed	RG	✓		
Ellis 5	Needs spot cleaned & Dusted, Tail need add. cleaning	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
* NORTH NO. 4	Needs spot cleaned Drive-Discharge	RG SH	✓		
NORTH NO. 5	Needs Spot Cleaned 60-flow-thru	SH	✓		
NORTH NO. 6	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 7	Needs Dusted	ME	✓		
Longwall	Belt needs Dusted	SH	✓		
GLORY HOLE	Pump & D-Box OK	ME	✓		
TG-22 NO. 1	Needs Dusted	ME	✓		
TG-22 NO. 2	Tail needs add. cleaning, Needs Dusted	ME	✓		
HG-22 #1	Needs Add. Dusting	ME	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO at time of exam

Travelways, Power Centers, D-Boxes, chargers OK at time of exam

Visual Check of CO monitors OK at time of exam

* chains down walkway Side Btwn 12-13 Bk,

SIGNED BY: Russell Gunnoe 1536-A   Scott Halstead 37567
Belt Examiners and Certificate Numbers
Michael Elswick 31521   Glen Ullman 1539A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore   33359
Mine Foreman   Certificate No.   Superintendent   Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-2-10 SHIFT: DAY 6:00 (AM) OR PM TO 3:00 AM OR (PM) ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom ______________ Time ________ AM or PM

Report received by: ______________________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	RG
Ellis 5	Cleaned on Tail	RG
NORTH 2		
NORTH 3		
NORTH 4	cleaned on tail	SH
NORTH 5	cleaned on tail, cleaned V-Plow at flowthru	SH
NORTH 6		
NORTH 7		
Longwall	cleaned on Mud around Drive Area & Dusted	SH
GLORY HOLE		
TG-22 NO. 1		
TG-22 NO. 2		
HG-22 #1		

Refuge Chambers 6, 8, 89 BK all clear at EXAm time
All Phones Working

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers
Michael Elswick 31521
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-2-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM 800 AM OR PM TO 1100 AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	none Obseved	GV	—		
Ellis 5	Tail Needs Add Cleaning needs spot cleaned & dusted	GV	—		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs spot cleaned Drive - Discharge	GV	—		
NORTH NO. 5	Needs spot cleaned 60-F bw thru	GV	—		
NORTH NO. 6	Needs spot cleaned & dusted	GV	—		
NORTH NO. 7	Needs Dusted	WC	—		
Uwall	Belt needs Dusted	WC	—		
GLORY HOLE	Pump & D-Box ok	WC	—		
T622 NO. 1	no power no preshift				
T622 NO. 2	no power no preshift				
H622 #1	needs Add Dusting	WC	—		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

OBCH4 O2 CO 20.8 O2

PCS, Charger, D-Box, Pump, Timelines ok

SIGNED BY: [signature] 15394
Belt Examiners and Certificate Numbers

William Campbell 13544
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 4-2-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom__________ Time________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 5	Tail gobbed off, cleaned on Tail, change Blow Key	GU/WC
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked out by Refugs 6-8-89 ok Phones are working

SIGNED BY: [signature] 15794
Belt Examiners and Certificate Numbers

William Campbell 1354-A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. 200 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes___ No X By Whom ______ Time ______ AM or PM

Report received by: ______ Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis#4	Needs Dusted; TAil Needs Add Cleaning	GU	✓		
Ellis#5	needs spot cleaned & dusted, TAil needs Add cleaning	GU	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs spot cleaned Hd - Drives	GU	✓		
NORTH NO. 5	needs spot cleaned 60' Fbw tail	GU	✓		
NORTH NO. 6	Needs spot cleaned & dusted	GU	✓		
NORTH NO. 7	Needs Dusted	WC	✓		
LWall	Needs Dusted	WC	✓		
GLORY HOLE	D-Box & Pump OK	WC	✓		
TG22 NO. 1	Belts Idle				
TG22 NO. 2	No Power				
HG22#1	Needs Add Dusting	WC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O2 CH4, O2 CO, 20.8 O2

PC's, Chargers, Pumps, Tradeshuttles OK

SIGNED BY: [signature] 15790 Johnny Neely 33472

Belt Examiners and Certificate Numbers

William Campbell 1354A

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33339

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Russell Gunnoe 1536-A Mike Elswick 31521 Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: Owl 1000 AM OR PM TO 300 AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ______________ Time ________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Cleaned on tail	GU
Ellis 5	Cleaned on Tail cleaned up Gob out L.C.	GU
NORTH 2		
NORTH 3		
NORTH 4	changes w/ LC.	
NORTH 5	Cleaned F6 [illegible]	GU
NORTH 6	Cleaned F6 [illegible], Shoveled on V-plow changes w/ LC	GU/BC
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked out by Refuges 6-8-89 OK phones are working

SIGNED BY: [signature] 15394
Belt Examiners and Certificate Numbers

William Campbell 13544
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ____ By Whom John Neely, Mike Elswick Time 2:15 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	TAil needs add. cleaning, Needs Dusted	RG	✓		
Ellis 5	Needs spot cleaned, Needs Dusted, TAil needs add. cleaning	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs spot cleaned Drive-Discharge	RG SH	✓		
NORTH NO. 5	Needs Spot Cleaned 60-Flowthru	SH	✓		
NORTH NO. 6	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 7	Needs Dusted	ME	✓		
Longwall	Needs Dusted	SH	✓		
GLORY HOLE	D-Box + Pump OK	ME	✓		
TG-22 NO. 1	Needs Dusted	JN	✓		
TG-22 NO. 2	Needs Dusted, TAil needs add cleaning, water 1½ Bk outby Feeder	JN	✓		
HG-22 #1	Needs spot cleaned + Dusted	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0 ppm CO at time of exam

TRAvelwAys, Power Centers, D-Boxes, chargers, KVAs OK at time of exam

Visual check of CO monitors OK at time of exam

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37564
Belt Examiners and Certificate Numbers
Mike Elswick 31521 Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY ______ Mine Foreman ______ Certificate No. ______ Superintendent ______ Certificate No.

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Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: DAY 6:00 (AM) OR PM TO 3:00 AM OR (PM) ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________ Time________ AM or PM

Report received by:________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	RG
Ellis 5	Cleaned on Tail	RG
NORTH 2		
NORTH 3		
NORTH 4	cleaned on tail	SH
NORTH 5	cleaned tail Roller	SH
NORTH 6		
NORTH 7	cleaned on offside of belt at Flow Through	ME
Longwall	cleaned on Drive area & Dusted, cleaned Discharge	SH
GLORY HOLE		ME
TG-22 NO. 1	Clean Tail + V Plow - Dust Area	JN
TG-22 NO. 2	Dust Head Area	JN
HG-22 #1		

Refuge chambers 6, 8, 89 clear at EXAM time
All Phones Working

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers
Mike Elswick 31521
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY________ ________ ________ ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: EVE ________ AM OR PM TO ________ AM OR PM 800 AM OR (PM) TO 1100 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ____________ Time ________ AM or PM

Report received by: ____________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4 [redacted]		GU	✓		
Ellis 5 [redacted]		GU	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4		GU	✓		
NORTH NO. 5		GU	✓		
NORTH NO. 6		BC	✓		
NORTH NO. 7	Fire Bossed PC's Chargers	BC	✓		
L/Wall [redacted]	all Clear	BC	✓		
GLORY HOLE		BC	✓		
TG22 NO. 1	no Power				
TG22 NO. 2	no Power				
HG22#1		BC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O6 CH4 O6 CO 20 P302

PC's, Chargers, D-Box, TACK, Travelways OK

SIGNED BY: [signature] 1839A
Belt Examiners and Certificate Numbers

William Campbell 1354-A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY ____________ ____________ ____________ ____________

Mine Foreman Certificate No. Superintendent Certificate No.

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: CVC 600 AM OR PM TO 800 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked outby Refuges 6-8-89 OK

SIGNED BY: [signature] 15397
Belt Examiners and Certificate Numbers

William Campbell 13544
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY______________ ______________ ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-3-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom______ Time______ AM or PM

Report received by:______
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis M		GU			✓
Ellis S		GU			✓
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4		GU			✓
NORTH NO. 5	Done Fire Run	GU			✓
NORTH NO. 6	no Hot Rollers	WC			✓
NORTH NO. 7	or Fires	WC			✓
L.Wall		KM			✓
GLORY HOLE					
TG22 NO. 1	Belt Idle				
TG22 NO. 2	Belt Idle				
HG22		BB			✓

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0 CH4, 0 CO, 20.8 O2

Travelways Clear

Brad Bong 1122-A

SIGNED BY: [signature] 1530A Kevin W. Medley 38810
Belt Examiners and Certificate Numbers

William Campbell 1354-A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY______ ______ ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE________________ SHIFT:__________ ________ AM OR PM TO ________ AM OR PM ________ AM OR PM TO ________ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________________ Time__________ AM or PM

Report received by:________________________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

SIGNED BY: ________________________________
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY________________ __________ ________________ __________

Mine Foreman | Certificate No. | Superintendent | Certificate No.

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-4-10 SHIFT: EVC. ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes ____ No ✓ By Whom ______ Time ______ AM or PM

Report received by: ______ Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO. 4	IDLE PC's, Pumps + D' Boxs ok	JAB	✓		
Ellis NO. 5		JAB	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Pumps + PC + D' Boxs ok	JAB JN	✓		
NORTH NO. 5	Pumps, PC's + D' Box's ok	JAB JN	✓		
NORTH NO. 6	PC's ok	JAB JN	✓		
NORTH NO. 7	PC, chargers	JAB JN	✓		
Lg. Walt	IDLE	JS	✓		
GLORY HOLE	Pumps + D' Box ok	JAB JN	✓		
TG 22 NO. 1	IDLE	JS	✓		
TG 22 NO. 2					
HG22 #1	IDLE	JS JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0% CO 20.8% AT TIME OF EXAM

CHARGERS, POWER CENTER, D-BOXES OK AT OF EXAM

SIGNED BY: [signature] 32476 [signature] 33472
Belt Examiners and Certificate Numbers
[signature] 26173
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY ______ Mine Foreman ______ Certificate No. ______ Superintendent ______ Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-4-10 SHIFT: EVE. ______ AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4		
Ellis 5		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NO[illegible]		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

REFUGE BOXES 6, 8, 89 OK. AT TIME OF EXAM.

SIGNED BY: John A. Bickford 26176 Johnny Neely 33472
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY______________________

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-5-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom ______ Time ______ AM or PM

Report received by: ______
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
4 ELLIS	NEEDS Added Dusting	JS	✓		
5-ELLIS	NEEDS DUSTED	JS	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	NEEDS SPOT CLEAN & DUSTED	JS	✓		
NORTH NO. 5	Needs spot cleaned 60 to [illegible]	JAB	✓		
NORTH NO. 6	Needs spot cleaned & dusted	JAB	✓		
NORTH NO. 7	Needs dusted	JN	✓		
Lg North	Needs spot cleaned	LB	✓		
GLORY HOLE	D. Box & Pump OK	JN	✓		
TG NO. 1	Need spot cleaned & spot dusted	JN	✓		
TG NO. 2	None observed	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4 0% CO + 20.8% O_2 detected

PC's, Track, Travelways, Chargers, Pumps + 'D' Box's clean at time of exam

Visual check of CO's OK

SIGNED BY: John L. Bickford 26171 Johnny Neely 33472 [illegible] 38927
Belt Examiners and Certificate Numbers
[illegible] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY ______ ______ ______ ______
Mine Foreman | Certificate No. | Superintendent | Certificate No.

46543—BJW Printing & Office Supplies

Mike [illegible] 31521 Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-5-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time__________ AM or PM

Report received by: ______________________________
Signed

BELTS	ACTION TAKEN	INT.
4 ELLIS	DUSTED TAIL	JS
5 ELLIS	ROCK DUSTED HEAD	JS
NORTH 2		
NORTH 3		
NORTH 4	Helped cleaned on tail + "V" Plow	JAB, JW, JS
NORTH 5	Cleaned on tail + flow-thru	JAB
NORTH 6	Cleaned on flow-thru + tail	JAB
NORTH 7	CLEAN ON TAIL	
GLORY HOLE		
TG NO. 1	clean on off side of TAIL	JW
TG NO. 2		

Checked Refuges 6, 8 + 89 Bahr, Phones OK

SIGNED BY: John A. Bulford 26176 Johnny Neely 33472
Belt Examiners and Certificate Numbers
[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY ______________ ______________ ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 4-5-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 10:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom Mike Elswick Time 2:30 AM or (PM)

Report received by: Scott Halstead 37567
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	Needs Added Dusting	SH	✓		
Ellis #5	Needs Dusted	SH	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 5	Needs Spot Cleaned 60-flowthru	SH	✓		
NORTH NO. 6	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 7	Belt needs Dusted	M.E.			
Longwall	Needs Spot Cleaned & Dusted	SH	✓		
GLORY HOLE	D-Box & Pump - OK	ME			
TG NO. 1	Needs Dusted	M.E.			
TG NO. 2	tail Needs Cleaned	M.E.			
HG 22	Belt Needs Spot Cleaned & Dusted	M.E.			

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH^4, 20.8% O^2, 0ppm CO Detected at EXAM
Power Centers, D-Box's, Chargers, track & travel ways Clear at EXAM
Visual CK of CO Monitors-Clear

SIGNED BY: Scott Halstead 37527
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY ______ ______ ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE________ SHIFT:________ ________ AM OR PM TO ________ AM OR PM ________ AM OR PM TO ________ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
GLORY HOLE		
NO. 1		
NO. 2		

Outby Chambers #6, 8, 89. Clear at Exam
All Phones Working

SIGNED BY: Scott Halstead 37567
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY________ ________ ________ ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

APPENDIX AD

BELT EXAMINATION BOOK
(3/16/2010 TO 4/1/2010)

APPENDIX AD

BELT EXAMINATION BOOK
(3/16/2010 TO 4/1/2010)

STARTED 3-16-10

Finished 4-1-10

EXAMINATION OF BELT CONVEYORS

L

COMPANY Performance Coal

MINE Upper Big Branch

LOCATION Naoma WV Raleigh WV
Post Office County State

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-16-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM 800 AM OR PM TO 1100 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes X No ____ By Whom SKAGGS Cambell Time 1045 AM or PM

Report received by: [signature]
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	Needs Dusted	GV	✓		
Ellis #5	Needs spot Cleaned 27-Tail + 7-3, Needs Dusted	GV	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Takeup needs Add cleaning, Needs Dusted	GV	✓		
NORTH NO. 5	None Observed	GV	✓		
NORTH NO. 6	Needs Dusted, Needs Cleaned 87-Tail	BC	✓		
NORTH NO. 7	Needs Dusted, Rib Roll 128 Brk, Dangered off	BC	✓		
E Wall	Belt Needs Dusted, Hd and Drives Needs Cleaned	JS	✓		
GLORY HOLE	D-Box Pump OK	WC	✓		
HG 22 #1	Needs Cleaned & dusted	JS	✓		
TG 22 #1	Needs Cleaned & dusted NEEDS CROSS OVER.	JS	—		
TG 22 #2	Needs Dusted	JS	—		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O2CH4, OK CO 208202

PC's, Chargers, D-Boxes, Track, Travelways OK

SIGNED BY: [signature] 15394 William Campbell 18544
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359

Mine Foreman | Certificate No. | Superintendent | Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-16-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes___ No X By Whom______ Time______ AM or PM

Report received by: ______
Signed

BELTS	ACTION TAKEN	INT.
NORTH 3		
NORTH 4	Ran Duster at Drives, cleaned at Head Area	GU
NORTH 5	cleaned & dusted Flow threw	GU
NORTH 6		
NORTH 7		
GLORY HOLE		

Checked outby Refuges 6,8,89 all OK

SIGNED BY: ______
Belt Examiners and Certificate Numbers

______
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33354 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-17-10 SHIFT: owl ______ AM OR PM TO ______ AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes X No ___ By Whom skaggs, campbell Time 530 AM or PM

Report received by: [signature]
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ells 4	Needs Dusted	GC	—		
Ells 5	Needs Dusted, Needs Cleaned 27-Tail	GC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs Dusted Hd-25Brk Takeup needs Add cleaning	GC	—		
NORTH NO. 5	needs spot Dusted	GC	✓		
NORTH NO. 6	Needs Dusted, 87-Tail Needs Cleaned	WC	✓		
NORTH NO. 7	Needs Dusted/ Dangered off At 128Brk Need 8 Jacks set	WC	✓		
Ells 1	Needs Dusted Drives and Hd wet & muddy	JS	✓		
GLORY HOLE	D-Box Pump OK	WC	✓		
LBB NO. 1					
LBB NO. 2					
H622	Needs Cleaned & dusted	JS	—		
T622 #1	Needs Cleaned & dusted	JS	—		
T622 #2	needs Dusted	JS	—		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O2 CH4 O6 CO 20.8 2 0 2

PCs, Chargers, D-Boxes, Travelways OK

SIGNED BY: [signature] 15504 [signature] 32476
Belt Examiners and Certificate Numbers

William Campbell 13544 Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

John A. Bickford 26176 Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 2-17-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom______________ Time__________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4		
Ellis 5	Cleaned from 3-7 Brk, Cleaned Tail	GV
NORTH 2		
NORTH 3		
NORTH 4	Cleaned V-Plow / 2 men Ousting change rollers LC	GC
NORTH 5	Cleaned V-Plow	GV
NORTH 6	change roller LC	
NORTH 7	Cleaned Rib Roll Ran Duster at HEAD	GV JS WC
L WAll	change roller LC	
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked outby Refuges 6-8-89 all clear

SIGNED BY: [signature] 15397
Belt Examiners and Certificate Numbers

William Campbell 1354-A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359

Mine Foreman	Certificate No.	Superintendent	Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-17-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM 12:00 AM OR PM TO 3:00 AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom J. Neely Time 250 AM or PM

Report received by: John A. Bickford 26176
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs dusted	JAB	✓		
Ellis 5	Needs dusted, Needs cleaned 27 to tail	JAB	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take up needs add'l cleaning Needs dusted - Head to 20 Bk	JAB	✓		
NORTH NO. 5	Needs spot dusted	JAB	✓		
NORTH NO. 6	Needs dusted, Needs cleaned 87 to tail	JAB	✓		
NORTH NO. 7	Tail Needs Add Cleaning Needs dusted, Dusted off 128 Bk, Nols Jack	SH	✓		
Lg Wall	DRive needs Cleaned, Wet muddy, Belt needs Dusted	SH	✓		
GLORY HOLE	Pump & D'Box OK	SH	✓		
LBB NO. 1					
LBB NO. 2					
HG 22	Needs cleaned & dusted	JN	✓		
TG22 #1	Needs cleaned & dusted	JN	✓		
TG22 #2	None Observed	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0% CO + 20.8% O_2 detected at time of exam.

Track, Travelways, PC's, chargers, D'Box's & Pumps clear at time of exam

Glen Ullman 1539

SIGNED BY: John A Bickford 26176 Scott Halstead 37567
Belt Examiners and Certificate Numbers
[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Johnny Neely Certificate No. 33472

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 3-17-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	cleaned tail & Greased tail / Bobby	
Ellis 5	cleaned tail & Greased tail / Bobby 7 BRK - 12 BRK Spay cleaned	
NORTH 2		
NORTH 3		
NORTH 4	Cleaned at V-Plow	JAB
NORTH 5	Cleaned at flow-thru	JAB
NORTH 6	Cleaned at tail	JAB
NORTH 7	cleaned on tail, Greased tail Roller	SH
NORTH 8	Cleaned on Mud at Drive, Greased Drive Rollers	SH
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
HG22	Rock Dust from Drive Across Both overcast Grease Drive	JN
TG-22 #1	Dust from Discharge to Drive Dust off PC's	JN

Checked Refuges at 6, 8 + 89 Brks - OK, Phones - OK

SIGNED BY: John A. Bickford 26176 Scott Halstead 37567
Belt Examiners and Certificate Numbers

Johnny Kelly 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. [illegible] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-17-10 SHIFT: Eve. ______ AM OR PM TO ______ AM OR PM 8:00 AM OR PM TO 11:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Brought out ______ Time______ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
[illegible] 1	NEEDS DUSTED	GV	✓		
[illegible] #5	NEEDS SPOT CLEAN 27-Tail & DUSTED	GV	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	TAKE UP NEEDS CLEAN Head +20 Brk Need Dusted	GV	✓		
NORTH NO. 5	NEEDS SPOT Dusted	GV			
NORTH NO. 6	NEEDS DUSTED 87-Tail need cleaned	GV	✓		
NORTH NO. 7	NEEDS CLEAN & DUSTED	JS	✓		
[illegible]	DRIVE NEEDS CLEAN	JS	✓		
GLORY HOLE	D-Box ok	JS	✓		
LBB NO. 1					
LBB NO. 2					
HG 22	NEEDS CLEAN & DUSTED	JS	✓		
TG22 #1	NEED SPOT CLEAN & DUSTED	JS	✓		
TG22 #2	NONE OBSERVED	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O2 CH4 CO 20.8 0 0

PC's Chargers D-Boxes Transformer ok

SIGNED BY: [signature] 32476
Belt Examiners and Certificate Numbers

[signature] 1539A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33357 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

John A. Bickford 21176

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-17-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Cleaned U/Bel	
NORTH 6		
NORTH 7	set Jacks	GV
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked Outby Refuges 6-8-8 9 OK

SIGNED BY: [signature] 1537
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-18-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. 600 AM OR PM TO 810 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ____ By Whom ______ Time ______ AM or PM

Report received by: E Hager
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
4 EH15 [redacted]	needs spot cleaned dusted	MARVIN PERDUE	✓		
5 EH15 [redacted]	Clear called out by Russell Gunnoe				
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs dusted head to tailpiece & add cleaning load transfer	JON BICKFORD	✓		
NORTH NO. 5	Tail needs add cleaning called out by Russell Gunnoe		✓		
NORTH NO. 6	needs spot cleaned dusted called out by Scott Halstead		✓		
NORTH NO. 7	7 north Belt + constructing area clear called out Marvin Kiplinger		✓		
LW WALL [redacted]	63 spad to 63.50 needs spot dusted called out by TIM DAVIS				
GLORY HOLE	Clean + Intake room				
LBB NO. 1					
LBB NO. 2					
HG 22	needs spot cleaned dusted	DEAN JONES			
TG22 #1	needs spot cleaned dusted called out Jeremy Burdorf		✓		
TG22 #2	Tail needs cleaned called out by JEREMY BURDORF		✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4 0% CO 20.8% O_2

CHARGERS, POWER BOXES, TRAVELWAYS OK

SIGNED BY: M Kiplinger 33017 — Scott Halstead 37567
Belt Examiners and Certificate Numbers

Jeremy Burdorf 1189-D
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389 E Hager 26041
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Marvin Perdue 37004

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3/18/10 SHIFT: 1st 6 AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ____ By Whom ______________ Time ________ AM or PM

Report received by: E Hagen
Signed

BELTS	ACTION TAKEN	INT.
~~SOUTH~~ VEIL'S 1	Clean Hm. tail & Groose tail shove to 1 3/4 Bkt - Bobby	
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4	76 Bk refuge clear called out by John Bickford	
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
	8 + 89 refuge clear called out by Scott Halstead	

SIGNED BY: Scott Halstead 37567
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-18-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No___ By Whom John Bickford Time 2:15 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs Dusted, Needs spot cleaned 27-Tail	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take-up needs add. cleaning Needs Cleaned Discharge to overcasts	RG	✓		
NORTH NO. 5	tail needs Added Cleaning	SH	✓		
NORTH NO. 6	Needs Spot Cleaned, Belt needs Dusted	SH	✓		
NORTH NO. 7	Needs cleaned + Dusted	JAB	✓		
LongWall	Wet + Muddy DRIVE AREA Needs Cleaned, Belt Needs Dusted	SH	✓		
GLORY HOLE	D-Box + Pump OK	JAB	✓		
TG-22 NO. 1	Needs spot cleaned + Dusted	JAB	✓		
TG22 NO. 2	None Observed	JAB	✓		
HG-22	Needs cleaned + Dusted	JAB	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO Detected at EXAM time
Powercenters, D-Box's, chargers, track & travelways Clear at EXAM
Visual CK of C.O Monitors Clear at EXAM

SIGNED BY: Scott Halstead 37567 John Bickford 26171
Belt Examiners and Certificate Numbers
Russell Gunnoe 1536-A John [illegible] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. [illegible] 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-18-10 SHIFT: DAY 6:00 AM ~~OR PM~~ TO 3:00 ~~AM OR~~ PM ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	
Ellis 5		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	cleaned V-Plow at flowthru	SH
NORTH 6	Cleaned V-Plow, cleaned at tail & OB	SH
NORTH 7		
Long wall	cleaned on Mud, Ran Duster	SH
GLORY HOLE		
TG-22 NO. 1	cleaned on walkway & at tail	JAB
TG-22 NO. 2		
HG-22		

CKd Refuge Chambers 6, 8, 89 BK OK at EXAM
All Phones Working

Dan [illegible] 5799

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers
John Bickford 26174
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-18-10 SHIFT: Eve ______ AM OR PM TO ______ AM OR PM 8:00 AM OR PM (PM circled) TO 11:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom________________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH~~ NO. 1 (Ellis #4)	Needs Dusted	GU	✓		
~~NORTH NO. 1~~ (Ellis #3)	Needs spot cleaned & Dusted	GU	✓		
NORTH NO. 2					
NORTH NO. 3	~~Belts Takeup cleaned & Discharge to overcast~~				
NORTH NO. 4	Needs clean at Take up & Discharge to overcast	GU	✓		
NORTH NO. 5	Tail Needs clean	GU	✓		
NORTH NO. 6	Needs spot clean & Dusted	GU	✓		
NORTH NO. 7	Need spot clean & Dusted	JS	✓		
NORTH NO. 8					
GLORY HOLE	D-Box and Pump ok	JS	✓		
LBB NO. 1					
LBB NO. 2					
HG22	Needs cleaned & Dusted	JS	✓		
TG22 #1	Need cleaned & Dusted	JS	✓		
TG22 #8	None observed	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4 0% CO 20.8% O2

Travelways, Track and Power centers ok at time of exam

SIGNED BY: [signature] 32476
Belt Examiners and Certificate Numbers

[signature] # 1539-A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3.18 SHIFT: EVE 8:00 AM OR PM TO 6:00 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	REPlaced WATER VAlve AT TAil	GV/JS
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

CK REfuge Boxes AT 8, 6, 89 OK AT Time oF EXAM
All PHONES work

SIGNED BY: [signature] 32476
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-19-10 SHIFT: OWL ______ AM OR PM TO ______ AM OR PM 3:00 AM OR PM TO 6:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom ______________ Time__________ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH NO. 1~~ 8115*4	NEEDS DUSTED	SW	✓		
~~NORTH NO. 1~~ 8115*5	NEEDS SPOT CLEANED AND DUSTED	SW	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	NEEDS CLEAN & DUSTED TAKEUP NEEDS CLEAN	SW	✓		
NORTH NO. 5	TAIL NEEDS CLEAN	SW	✓		
NORTH NO. 6	NEEDS SPOT CLEAN & DUSTED	JS	✓		
NORTH NO. 7	NEEDS DUSTED	JS	✓		
NORTH NO. 8					
GLORY HOLE	D-BOX AND PUMP OK.	JS	✓		
LBB NO. 1					
LBB NO. 2					
HG22	NEEDS CLEAN AND DUSTED	JS	✓		
LW	Need spot cleaned & Dusted	43	✓		
TG*22*1	NEED'S CLEAN AND DUSTED	JS	✓		
TG*22*2	NONE OBSERVED	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4 0% CO 20.8% O_2.

TRAVELWAYS AND TRACK OK AT TIME OF EXAM

SIGNED BY: [signature] 32476 [signature] 38929
Belt Examiners and Certificate Numbers
[signature] 19425A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Russell Dunmore 1536-A John G. Bickford 26176 Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE__________ SHIFT:__________ ______ AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom__________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1 4E/Ts	change rollr	
NORTH 1 5E/Ts	change roller LC	
NORTH 2		
NORTH 3		
NORTH 4	change roller LC	
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

SIGNED BY: ______________________
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY__________ __________ __________ __________
Mine Foreman Certificate No. Superintendent Certificate No.

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-19-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. 12:00 AM OR (PM) TO 3:00 AM OR (PM) PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Bickford Time 2:00 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs spot cleaned 27-29, + Needs Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs spot cleaned 29-Tail, Needs cleaned Drive Discharge	RG	✓		
NORTH NO. 5	tail needs Cleaned	SH			
NORTH NO. 6	Needs Some Spot Cleaning, Needs Dusted	SH	✓		
NORTH NO. 7	Needs dusted	JAB	✓		
Longwall	mother Drive Area Needs Cleaned, Belt needs Dusted	SH	✓		
GLORY HOLE	D-Box + Pump OK	JAB	✓		
TG22 NO. 1	Needs cleaned + Dusted	JAB	✓		
TG22 NO. 2	[illegible] - - Last setup needs dusted	JAB	✓		
HG-22	Needs cleaned + Dusted	JAB	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0 ppm CO at time of exam
Trackways, Power Centers, D-Boxes, chargers Ok at time of exam
Visual check of CO monitors ok at time of exam

SIGNED BY: Russell Gunnoe 1536-A   Scott Halstead 37567
Belt Examiners and Certificate Numbers
John A. Bickford 21171
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore ______ 33359 ______ ______ ______
Mine Foreman   Certificate No.   Superintendent   Certificate No.

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Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-19-10 SHIFT: DAY 6:00 AM OR PM TO 3:00 AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	~~Cleaned from 32-33BK~~ Shoveled V-plow SHoveled tail & Greased tail / Bobby	RG
Ellis 5	Shoveled V-plow	RG
NORTH 2		
NORTH 3		
NORTH 4	cleaned on Tail, RAN dusters at Tail + Drives	RG
NORTH 5	cleaned V-Plow, Cleaned on tail JAB	SH
NORTH 6	Cleaned + dusted at Tail	JAB
NORTH 7		
Longwall	cleaned on Mud at Mother drive	SH
GLORY HOLE		
TG22 NO. 1		
TG22 NO. 2	Cleaned at tail	JAB
HG-22		

Refuge chambers at 6, 84, 8 brk 2 sect OK + phones working at time of exam

SIGNED BY: Russell Gunnoe 1536-A
Belt Examiners and Certificate Numbers
John A. Bulford 26176
Belt Examiners and Certificate Numbers

Scott Halstead 37567

COUNTERSIGNED BY T. Moore 33383
Mine Foreman Certificate No. Superintendent Certificate No.

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Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-19-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM 800 AM OR PM TO 11:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________ Time________AM or PM

Report received by:________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	Needs Dusted	GU	✓		
Ellis #5	Needs cleaned 27-29 Needs Dusted	GU	✓		
Longwall	Headarea needs cleaned; Belt needs Dusted	BC	✓		
NORTH NO. 3					
NORTH NO. 4	Needs spot cleaned 29-tail Drives + Discharge needs cleaned	GU	✓		
NORTH NO. 5	tail needs cleaned	GU	✓		
NORTH NO. 6	Needs spot cleaned & Dusted	GU	✓		
NORTH NO. 7	Needs Dusted	BC	✓		
H622 #1	Needs Cleaned & Dusted	BC	✓		
GLORY HOLE	D-Box & Pump - Clear	BC	✓		
T622 NO. 1	Needs Cleaned & Dusted	BC	✓		
T622 NO. 2	Needs Dusted	BC	✓		

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0 ppm CO, 20.8% O2 Detected
Track/Travelways, KVA, P.C.'s, Pumps, D-Box's chargers and
visual check of CO monitors - all clear at Exam

SIGNED BY: William Campbell 13544
Belt Examiners and Certificate Numbers
[signature] 1539-A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359

Mine Foreman | Certificate No. | Superintendent | Certificate No.

46543—BJW Printing & Office Supplies

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-19-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
[illegible]		
[illegible]		
[illegible]		
[illegible]		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NE2EAY	Shoveled on section tail	BC
GLORY HOLE		
T6 NO. 1	Shoveled on tail	BC
T6 NO. 2		

Checked Outby Refuges at #6, 8, 89 brks all clear at Exam & phones are working

SIGNED BY: [signature] 1539-A
Belt Examiners and Certificate Numbers

[signature] 13540
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-20-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. 3:00 AM OR PM TO 6:00 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom ______ Time ______ AM or PM

Report received by: ______ Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
[illegible] NO. 4	Needs Dusted	GU	✓		
Ellis NO. 5	Needs Cleaned 7-7th needs Dusted	GU	✓		
LW #1 NO.	HEAD Needs cleaned Belt needs Dusted	BC	✓		
NO.					
NORTH NO. 4	needs spot cleaned 29-Tail Head needs cleaned	GU	✓		
NORTH NO. 5	Tail needs cleaned	GU	✓		
NORTH NO. 6	needs spot cleaned & dusted	GU	✓		
NORTH NO. 7	NEEDS Dusted	BC	✓		
H622 NO. 1	NEEDS cleaned and Dusted	BC	✓		
GLORY HOLE	D-Box + Pump clear at Exam	BC	✓		
T622 NO. 1	NEEDS Cleaned + Dusted	BC	✓		
T622 NO. 2	NEEDS added dusting	BC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0ppm CO, 20.8% O_2 Detected
TRACK / Travelways, D-Box's KVA's, Pumps, P.C's, and a visual
Check of CO monitor clear at Exam

SIGNED BY: [signature] 15394 Johnny Neeley 33472
Belt Examiners and Certificate Numbers
William Campbell 13540
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY: T. Moore 33359 [signature]
Mine Foreman / Certificate No. / Superintendent / Certificate No.

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John R. Bickford 26176 Russell Dunmore 1536-A Scott Halstead 37567

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-30-10 SHIFT: OW/ 100 AM OR PM TO 300 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4		
Ellis 5	changs rolla LC	
L Wall	changs roll LC, Dusting ow	
NORTH 4	changs rolla LC	
NORTH 5	changs rolla LC	
NORTH 6	Shoveled V plow	BC
NORTH 7	Shoveld V plow	BC
H622 #1		
GLORY HOLE		
T622 NO. 1		
T622 NO. 2		

Checked out my Refuges 1-8 89 ok

SIGNED BY: [signature] 6394
Belt Examiners and Certificate Numbers

[signature] 13544
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33559 ________ ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 3-20-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM 1200 AM OR PM TO 3 00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Neely Time 2 20 AM or PM

Report received by: John A. Bickford 26176
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs dusted	JAB	✓		
Ellis 5	Needs dusted, Needs add'l cleaning 27-29	JAB	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs spot cleaned 29 to tail Needs add'l cleaning drive to head	JAB	✓		
NORTH NO. 5	Tail needs add'l cleaning	JAB	✓		
NORTH NO. 6	Needs spot cleaned & dusted	JAB	✓		
NORTH NO. 7	Needs dusted	SH	✓		
Lg Wall	Mother Drive Needs Cleaned	SH	✓		
GLORY HOLE	Pump & D'Box OK	JN	✓		
TG22 #1	Idle, PC & charger	JN			✓
TG22 #2	Idle, PC & charger	JN			✓
HG22 #1	Needs cleaned & dusted	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4 0% CO & 20.8% O_2 detected at time of exam

Visual check of CO's - OK

Track, travelways, PC's, chargers, pumps & D'Box's clean at time of exam

[illegible] 1539-A

SIGNED BY: John A. Bickford 26176 Scott Halstead 37567
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

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[illegible]

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3·20·10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time__________ AM or PM

Report received by: ______________________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Cleaned at Tail & V'Plow	JAB
Ellis 5	Cleaned at V'Plow	JAB
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Cleaned at V'Plow & tail	JAB
NORTH 6	Cleaned at tail	JAB
NORTH 7	cleaned on tail Rax Duster	SH
Lg Wall	cleaned on Mud at Motherdrive	SH
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
Tailgate 22 #1	Clean Tail Piece	JN
HG 22 #1	Clean spillage at Discharge, Dust & Grease	JN

Checked Refuges 6, 8 & 89 Bcks: OK Phone OK - 8 & 89

Refuge #6 Phone not Paging

SIGNED BY: John P. Bickford 26276 — Belt Examiners and Certificate Numbers

Scott Halstead 37567

Johnny Neeley 33472

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389

Mine Foreman — Certificate No. — Superintendent — Certificate No.

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Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-20-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time________ AM or PM

Report received by: ______________________ Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO. 4	needs Dusted	GU	✓		
Ellis NO. 5	needs added Cleaning 27-29 bk, needs Dusted	GU	✓		
NO.					
Longwall NO.	Mother Drive needs cleaned, Belt needs spot cleaned	BC	✓		
NORTH NO. 4	needs spot cleaned 29-tail drives need added cleaning to Discharge	GU	✓		
NORTH NO. 5	needs added cleaning at take up	GU	✓		
NORTH NO. 6	needs spot cleaned at airlock, 87-tail + Dusted	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
H622 NO. 1	Needs Cleaned an dusted	BC	✓		
GLORY HOLE	D-Box + Pump - clear at Exam	BC	✓		
T622 NO. 1	IDLE, P.C's + chargers clear at Exam	BC	✓		
T622 NO. 2	IDLE, P.C's + Pump - clear at Exam	BC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0ppm CO, 20.8% O2 Detected
Track/Travelways, KVA's, D-Box's, Chargers, Pumps + Powercenters clear at Exam, An a visual check of CO monitors clear at Exam,

SIGNED BY: [signature] 13540
Belt Examiners and Certificate Numbers
[signature] 15390
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33357
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-20-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Cleaned V plow	GU
Ellis 5		
Longwall		
NORTH 4		
NORTH 5	Cleaned V plow	GU
NORTH 6	Raw Duster, shoveled V plow	BC
NORTH 7		
W622 #1	Shoveled V-plow at ~~[illegible]~~ section tail	BC
GLORY HOLE		
T622 NO. 1		
T622 NO. 2		

Checked Outby Refuges at 6, 8, 89 brks - all clean, phones working

SIGNED BY: William Campbell 1354-A
Belt Examiners and Certificate Numbers

Don Allen 1570A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-21-10 SHIFT: OWL 1100 AM OR PM TO 300 AM OR PM 300 AM OR PM TO 600 AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO. 4	needs Dusted	GU	✓		
Ellis NO. 5	needs added cleaning 27-29 bk, need Dusted	GU	✓		
NO.					
Longwall NO.	Belt needs spot cleaned Mother Drive needs cleaned	BC	✓		
NORTH NO. 4	needs spot cleaned 29 tail Drives - Discharge needs cleaned	GU	✓		
NORTH NO. 5	needs added cleaning at Take up	GU	✓		
NORTH NO. 6	needs spot cleaned at airlock 87 tail & need Dusted	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
HG22 #1	needs cleaned & Dusted	BC	✓		
GLORY HOLE	D-Box & Pump none observed	BC	✓		
TG22 NO. 1	IDLE	BC	✓		
TG22 NO. 2	IDLE	BC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0% ppm CO, 20.8% O2 detected
Track/Travelways, KVA's D-Box's, Powercenters + Pump
clear at Exam, Visual check of CO's all clear at
Exam

SIGNED BY: [signature] 13542 [signature] 33472
Belt Examiners and Certificate Numbers
[signature] 1529
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33339
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

[signature] 2617

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-21-10 SHIFT: Owl 1100 PM TO 300 AM — ON-SHIFT EXAM. 300 AM TO 600 AM — PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4		
Ellis 5		
Longwall	Run Duster	BC
NORTH 4	Run Duster	
NORTH 5		
NORTH 6	Run Duster, shoveled v-plow	BC
NORTH 7	Run Duster, shoveled v-plow	BC
H622#1		
GLORY HOLE		
T622 NO. 1		
T622 NO. 2		

Checked Outby Refuges at 6, 8, 8, 9 blk - all clearcut Exam
and Phones are working

SIGNED BY: Whitto Campbell 13544
Belt Examiners and Certificate Numbers

Dan Uhlm 153?A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-21-10 SHIFT: ________ AM OR PM TO ________ AM OR PM 12:00 AM OR PM TO 3:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom J. Neely Time 2 30 AM or PM

Report received by: John A. Bickford
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO. 4	Needs dusted	JAB	✓		
Ellis NO. 5	Needs dusted; Needs cleaned 27-29 Brk	JAB	✓		
NORTH NO. 2					
NORTH NO. 3		JAB	✓		
NORTH NO. 4	Needs cleaned 29 to tail Drive to head needs add'l cleaning	JAB	✓		
NORTH NO. 5	Needs add'l cleaning at take-up & tail	JAB	✓		
NORTH NO. 6	Needs dusted & spot cleaned	JAB	✓		
NORTH NO. 7	Needs dusted	JN	✓		
Lg Wall	Needs spots Dusted m/o needs Clean lots of Coal	TD	✓		
GLORY HOLE	Pump & 'D' Box - OK	JN	✓		
TG22 NO. 1	Idle PCs OK	JN			
TG22 NO. 2	Idle PCs - OK	JN			
HG 22 #1	Needs cleaned & dusted	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0% CO & 20.8% O_2 detected at time of exam

Visual check of CO's - OK

Track, travelways, PC's, chargers & Pumps & 'D' Box's clear at time of exam

SIGNED BY: John A. Bickford 26176 Tim Davis 38322
Belt Examiners and Certificate Numbers
Johnny Neely 33472 [illegible] 33476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357 ________ ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-21-10 SHIFT Day ______ AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:______________________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	cleaned at V Plow	JAB
Ellis 5	cleaned at V Plow	JAB
NORTH 2		
NORTH 3		
NORTH 4	Cleaned at 'V' Plow	JAB
NORTH 5	Cleaned at 'V' Plow + Tail + flow thru JN	JAB
NORTH 6	Cleaned at Tail	JAB
NORTH 7		
[illegible]		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
HGZZ#1	Clean on Rib Rolls Dust around PC's TRIM splices	JN

Checked Refuges 6, 8 + 89 Brks. - OK; Phones OK

SIGNED BY: John A. Bickford 26176 Johnny Neely 33472
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-21-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Broughtout Time________ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #1	needs Dusted	BC	✓		
Ellis 5	needs cleaned 27-29 bnc, needs Dusted	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs cleaned from Drives-Discharge needs spot cleaned Tail needs added cleaning, from 32-tail	BC	✓		
NORTH NO. 5	Take up needs added cleaning	BC	✓		
NORTH NO. 6	need Dusted, needs spot cleaned from 87-tail + Airlock	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
Long Wall	Mother Drive needs cleaned, needs spot cleaned + Dusted	JS	✓		
GLORY HOLE	D Box + Pump clear at Exam	BC	✓		
H622 #1	needs cleaned + Dusted	JS	✓		
1L22 #1	needs cleaned + Dusted	JS	✓		
#2	needs Dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0ppm CO, 20.8% O^2 Detected

Track / Travelways, D-Box's, Powercenters, KVAS, Pumps, chargers

an a visual check of all CO monitors all clear at Exam

SIGNED BY: William Campbell 73547
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-21-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM 800 AM OR PM TO 1100 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
E 11.5 4		
E 11.55		
NORTH 2		
NORTH 3		
NORTH 4	Shoveled on tail	BC
NORTH 5	Shoveled on vplow	BC
NORTH 6		
NORTH 7		
Longwall		
GLORY HOLE		
[illegible] 1		
[illegible] 2		

Checked outby Refuges at 6, 8, 89, brk all clear at Exam and phones working

SIGNED BY: William Campbell 1354[illegible]
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-22-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes___ No X By Whom Brought out Time______ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	needs Dusted	BC	✓		
Ellis 5	needs cleaned from 27-29 brk needs Dusted	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs spot cleaned from 32-tail needs cleaned from Discharge-Drives, tail needs added cleaning	BC	✓		
NORTH NO. 5	take up needs added cleaning, outby tail needs added cleaning	BC	✓		
NORTH NO. 6	needs spot cleaned at air out of 87-tail needs Dusted	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
Longwall	mother drive needs cleaned, belt needs spot cleaned	JS	✓		
GLORY HOLE	D-Box-Pump-clear at Exam	BC	✓		
H622 #1	needs cleaned & Dusted	JS	✓		
T622 #1	needs cleaned & Dusted	JS	✓		
#2	needs Dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0ppm CO, 20.8% O2 Detected
TRACK/Travelways, D-Box's, pumps, KVA's, Powercenters, Chargers,
an a visual check of CO monitors all clear at Exam

SIGNED BY: William Campbell 1354-A Johnny Neely 33472
Belt Examiners and Certificate Numbers
[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Russell Dunmol 1536-A Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-22-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM 300 AM OR PM TO 600 AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________ Time________ AM or PM

Report received by: ________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	BC
Ellis 5		
NORTH 2		
NORTH 3		
NORTH 4	worked on Gob out at tail	BC
NORTH 5	Shoveled V plow's at flow thru and tail and shoveled on tail, Dusted at Flow thru	BC
NORTH 6	Ran Duster at Head	BC
NORTH 7	[illegible]	JS
[illegible]		
GLORY HOLE		
H6 22 # 1	Shovel Tail & Replaced V-Plow, work on Hanging Life Line on Belt	JS
[illegible]		
J6 # 22 # 1	Shovel on Tail, work on Belt switch cable Rehanging	JS

Checked Outby Refuges at #6, 8, 89 blks, none observed at exam
20.8% O_2, 0% CH_4, 0ppm CO Detected

SIGNED BY: [signature] 32476
Belt Examiners and Certificate Numbers
William Campbell 13547
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-22-10 SHIFT: Day ____ AM OR PM TO ____ AM OR PM 12:00 AM OR PM TO 3:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Neely Time 2:45 AM or PM

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
E1/13 4	Needs Dusted	RG	✓		
E1/13 5	Needs cleaned 27-29, Needs Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs Some Spot Cleaning, tail Needs Add Cleaning Needs cleaned Drive-Discharge	RG SH	✓		
NORTH NO. 5	takeup Needs Add Cleaning	SH	✓		
NORTH NO. 6	Needs Spot Cleaned at AirLock, 87-tail Needs Dusted	SH	✓		
NORTH NO. 7	Needs Dusted	JN	✓		
LONGWALL	Needs Some Spot Cleaning, Added Dusting Needed Area Btwn Discharge & Drive Needs Cleaned	SH	✓		
GLORY HOLE	D-Box + Pump OK	JN	✓		
HG-22	Needs cleaned & Dusted	JN	✓		
TG-22 #1	Needs cleaned & Dusted	JN	✓		
TG-22 #2	Needs Dusted	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 20.8% O2, 0 ppm CO at time of exam

TRAvelways, Power Centers, D-Boxes, Chargers OK at time of exam

Visual check of CO monitors OK at time of exam

SIGNED BY: Russell Gunnoe 1536-R Scott Halstead 37567

Belt Examiners and Certificate Numbers

Johnny Neely 33472 John [illegible] 32476

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

William Campbell 13544

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-22-10 SHIFT: Day 6:00 AM ~~OR PM~~ TO 3:00 ~~AM OR~~ PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled v-plow Cleaned tail + Greased, Cleaned from tail to 31 BK (Bobby)	RG
Ellis 5	Shoveled v-plow cleaned tail + Greased (Bobby)	RG
NORTH 2		
NORTH 3		
NORTH 4	RAN Duster At Drives, Cleaned Some on tail	RG
NORTH 5	Cleaned V-Plows	SH
NORTH 6	Cleaned V-Plows	SH
NORTH 7	Ran Duster at Head clean TAIL	SH JN
Longwall	Cleaned Mud at Mother Drive, ckd Splices	SH
GLORY HOLE		
HG-22	clean on Rib Roll clean V Plow at TAIL	JN
TG-22 #1	clean TAIL Dust from Discharge To Drive Grease Discharge Drive	JN
TG-22 #2		

Refuge chambers, 6, 8, 89 clear at EXAM
Phones working in 8, 89 BK
6 BK Phone Needs Battery

SIGNED BY: Russell Gunnoe 1536-A — Scott Halstead 37567
Belt Examiners and Certificate Numbers

Johnny Neely
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357
Mine Foreman — Certificate No. — Superintendent — Certificate No.

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-22-10 SHIFT: Eve 600 AM or PM TO 300 AM OR PM 1200 AM OR PM TO 1100 AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________ Time________ AM or PM

Report received by:________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	needs Dusted	BC	✓		
Ellis #5	needs Dusted, needs cleaned 27-29	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs cleaned from Drives - Discharge 37-tail needs spot cleaned	BC	✓		
NORTH NO. 5	tail needs cleaned out by needs Dusted, spot takeup needs cleaned	BC	✓		
NORTH NO. 6	needs spot cleaned at airlock, 87-tail needs cleaned + Dusted	BC	✓		
NORTH NO. 7	needs Dusted	JS	✓		
Thoroughfare	needs spot cleaning + Dusted Mother Drive needs cleaned, Drive-Discharge needs cleaned	JS	✓		
GLORY HOLE	D-Box + Pump clear	JS	✓		
1HG22 #1	needs cleaned + Dusted	JS	✓		
[illegible]					
T622 #1	needs cleaned + Dusted	JS	✓		
#2	needs Dusted	JS	✓		

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0 ppm CO, 20.8% O_2 Detected
Track / Travelways, D-Box's, Chargers, Powercenters, Pumps, KVA's
and a visual check of CO monitors were - all clear at Exam

Neil Cilly 28045

SIGNED BY: William Campbell 1354-A
Belt Examiners and Certificate Numbers
[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389
Mine Foreman Certificate No. Superintendent Certificate No.

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Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-22-10 SHIFT: Eve 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by: ____________________ Signed

BELTS	ACTION TAKEN	INT.
4 Ellis		
	Shoveled V-plow at tail	BC
5 Ellis	worked on Mud at tail	BC
NORTH 4	Ran pumps at 12+17 brks - shoveled on tail / worked on Mud at Discharge	BC
NORTH 5	Shoveled V-plows at Flowthru, + Tail	BC
NORTH 6	shoveled V-plow at tail	BC
NORTH 7		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
Longwall -	Dusted P.L at storage unit	BC
HG 22 #1	Shoveled on Tail V-Plow	JS
TG #22 #1	Work on Hangers Life Line	JS

Checked Outby Refuges at #6 brk - Replaced battery in phone working now
section #8 brk - phone working + all clear at Exam
#89 brk - phone not working 20.6% O_2, 0% CH_4, 0 co

SIGNED BY: William Campbell 13544
Belt Examiners and Certificate Numbers
Joel [signature] 3297C
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-23-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________ Time________ AM or PM

Report received by:________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
EM5#4	needs Dusted	BC	✓		
EM5#5	needs spot cleaned 27-29	BC	✓		
NORTH NO. 3					
NORTH NO. 4	Drives - Discharge needs cleaned needs spot cleaned 37-tail	BC	✓		
NORTH NO. 5	Outby tail needs cleaned Takeup needs added needs spot cleaned from 60-Flowthru; cleaning	BC	✓		
NORTH NO. 6	needs spot cleaned from 87-tail	BC	✓		
NORTH NO. 7	needs Dusted	JS	✓		
Longwall	needs cleaned at Drives-Discharge ~~[illegible]~~ needs spot cleaned + added Dusting	JS	✓		
GLORY HOLE	D-Box-Pump clear at Exam	JS	✓		
TG22 NO. 1	needs cleaned + Dusted	JS	✓		
TG22 NO. 2	Needs Dusted	JS	✓		
HG22 #1	needs cleaned + Dusted	JS	✓		

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0ppm CO, 20.8% O_2 Detected
Track / Travelways, D-Box's, Chargers, Powercenters, KVA, Pumps
and a visual check of CO monitors, all clear

SIGNED BY: William Campbell 1354-17 John [illegible] 30476
Belt Examiners and Certificate Numbers
Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Scott Halstead 37567

[illegible] 15214

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-23-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________________ Time________ AM or PM

Report received by:________________________ Signed

BELTS	ACTION TAKEN	INT.
#4 E 11.3	shoveled v-plow, Finished Airlock on Belt line	BC/JS
#5 E 11.3	worked on Mud at tail	BC
NORTH 3		
NORTH 4	shoveled ~~tail~~ v-plow	BC
NORTH 5	Shoveled v-plow at Flowthru	BC
NORTH 6		
NORTH 7		
GLORY HOLE		
NO. 1		
NO. 2		
HG22" 1	SHOVEL ON WALKWAY	JS
TG22* 1	SHOVEL ON WALKWAY	JS

Checked Outby Refuges at #6 - clear - phones working
#8 - clear - phone working
#89 - clear - phone not working
20.6% O_2, 0% CH_4, 0 ppm CO

* cut matts & Dateboard for New Powerbox at 5E 11.3 Head BC, JS

SIGNED BY: William Campbell 13844
Belt Examiners and Certificate Numbers
Joel Lingg 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-23-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Neely Time 2:40 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs spot cleaned 27-29, Needs Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs Spot Cleaned 33-tail, Needs cleaned Drive-Discharge	RG SH	✓		
NORTH NO. 5	Takeup Needs Add Cleaning, Needs Spot Cleaned 60-Flowthru	SH			
NORTH NO. 6	Needs Spot Cleaned 87-tail	SH	✓		
NORTH NO. 7	Needs Dusted	JN	✓		
Longwall	Mother Drive Area Needs Cleaned, Belt Needs Some spot Clean	SH	✓		
GLORY HOLE	D-Box + Pump OK	JN	✓		
TG-22 NO. 1	Needs cleaned + Dusted	JN	✓		
TG-22 NO. 2	Needs Dusted	JN	✓		
HG-22 #1	Needs Dusted, Needs Rib Roll cleaned up in walkway	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% Ch4, 20.8% O2, 0ppm CO at time of exam

TRAvelways, Power Centers, D-Boxes, chargers OK at time of exam

Visual check of CO monitors OK at time of exam

[signature] 1539A [signature] 32476

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567

Belt Examiners and Certificate Numbers Johnny Neely 33472

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-23-10 SHIFT: Day 6:00 AM TO 3:00 PM ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes___ No___ By Whom________ Time______ AM or PM

Report received by:________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	shoveled v-plow, cleaned from tail to 31BK cleaned & Greased on tail (Bobby)	RG
Ellis 5	shoveled v-plow, cleaned & Greased on tail (Bobby)	RG
NORTH 2		
NORTH 3		
NORTH 4	cleaned V-Plow	SH
NORTH 5	cleaned V-Plows clean on Tail	SH JN
NORTH 6	cleaned V-Plow	SH
NORTH 7		
Longwall	cleaned on Mud at Mother Drive	SH
GLORY HOLE		
TG-22 NO. 1	clean on Tail	JN
TG-22 NO. 2		
HG-22 #1	Clean on Rib Rolls in walkway Clean V Plow at Tail	JN

Refuge chambers 6, 8, 89 BK Good at EXAM
Phones Working at EXAM

SIGNED BY: Russell Gumm 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33354 ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-23-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM (ON-SHIFT EXAM.) 800 AM OR PM TO 1100 AM OR PM (PRE-SHIFT EXAM.)

Was this report phoned to outside Yes____ No____ By Whom____________ Time__________ AM or PM

Report received by:______________________ Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
E11S NO. 4	needs Dusted	GU	✓		
E11S NO. 5	needs spot cleaned & Dusted	GU	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs spot cleaned 37-tail needs cleaned from Drive - Discharge	GU	✓		
NORTH NO. 5	take up needs added cleaning - needs spot cleaned 60-tail	GU	✓		
NORTH NO. 6	needs spot cleaned 87-tail	BC	✓		
NORTH NO. 7	Needs Dusted	BC	✓		
Longwall	Mother Drive area needs cleaned Belt needs spot cleaned	JS	✓		
GLORY HOLE	D-Box & Pump Clean at Exam	BC	✓		
T622 NO. 1	needs cleaned & Dusted	JS	✓		
T622 NO. 2	needs Dusted	JS	✓		
H622 #1	needs Dusted, needs Rib-Roll cleaned up in Walkway	JS	✓		
	and Belt needs cleaned				

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0% CO, O_2 20.8% Detected

Track/Travelways, D-Box's, Chargers, Powercenters, an a visual check of CO's

SIGNED BY: William Campbell 1339-A Glen Ullom 1539-H
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 53289
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-23-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
GLORY HOLE		
7632 NO. 1	Shovel V-Plow	JS
NO. 2		

Checked Outby Refuges at #6 - N/O - phones working
#8 - N/O - phones working
#89 - N/O - Changed battery phone working
20.6% O_2, 0% CH_4, 0ppm CO

SIGNED BY: William Campbell 1384?
Belt Examiners and Certificate Numbers
[signature] 1539A
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T Moore 33389
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-24-10 SHIFT: Owl ____ AM OR PM TO ____ AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Broughtout Time________ AM or PM

Report received by:____________________
Signed

BELTS	~~Needs~~ VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	GU	✓		
Ellis 5	Needs spot cleaned & dusted	GU	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs spot cleaned 37-Tail Needs Cleaned Drive-Head	GU	✓		
NORTH NO. 5	Takeup Needs Add Cleaning 60 Break - Flow thru	GU	✓		
NORTH NO. 6	needs spot cleaned 87-Tail	WC	✓		
NORTH NO. 7	Needs Dusted	WC	✓		
LW #1	mother Drive needs Cleaned Belt needs spot Cleaned	JS	✓		
GLORY HOLE	D-Box Pump OK	WC	✓		
TG22 #1	needs Cleaned & dusted	JS	✓		
TG22 #2	needs Dusted	JS	✓		
HG22 #1	Needs Dusted, Rib Roll cleaned up in walkway	JS	✓		
	Belt needs Cleaned				

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

06 UY 06 CO 20.8802

PC's, Travelways, D-Box, charger OK

SIGNED BY: [signature] 1339-A [signature] 32476
Belt Examiners and Certificate Numbers
[signature] 1334-A Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.
Scott Halstead 37567

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-24-10 SHIFT: Owl 1100 AM OR (PM) TO 300 (AM) OR PM ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom____ Time____ AM or PM

Report received by:____
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	cleaned V-plow	GV
Ellis 5	change roller LC	
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	cleaned Flowthru, made splice	GV
NORTH 6	Shoveled V plow at Flowthru	BC
NORTH 7	change roller LC	
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
7N Const-	Set 3 Jacks near D Box & Powercenter	BC, JS
North Mains		BC, JS
intake Rooms	Moved pump in #[illegible] up closer to Face were water is Deeper	

Checked out by Ref[illegible] 6-8-89 OK Phones working

SIGNED BY: [signature] 15394 [signature] 32476
Belt Examiners and Certificate Numbers
William Campbell 135474
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33387
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-24-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 12:00 AM OR PM TO 3:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Bickford, John Neely Time 2:20 AM or PM

Report received by: ____________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs spot cleaned + Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Needs cleaned Drive-Discharge, Needs spot cleaned 37-Tail	JAB RG	✓		
NORTH NO. 5	Take-up needs add. cleaning, Needs spot cleaned 60-Flow Thru	JAB	✓		
NORTH NO. 6	Needs spot cleaned 87-Tail	JAB	✓		
NORTH NO. 7	Needs Dusted	SH	✓		
Longwall	Belt Needs Spot cleaned Mother Drive Needs Add Cleaning	SH	✓		
GLORY HOLE	D-Box + Pump OK	SH	✓		
TG-22 NO. 1	Needs spot cleaned + Dusted	JN	✓		
TG-22 NO. 2	Needs Spot cleaned + Dusted	JN	✓		
HG-22 #1	Needs cleaned + Dusted, Rib Roll needs cleaned up in walkway	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 20.8% O2, 0ppm CO at time of exam

Travelways, Power Centers, D-Boxes, Chargers OK at time of exam

Visual check of CO monitors OK at time of exam

[signature] 32476

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567

Belt Examiners and Certificate Numbers

John G. Bickford 2617 Johnny Deily 33472

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______ ______

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-24-10 SHIFT: DAY 6:00 AM ~~OR PM~~ TO 3:00 ~~AM OR~~ PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____________ Time________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled v-plow (shoveled tail & Greased tail) Bobby	RG
Ellis 5	Shoveled v-plow shoveled tail (Greased tail) Bobby.	RG
NORTH 2		
NORTH 3		
NORTH 4	Cleaned at tail & V Plow	JAB
NORTH 5	Cleaned at flow-thru	JAB
NORTH 6	Cleaned at flow-thru & tail	JAB
NORTH 7		
Longwall	Cleaned on Mud at Mother Drive All Shift	SH
GLORY HOLE		
~~TG-22~~ NO. 1	Clean Tail + V Plow Dust from Head To Takeup	JN
~~TG-22~~ NO. 2		
HG-22	Dust Head To Takeup fill Duster + Run Dust Guard Back up	JN
	Straighten out Life line Inby Drive clean on Rib Roll	JN

Refuge chamber 6, 89, 8 bk 2 set OK + phones working at time of exam

SIGNED BY: Russell Gunnoe 1536-A
Belt Examiners and Certificate Numbers

John A. Bulford 26176
Belt Examiners and Certificate Numbers

Scott Halstead 37567

Johnny Nealy 33472

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. ______ Superintendent ______ Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 3-24-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO. 4	needs Dusted	BC	✓		
Elkys NO. 5	needs spot cleaned & Dusted	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	needs cleaned from Drives - Discharge needs spot cleaned 37-tail	BC	✓		
NORTH NO. 5	Takeup needs added cleaning needs spot cleaned 60-Flowthru	BC	✓		
NORTH NO. 6	needs Dusted needs spot cleaned 87-tail	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
Longwall	Belt needs spot cleaned & Dusted Mother Drive needs added cleaning	JS	✓		
GLORY HOLE	D-Box & Pump Cleared Exam	BC	✓		
TGR NO. 1	needs spot cleaned & Dusted	JS	✓		
TGR NO. 2	needs spot cleaned & Dusted	JS	✓		
HG22 #1	needs cleaned & Dusted Rib Roll needs cleaned up in walkway	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0ppm CO, 20.8% O2 Detected
Track/Travelways, KVA, Powercenters, Chargers D-Box's, Pumps an
a visual check of CO monitors cleared Exam

SIGNED BY: [signature] 135414
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-24-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 11 00 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________ Signed

BELTS	ACTION TAKEN	INT.
4 Ellis	Shoveled V-plow	BC
5 Ellis		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Shoveled V-plow at Flowthru	BC
NORTH 6	Shoveled V-plow at Flowthru	BC
NORTH 7		
Longwall		
GLORY HOLE		
T622 NO. 1		
T622 NO. 2		
2G22 #1		

Checked outby Refuge at #6 w/O
#8 w/O } and phones working
#89 w/O 20.6% O_2, 0 ppm CO, 0% CH_4

SIGNED BY: Walter Campbell
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-25-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________ Time________AM or PM

Report received by:________

Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO. 4	needs Dusted	BC	✓		
Ellis NO. 5	needs spot cleaned & Dusted	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take up needs added cleaning, tail needs added cleaning Drives to Discharge needs cleaned, needs spot cleaned 87-tail	BC	✓		
NORTH NO. 5	needs from 65-Flow thru, Take up needs added cleaning	BC	✓		
NORTH NO. 6	needs Dusted needs spot cleaned 87-tail	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
Longwall	Belt needs spot cleaned & Dusted	JS	✓		
GLORY HOLE	D-Box & Pump clear at Exam	BC	✓		
T622 NO. 1	needs spot cleaned & Dusted	JS	✓		
T622 NO. 2	needs spot cleaned & Dusted	JS	✓		
H622 #1	needs Cleaned & Dusted, Rib Rolls need cleaned up	JS	✓		
	in walk way				

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0ppm CO, 20.8% O2 Detected

Track / Tramways, D-Box's, Chargers, KVA's, Powercenters, an a Visual check of CO monitors all clear at Exam

SIGNED BY: William Campbell 13847
Belt Examiners and Certificate Numbers

[signature] 32476.
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Russell Dunmore 15364A John L. Bickford 21176 Scott Halstead 37567

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-25-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	shoveled v plow change rolls LC.	BC
Ellis 5		
NORTH 2		
NORTH 3		
NORTH 4	shoveled on tail shoveled v plow Ran Duster change rolls LC	BC
NORTH 5	shoveled v plow at Flow thru + tail, shoveled on tail	BC
NORTH 6		
NORTH 7	shoveled on Flow thru	BC
Longwall	SHOVELED AT AirLock. change rolls LC	JS
GLORY HOLE		
T622 NO. 1	SHOVELED V-Plow	JS
T622 NO. 2		
H622#1	SHOVELED V-Plow	JS

Checked Outby Refuges at #6 - N/O
#8 - N/O } all Phones working
#89 - N/O 0% CH4, 0ppm CO, 20.8% O2

SIGNED BY: William Campbell 1334-?
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-25-10 SHIFT: DAY ____ AM OR PM TO ____ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ____ By Whom John Bickford Time 2:25 AM or (PM)

Report received by: Russell Gunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs Spot Cleaned + Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Takeup + tail Needs Add Cleaning, Needs Spot Cleaned Needs cleaned Drive-Discharge	RG SH	✓		
NORTH NO. 5	Takeup Needs Add Cleaning, Needs Cleaned 60-Flowthru	SH	✓		
NORTH NO. 6	Needs Dusted, Needs Spot Cleaned 87-tail	SH	✓		
NORTH NO. 7	Needs Spot cleaned + Dusted	JAB	✓		
Longwall	Belt needs Spot Cleaned & Dusted	SH	✓		
GLORY HOLE	D-Box + Pump OK	JAB	✓		
TG-22 NO. 1	Needs spot cleaned + Dusted	JAB	✓		
TG-22 NO. 2	Needs spot cleaned, Water at tail	JAB	✓		
HG-22 #1	~~Needs add'l cleaning in Walk-way~~ Needs add. spot cleaning + dusting, Water Accumulating at Head	JAB	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO at time of exam

Travelways, Power Centers, Chargers, D-Boxes OK at time of exam

Visual Check of CO monitors OK at time of exam

Glen Allman [illegible]

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers

John A. Bickford [signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ____
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-25-10 SHIFT: DAY 6:00 (AM) OR PM TO 3:00 AM OR (PM) ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____________ Time________ AM or PM

Report received by:____________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow, cleaned & Greased tail (Bobby)	RG
Ellis 5	Shoveled V-plow, cleaned & Greased tail (Bobby)	RG
NORTH 2		
NORTH 3		
NORTH 4	RAN Duster at Drive, cleaned Some on tail SH	RG
NORTH 5	Cleaned V-Plow at tail & flowthru, Ran Duster	SH
NORTH 6	cleaned V-Plow, Ran Duster, Cleaned & dusted tail & flow-thru	SH
NORTH 7		
Longwall	Cleaned Spillage at Discharge Greased on Drive, Dusted around Drive, Spot Cleaned at Box ck	SH
GLORY HOLE		
TG-22 NO. 1		
TG-22 NO. 2		
HG-22 #1		

Refuge Chambers 6, 8, 89 BK ok at EXAM
Phones Working at time of EXAM

[signature] 15537

SIGNED BY: Russell Gunnoe 1536-A — Scott Halstead 37567

Belt Examiners and Certificate Numbers

John R. Buckford 26176 — [signature] 32476

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33357

Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 3-25-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM 800 AM OR PM TO 1100 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes___ No X By Whom Brought out Time______ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	Needs Dusted	GU	✓		
Ellis #5	Needs Spot Cleaned and Dusted	GU	✓		
Eiwall	Needs spot Cleaned + Dusted	JS	✓		
NORTH NO. 3					
NORTH NO. 4	Takeup needs Add Cleaned, Needs Spot Cleaned Needs Cleaned Drive - Discharge	GU	✓		
NORTH NO. 5	Takeup Needs Add Cleaning Needs cleaned 60 Brk - Flowthru	GU	✓		
NORTH NO. 6	Needs Dusted, needs spotcleand 87-Tail	GU	✓		
NORTH NO. 7	needs spot cleand + Dusted	JS	✓		
NORTH NO. 8					
GLORY HOLE	D-Box Pump OK	JS	✓		
TG NO. 1	Needs spot Cleand + Dusted	JS	✓		
TG NO. 2	Needs spot Cleand water At Tail	JS	✓		
HG22 #1	needs Add Cleaning walkway needs spot cleand + dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

OG CH4, OG CO, 20.8 O2

PC's, Chargers, O-Boxes, Pumps, Travelways OK

SIGNED BY: [signature] 15394
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33357
Mine Foreman Certificate No. Superintendent Certificate No.

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-25-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ____ Time ____ AM or PM

Report received by: ____ Signed

BELTS	ACTION TAKEN	INT.
Ellis #4	Cleaned V-Plow Ran Duster	GV
Ellis #5	Cleaned V-Plow	GV
NORTH 2		
NORTH 3		
NORTH 4	Ran Duster	GV
NORTH 5	Ran Duster Cleaned V-Plow	GV
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked outby refuges 6-8-89 OK

SIGNED BY: [signature] 153?? Belt Examiners and Certificate Numbers

____ Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] Mine Foreman 33359 Certificate No. ____ Superintendent ____ Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-26-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM 3:00 AM OR PM TO 6:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom______________ Time________ AM or PM

Report received by: Brought out
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
ellis #4	Needs Dusted	GLC	✓		
ellis #5	Needs spot cleaned and Dusted	GLC	✓		
Longwall	Needs spot cleaned and Dusted	JS	✓		
NORTH NO. 3					
NORTH NO. 4	Take up needs Add cleaning Needs spot cleaned Needs cleaned Drive - Discharge	GLC	✓		
NORTH NO. 5	Take up Needs Add cleaning Needs cleaned 60BRK to flowthe	GLC	✓		
NORTH NO. 6	Needs Dusted, Needs spot cleaned 87-Tail	GLC	✓		
NORTH NO. 7	Needs spot cleaned and Dusted	JS	✓		
NORTH NO. 8					
GLORY HOLE	D-Box pump ok	JS	✓		
TG NO. 1	Needs spot cleaned and Dusted				
TG NO. 2	Needs spot cleaned, water At Tail	JS	✓		
HG22 #1	Need Add cleaning walkways Needs spot cleaned and Dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 20.8% O^2, 0ppm C.O Detected

PC,S, Chargers, D-Boxes, Pumps, Travelways, Track OK At Time of exam

Visual check of C.O. monitors OK At exam

SIGNED BY: [signature] 1947-A
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33389
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Scott Halstead 37567

Russell Mummer 1536-A

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-26-10 SHIFT: OWL ______ AM OR PM TO ______ AM OR PM 3:00 AM OR PM TO 6:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom______________ Time__________ AM or PM

Report received by: Brought Out
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1 Ellis	change roller LC	
NORTH 1 Ellis	change roller LC	
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Cleaned Flow Threw V-Plow	GLC
NORTH 6	change roller LC	
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
Ellis #4	Cleaned V-Plow	GLC

Refuge At GLC 6BRK, 81BRK OK At time OF exam

SIGNED BY: Greg Cole 1947-A
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-26-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 12:00 AM OR PM (circled) TO 3:00 AM OR PM (circled)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time__________ AM or PM

Report received by:______________________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs Spot cleaned + Dusted	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	TaKeup Needs Cleaned, Belt Needs Spot Cleaned Needs cleaned Drive to Discharge	RG SH	✓		
NORTH NO. 5	TAKeup Needs Add Cleaning, Needs Spot Cleaned 66BK To flowthru	SH	✓		
NORTH NO. 6	Needs Spot Cleaned 87-tail, Needs Dusted	SH	✓		
NORTH NO. 7	Belt Needs Spot Cleaned & Dusted,	SH	✓		
Longwall	Needs Dusted 55+25, 56+50, 66+00, 66+50	TD	✓		
GLORY HOLE					
TG22 NO. 1	Belt needs Additional Dusting, Needs Spot Cleaned	TM	✓		
TG22 NO. 2	Belt needs Additional Dusting Needs Spot Cleaned	TM	✓		
HG-22 #1	Belt Needs Additional Dusting, Needs Spot Cleaned	TM	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO at time of exam

TRAvelways, Power Centers, D-Boxes, Chargers OK at time of exam

Visual Check of CO monitors OK at time of exam

Glen Ullman 1539-A

SIGNED BY: Russell Gunnoe 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers

T. Moore 33389 Tim Dawson 38,322
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389 ______________ ______________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

William Campbell 1354-A

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-26-10 SHIFT: DAY 6:00 (AM) OR PM TO 3:00 AM OR (PM) ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time__________ AM or PM

Report received by:______________________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow (shoveled tail & Greased tail) Bobby	RG
Ellis 5	Shoveled v-plow (shoveled tail & Greased tail (Bobby	RG
NORTH 2		
NORTH 3		
NORTH 4	Ran duster at Drive, cleaned on tailpiece SH	RG
NORTH 5	cleaned V-Plows at tail & Flowthru, Ran Duster at Head	SH
NORTH 6	cleaned V-Plow, Ran Duster at Head	SH
NORTH 7	Cleaned on tail & Greased tail Roller	SH
Longwall	cleaned at Head, Hand Dusted Head & Drive Area, ckd Splices	SH
GLORY HOLE		
TG-22 NO. 1		
TG-22 NO. 2		
HG-22 #1		

Refuge Chambers 6, 8, 89 BKs were Clear time of EXAM
All phones working at Exam time

Don Ulm 1537

SIGNED BY: Russell Gunnoe 1536-A Scott Halsted 37567
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33387

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-26-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM 800 AM OR PM TO 1100 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Brought out ____ Time ____ AM or PM

Report received by: ____________________

Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO.4	Needs Dusted	BC	✓		
Ellis NO.5	Needs Dusted + Spot cleaned	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take up needs cleaned, needs spot cleaned Drive to Discharge needs cleaned	BC	✓		
NORTH NO. 5	Take up needs added cleaning needs spot cleaned 60-Flowthru	BC	✓		
NORTH NO. 6	needs Dusted, needs spot cleaned from 87-tail	GU	✓		
NORTH NO. 7	needs Dusted + spot cleaned	GU	✓		
Longwall	needs Dusted 55+25, 55+50, 66+00, 66+50	GU	✓		
GLORY HOLE	D-Box + Pump clear at exam	GU	✓		
T622 NO. 1	Needs added dusting + spot cleaning	GU	✓		
T622 NO. 2	Needs added dusting & spot cleaning	GU	✓		
H622 #1	needs added dusting + spot cleaning	GU	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0ppm CO, 20.8% O2 Detected

Track/Travelways, D-Box's, Chargers, Powercenters, KVA, Pumps and

visual check of CO monitors were all clear at Exam

SIGNED BY: William Campbell 13547

Belt Examiners and Certificate Numbers

Glen [illegible] 15391

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33357

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-26-10 SHIFT: EVE 6:00 AM OR PM TO 8:00 AM OR PM ON-SHIFT EXAM. 8:00 AM OR PM TO 11:00 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________ Time________ AM or PM

Report received by:________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	BC
Ellis 5		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Shoveled V-plow at Blowthru + tail	BC
NORTH 6		
NORTH 7		
Longwall		
GLORY HOLE		
T623 NO. 1		
T622 NO. 2		
H622 #1		

Check outby Refuges at #6 - n/o all phones working
#8 - n/o
#89 - n/o
20.6% O2, 0% CH4, 0ppm CO
Checked Intake Rams 5 CU

SIGNED BY: William Campbell 13844
Belt Examiners and Certificate Numbers
[signature] 15394
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33789
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-27-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM 800 AM OR PM TO 600 AM OR PM
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Brought out ______ Time______ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	WC	—		
Ellis 5	Needs Dusted & Spot cleand	WC	—		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Takeup needs cleand, Needs spot cleand Drive to Discharge needs cleand	WC	✓		
NORTH NO. 5	Takeup needs add cleaning Needs spot cleand 40 - Flexthing	WC	✓		
NORTH NO. 6	Needs spot cleand & Dusted From 87-TA	GU	—		
NORTH NO. 7	Needs Dusted & Spot cleand	GU	✓		
Llwall	Needs Spot Dusted	LB	✓		
GLORY HOLE	D-Box Amp OK	GU	—		
T622 #1	Belts Idle no Power	GU			
T622 #2	Belts Idle no Power	GU			
H622 #1	need Add spot cleaning & dusting	GU	—		

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O6 CH4 O2 CO 20.8 20.2

PC'S, Charger, D-Boxes, Travelways OK

SIGNED BY: [signature] 15394 Neil Cully 28045
Belt Examiners and Certificate Numbers

William Campbell 13544
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

John A. Bickford 26176

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-27-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled Vplow	BC
Ellis 5		
NORTH 2		
NORTH 3		
NORTH 4	Shoveled vplow	BC
NORTH 5	Shoveled Vplow at Flowthru + tail	BC
NORTH 6	Cleaned VPlow	GW
NORTH 7	Cleand V-Plow	GW
NORTH 8		
GLORY HOLE		
___ NO. 1		
_3 NO. 2		
H622 #1	Cleaned on TAil	GW

Checked outby Refuges 6,8,89 OK
checked Intake Rooms OK

SIGNED BY: [signature] 15794
Belt Examiners and Certificate Numbers
William Campbell 13544
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33389
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-27-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM 1200 AM OR PM TO 300 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs dusted	JAB	✓		
Ellis 5	Needs dusted + spot cleaned	JAB	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take-up needs cleaned drive to head needs cleaned	JAB	✓		
NORTH NO. 5	Take up needs add'l cleaning needs spot cleaned 60 to Flow. Chu	JAB	✓		
NORTH NO. 6	Needs spot cleaned + dusted	JAB	✓		
NORTH NO. 7	Needs dusted + spot cleaned	SH	✓		
LWALL	Need more cleaning + dusting	HL	✓		
GLORY HOLE	D Box + Pump ok	SH	✓		
LBB NO. 1					
LBB NO. 2					
HG 22 #1	Needs add'l spot cleaning + dusting	SH	✓		
#					
TG 22 #1	Idle PCs - OK	SH			
TG 22 #2	Idle PCs OK	SH			

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4 0% CO + 20.8% O_2 detected

Track, travelways, PC's, chargers, D'Box's + Pumps clear at time of exam

SIGNED BY: [signature] 21171 [signature] 28047 [signature] 32058-86
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-27-10 SHIFT: Day ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:____________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH		
E4		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Cleaned at Tail & flow-Thru SH,	SAB
NORTH 6	Cleaned at flow-Thru & Tail SH,	SAB
NORTH 7	Cleaned at Tail	SH
Hiwall	1 MAN Cleaning ON Belt.	HL
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked Refuges 6, 8 & 89 Bnks. - OK Phone OK

SIGNED BY: John L. Buford 21171 ______ [illegible] 28045
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33387 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-27-10 SHIFT: EVE 800 AM OR PM TO 1100 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom________________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	NEEds Dusted	J.M	✓		
Ellis 5	Needs spot cleaned + Dusted	JM	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take-up needs cleaned, drive to head needs cleaned	BB	✓		
NORTH NO. 5	take up needs add cleaning, needs spot cleaned Go to flu thru	BC	✓		
NORTH NO. 6	needs spot cleaned & dusted	BC	✓		
NORTH NO. 7	needs spot cleaned & dusted	BC	✓		
L.W. BELT	NEEDS add Cleaning & Dusting	JM	✓		
GLORY HOLE					
LBB NO. 1					
LBB NO. 2					
TG 22 #1	Idle -> P/C & Chargers				
TG 22 #2	Idle -> Clear time of exam	JM	✓		
HG#22 1	needs add spot cleaning & dusting	BC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% ch4 20.8 o2, 0% co

Track - Haulways - P/C's - KVA'S - D-Boxes - Pumps - all clear
Time of exam

SIGNED BY: Jack Martin 37793 Brian Collins 1543-A
Belt Examiners and Certificate Numbers
Bobby L Bl... 38699
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-27-10 SHIFT: Eve 6 AM OR PM TO 1200 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Refuges at 6, 8, & 89 OK Phones OK

SIGNED BY: Brian Collins 1543-A
Belt Examiners and Certificate Numbers
Billy J. [illegible] 38699
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33309
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-28-10 SHIFT: owl ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom ____________ Time ________ AM or PM

Report received by: ________________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	Needs Dusted	JM	✓		
Ellis #5	Needs spot cleaned + dusted	JM	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Take-up needs cleaned, drive to head needs cleaned	BB	✓		
NORTH NO. 5	Take-up needs add. cleaning, needs spot cleaned 60-to 80-Xcut	BC	✓		
NORTH NO. 6	Needs spot cleaned + dusted	BC	✓		
NORTH NO. 7	Needs spot cleaned + dusted	BC	✓		
LW Belt	Needs Add. cleaning + dusting	JM	✓		
GLORY HOLE					
LBB NO. 1					
LBB NO. 2					
TG 22 #1	Idle > PC + chargers	JM	✓		
TG 22 #2	Idle > Clear at time of exam	JM	✓		
HG 22 #1	Needs Add. spot cleaning + dusting	BC	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

CH4 0% O2 20.8% CO 0

Track, Travelways, PC's, KVA's - D-Boxes, Pumps — All clear at time of exam

SIGNED BY: Billy L Bishop 38649 — Jack Marrow 37793 — Bilam Collins 1543-A
Belt Examiners and Certificate Numbers

Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-28-10 SHIFT: owl 1200 AM OR PM TO 600 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ______ Time ______ AM or PM

Report received by: ______
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Refuges at 6, 8, 89 ok Phones ok

SIGNED BY: Brian Collins 1543-A
Belt Examiners and Certificate Numbers
Billy [illegible] 38699
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Richard Burkhard 26176 Johnny Kelly 33472

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3·28·10 SHIFT: Day ____ AM OR PM TO ____ AM OR PM 1200 AM OR PM TO 300 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom J Neely Time 200 AM or PM

Report received by: John A. Bickford 26176
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
E4L4 NO. 4	Needs dusted	JAB	✓		
E4L5 NO. 5	Needs spot cleaned & dusted	JAB	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Tail needs cleaned Take-up & drive to head needs cleaned	JAB	✓		
NORTH NO. 5	Take up needs add'l cleaning Needs spot cleaned & O to floor thru	JAB	✓		
NORTH NO. 6	Needs spot cleaned & dusted	JAB	✓		
NORTH NO. 7	Needs spot cleaned & dusted	JN	✓		
Lg Wall	Needs spot Dusted	TD	✓		
GLORY HOLE	Pump & D'Box - OK	JN	✓		
TG 22 NO. 1	Idle PC · OK	JN			
TG 22 NO. 2	Idle PC OK	JN			
HG 22 #1	Discharge area needs add'l cleaning Needs add'l cleaning & dusting	JN	✓		
*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS					

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4 0% CO & 20.8% O_2 detected at time of exam

Visual check of CO's - OK

PC's, Track, Trans[illegible], chargers, Pumps & D'Box

[illegible signature] 15394

[illegible signature] 32476

SIGNED BY: John A. Bickford 26176 Charles J Davis 38322

Belt Examiners and Certificate Numbers

Johnny Neely 33472 [illegible signature] 15394

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. [illegible] 33359

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3.28.10 SHIFT Day ______ AM OR PM TO ______ AM OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time__________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Cleaned at Tail + flow thru JAB	JAB
NORTH 6	Cleaned at Tail + flow thru	JAB
NORTH 7	CLEAN ON 7 North V Plow + TAIL	JN
Lg Hall		
GLORY HOLE		
HG 22 #1	CLEAN ON Discharge Area. Pump Water Grease Discharge	JN
JG 22 # 1		

Checked Refuges at 6.8 + 89 Brks; OK, Phones OK

SIGNED BY: John A. Bickford 26176 Johnny Neely 33472
Belt Examiners and Certificate Numbers

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33337
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-28-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM 800 AM OR PM TO 1100 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ___ No X By Whom Brought out Time ______ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH~~ Ellis NO. 4	Needs Dusted	GV	✓		
~~NORTH~~ Ellis NO. 5	Needs Dusted & Spot Cleaned	GV	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Tail needs Add Cleaning Take up and Drive to Hd Needs Cleaned	GV	✓		
NORTH NO. 5	Take up needs Add Cleaning Needs Spotcleaned CO - Flowtmen	GV	✓		
NORTH NO. 6	Needs Spot Cleaned & dusted	GV	✓		
NORTH NO. 7	Needs spot cleaned & dusted	JS	✓		
~~NORTH NO. 8~~ Linnell	Needs Spot Dusted	JS	✓		
GLORY HOLE	D-Box Pump OK	JS	✓		
~~HB~~ TG22 NO. 1	Needs spot cleaned & dusted	JS	✓		
~~HB~~ TG22 NO. 2	Needs spot cleaned & dusted	JS	✓		
HG22 #1	Needs Spot cleaned & dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O2 CH4 O2 CO 20.8 0 0

PC's, Chargers, D-Boxes, Pumps, and Travelways OK

Phones Does Not Page At HG 22 #1 Head

SIGNED BY: Dan Miller 15592
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-28-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ____________ Time ________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
~~NORTH~~ E11:55 1	cleaned At TAil	6U
NORTH 2		
NORTH 3		
NORTH 4	cleanedAt TAil Fixed Broke chain at 37Brk	6U
NORTH 5	cleaned Fbw tree	6U
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked out by Refuges 6, 8, 89 all OK

SIGNED BY: Don Ulhn 1539A
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-29-10 SHIFT: owl ______ AM OR PM TO ______ AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH NO. 1~~ E11-4	Needs Dusted	GV	—		
~~NORTH NO. 1~~ E11-5	needs spot cleaned & dusted	GV	—		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Takeup, Drive to Head needs cleaned	GV	✓		
NORTH NO. 5	Takeup needs add cleaning Needs spot cleaned 60 brk - ? bottom	GV	—		
NORTH NO. 6	needs spot cleaned & dusted	GV	✓		
NORTH NO. 7	NEEDS DUSTED	JS	✓		
NORTH NO. 8					
GLORY HOLE	D-Box & PC ok	JS	✓		
LBB NO. 1					
LBB NO. 2					
T622 #1	NEEDS DUSTED	JS	✓		
T622 #2	NEEDS SPOT CLEAN & DUSTED	JS	✓		
H622 #1	NEEDS DUSTED	JS	✓		
Longwall	NEEDS DUSTED	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

O2 CH4 CO CO 20.8 0 0

PC's Chargers, D-Boxes, Pumps, Travelways ok

SIGNED BY: [signature] 15399
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

[signature: Johnny Neely] 33472

COUNTERSIGNED BY [signature: T. Moore] 33359
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Scott Halstead
37547

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-29-10 SHIFT: Owl 1100 AM or PM TO 3 00 AM or PM ____ AM or PM TO ____ AM or PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ____________ Time ________ AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
~~SOUTH 1~~ E11:24	cleaned U-Pan / change roller L.C	6 U
NORTH 1	change roller LC	
NORTH 2		
NORTH 3		
NORTH 4	Cleaned on TAil, Randuster At drives change roller LC	6 U
NORTH 5	cleaned Flow thru, Randuster change roller LC	6 U
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
T622 #1	CLEAN ON WALKWAY WORK ON LIFE LINE	JS
LWA11	change roller L.C.	

Checked out by Refuges 6-8-8 9 OK

SIGNED BY: [signature] 15392
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33357 ________ ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-29-10 SHIFT: DAY ____ AM OR PM TO ____ AM OR PM ON-SHIFT EXAM. 12:00 AM OR (PM) TO 3:00 AM OR (PM) PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ____ By Whom J. Neely Time 2:47 AM or (PM)

Report received by: ____________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis #4	Needs Dusted	SH	✓		
Ellis NO. 5	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	TAKeup, Drive - Head Needs Cleaned	SH	✓		
NORTH NO. 5	TAKeup Needs Add Cleaning Needs Spot Cleaned 60 BK - Flowthru	SH	✓		
NORTH NO. 6	Needs Spot Cleaned & Dusted	SH	✓		
NORTH NO. 7	Needs Dusted	JN	✓		
LongWAll	Needs Dusted from 8BK to Storage Unit	TD	✓		
GLORY HOLE	D-BOX & Pump Clean	JN	✓		
LBB NO. 1					
LBB NO. 2					
TG22 #1	Needs Dusted, TAIL Needs ADD CLEANING	JN	✓		
TG22 #2	Needs Spot Cleaned & Dusted	JN	✓		
HG22 #1	Needs Dusted	JN	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO Detected at EXAM time
Power Centers, D-Boxs, Chargers, track & Travelways Clear at EXAM time
Visual CK of C.O. Monitors - Clear.

SIGNED BY: [signature] 38522 — Scott Halstead 37567
Belt Examiners and Certificate Numbers
Johnny Neely 33472 — [signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. [signature] 33359
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

William Caruso 1354-A

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-29-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM ______ AM OR PM TO ______ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom______________ Time__________ AM or PM

Report received by:______________________
Signed

BELTS	ACTION TAKEN	INT.
#4	cleaned tail & Greased & Dusted (Bobby)	
#5	Cleaned tail & Greased & Dusted (Bobby)	
NORTH 2		
NORTH 3		
NORTH 4	Cleaned on tail	SH
NORTH 5	cleaned V-Plow at tail & flowthru Ran Duster clean on TAIL	JN SH
NORTH 6	cleaned V-Plow Ran Duster	SH
NORTH 7	Ran Duster SH	
LongWall	Cleaned V-Plow at Head, Greased Discharge, cleaned & Dusted at Drive	SH
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
HGZZ#1	Hand Dust Drive Area, Grease on Drive	JN
TGZZ#1	clean on V Plow & TAIL, Dust from Discharge to Takeup Pump Water	JN
	Ran Trickle duster.	JN

CKd outby Refuge Chambers 6-8-89 BK -clear
All Phones Working

Clean off PC's at HGZZ Drive & splitter clean off PC at 130 Brk

SIGNED BY: Scott Halstead 37567
Belt Examiners and Certificate Numbers
Johnny Nelly 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33339
Mine Foreman Certificate No. Superintendent Certificate No.

6543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-29-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom________________ Time________ AM or PM

Report received by:________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO.4	needs Dusted	BC	✓		
Ellis NO.5	needs spotcleaned & Dusted	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Takeup, Drive-Head needs cleaned	BC	✓		
NORTH NO. 5	Takeup needs added cleaning needs spot cleaned from work - Plowithm	BC	✓		
NORTH NO. 6	needs spot cleaned & Dusted	BC	✓		
NORTH NO. 7	needs Dusted	BC	✓		
Longwall	needs Dusted from 86MC - Storage unit	JS	✓		
GLORY HOLE	D-Box & Pump clear at Exam	BC	✓		
T622 NO. 1	needs Dusted, TA needs added cleaning	JS	✓		
T622 NO. 2	needs spotcleaned & Dusted	JS	✓		
H622 #1	needs Dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0ppm CO, 20.8% O_2 Detected

Track / Travelways, D-Box's Chargers Power Centers

an a visual check of CO monitors all clear at Exam

SIGNED BY: William Campbell 1354-[illegible]
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-29-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ON-SHIFT EXAM. 800 AM OR PM TO 1100 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____________ Time________ AM or PM

Report received by:____________________ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled v-plow	BC
Ellis 5		
NORTH 3		
NORTH 4	shoveled on v-plow	BC
NORTH 5	Shoveled v plow at Flowthru	BC
NORTH 6		
NORTH 7		
Longwall		
GLORY HOLE		
T622 NO. 1		
T622 NO. 2		
H622 #1		

Checked ~~O~~ by Refuges at #6 - N/O
#8 - N/O
#89 - N/O
} all phones working
20.6% O_2, 0% CH_4, 0ppm CO Detected

SIGNED BY: William Campbell 35414
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-30-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom__________ Time________ AM or PM

Report received by:__________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis NO.4	needs Dusted	BC	✓		
Ellis NO.5	needs some spot cleaning & Dusting	BC	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Takeup, Drive - Head needs cleaned, Tail needs added cleaning	BC	✓		
NORTH NO. 5	Takeup needs added cleaning needs spot cleaned 60-70 [illegible]	BC	✓		
NORTH NO. 6	needs spot cleaned	BC	✓		
NORTH NO. 7	needs Dusted	JS	✓		
Longwall	needs Dusted from 8bk - storage unit	JS	✓		
GLORY HOLE	D-Box & Pump all clear	BC	✓		
T622 NO. 1	needs Dusted, Tail needs added cleaning	JS	✓		
T622 NO. 2	needs spot cleaned & Dusted	JS	✓		
H622 #1	needs Dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 0ppm CO, 20.8% O^2 Detected

Track / Travelways, chargers, D-Box, Powercenters, KVA's, & Pumps an a visual check of all CO monitors all clear at Exam

SIGNED BY: William Campbell 13544
Belt Examiners and Certificate Numbers
[signature] 32476
Belt Examiners and Certificate Numbers

[signature] 28045
Johnny Neely 33472

COUNTERSIGNED BY T. Moore 33257
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Russell Brannon 1536-A

Scott Halstead 37547

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-30-10 SHIFT: Owl 1100 AM OR PM TO 300 AM OR PM — ON-SHIFT EXAM. 300 AM OR PM TO 600 AM OR PM — PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________ Time________ AM or PM

Report received by:________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow	BC
Ellis 5	change rolls LC.	
NORTH 2		
NORTH 3		
NORTH 4	Shoveled V-plow + Worked on shoveling tail / working on Take up LC.	BC
NORTH 5	Shoveled V-plows at Flow thru + tail	BC
NORTH 6	Shoveled V-plows at tail + Flow thru change roll inpit LC.	BC
NORTH 7		
Longwall	set 2 Jacks at Powercenter at Storage unit	BC/JS
GLORY HOLE		
T622 NO. 1	SHOVEL ON TAIL AND Airlock	JS
T622 NO. 2		
H622#1		

Checked Outby Refuges at #6 - w/o
#8 - w/o
#89 - w/o
20.6% O2, 0% CH4, Oppm CO + phones working

*

SIGNED BY: William Campbell 1354-A
Belt Examiners and Certificate Numbers
[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33369
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-30-10 SHIFT: DAY ______ AM OR PM TO ______ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom John Neely Time 2:50 AM or (PM)

Report received by: Russell Dunnoe
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs spot cleaned	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Tail Needs additional cleaning Drive to Head needs cleaned	RG SH	✓		
NORTH NO. 5	Takeup Needs Add Cleaning, needs Spot Cleaned 60-Flowthru	SH	✓		
NORTH NO. 6	Needs Some Spot Cleaning	SH	✓		
NORTH NO. 7	Need Dusted	JN			
Longwall	Needs Dusted from 8 BK to Storage Unit	SH	✓		
GLORY HOLE					
TG-22 NO. 1	Needs Dusted, Tail needs add cleaning	JN			
TG-22 NO. 2	Needs spot cleaned + Dusted	JN			
HG-22 #1	Needs Dusted, 2 Belt Rails out 2½ Bnk. outby Drive	JN			

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0 ppm CO at time of exam

Travelways, Power Centers, Chargers, D-Boxes OK at time of exam

Visual check of CO monitors OK at time of exam

[signature] 32476

SIGNED BY: Russell Dunnoe 1536-A Scott Halstead 37567
Belt Examiners and Certificate Numbers

Johnny Neely 33472

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-30-10 SHIFT: DAY 6:00 (AM) OR PM TO 3:00 AM OR (PM) ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom____ Time____ AM or PM

Report received by:____ Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow (Shoveled tail & Greased tail) Bobby	RG
Ellis 5	Shoveled V-plow (shoveled BRK 27 to 24) Bobby	RG
NORTH 2		
NORTH 3		
NORTH 4	cleaned on tail	SH
NORTH 5	cleaned on V-Plows at tail & flowthru - clean on tail	SH JN
NORTH 6	cleaned on V-Plow	SH
NORTH 7	Ckd Splices Clean on tail - Grease	JN
Longwall	cleaned Mud on inby & outby side of Drive Area, Greased Drive Bearings	SH
GLORY HOLE		
TG-22 NO. 1	Clean on tail + V Plow - Grease tail	JN
TG-22 NO. 2	Clean under drive Rollers	JN
HG-22 #1		

Refuge chambers 6, 8, 89 BKs clear at EXAM
Phones working at EXAM

SIGNED BY: Russell Gunnoe 1536-A — Scott Halstead 37567
Belt Examiners and Certificate Numbers

Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ____ ____
Mine Foreman — Certificate No. — Superintendent — Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-30-10 SHIFT: EVE _____ AM OR PM TO _____ AM OR PM 8:00 AM OR PM TO 11:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes X No ____ By Whom SKAGGS, Cambell Time ________ AM or PM

Report received by: [signature] Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	WC			
Ellis 5	Needs Dusted	WC	✓		
Llwall	Needs Dusted 8Brk - Storage unit	JS	✓		
NORTH NO. 3					
NORTH NO. 4	Tail Needs Add Cleaning Drive - Hd needs Cleaned	WC	✓		
NORTH NO. 5	Needs spot cleaned Co-Further TAKeup Needs Add cleaning	WC	✓		
NORTH NO. 6	needs some spotcleaned	WC	✓		
NORTH NO. 7	Needs Dusted	WC	✓		
NORTH NO. 8					
GLORY HOLE	D-Box Pump OK	JS	✓		
TG22 NO. 1	Needs Dusted - Tail Needs Add cleaning	WC/JS	✓		
TG22 NO. 2	needs spot cleaned & dusted.	JS	✓		
		JS	✓		
HG22 1	Needs Dusted 2 Belt Rails out 2-2Brk outby Dm	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

06 CH4, O2 20, 20.8 O2

PC's, Chargers, D-Box, Pump, Travel ways OK

SIGNED BY: William Campbell 13542
Belt Examiners and Certificate Numbers

John Skaggs 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359 ____________

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-30-10 SHIFT: 4 6 600 AM OR PM TO 860 AM OR PM ON-SHIFT EXAM. ____ AM OR PM TO ____ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom ____ Time ____ AM or PM

Report received by: ____ Signed

BELTS	ACTION TAKEN	INT.
S11.54	Shoveled V plow	BC
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5	Shoveled V plow at Flow thru	BC
NORTH 6	Shoveled V plow at Flow thru	BC
NORTH 7		
NORTH 8		
GLORY HOLE		
NO. 1		
NO. 2		

Checked outby Refuges 6-8-89 all OK

SIGNED BY: William Campbell 13546
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33309
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-31-10 SHIFT: Owl ______ AM OR PM TO ______ AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes___ No X By Whom Brought out Time ______ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4 ~~SOUTH NO. 1~~	Needs Dusted	GV	—		
Ellis 5 ~~NORTH NO. 1~~	Needs Dusted, Needs spot cleaned	GV	—		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Drive to Head needs cleaned	GV	✓		
NORTH NO. 5	Needs spot cleaned 60-Flow threw TAKeup needs Add Cleaning	GV	✓		
NORTH NO. 6	Needs spot cleaned, TA.I Needs Add cleaning	BC	—		
NORTH NO. 7	Needs Dusted, Flow threw needs Add Cleaning	BC	—		
LWAll ~~NORTH NO. 8~~	Needs Dusted 8Brk-Storage unit	JS	—		
GLORY HOLE	D-Box Pump OK	BC	—		
T622 ~~LBB~~ NO. 1	Needs Dusted TA.I Needs Add cleaning	JS	—		
T622 ~~LBB~~ NO. 2	Needs spot cleaned & Dusted	JS	—		
H622 #1	2 Belt Rails out 2¼ Brks out by Drive	JS	✓		

***FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS**

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4 0% CO 20.8 O2

PC's, Chargers, D-Boxes, Pumps, Travelways OK

SIGNED BY: [signature] 15397 [signature] 32476
Belt Examiners and Certificate Numbers
William Campbell 135472 Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore 33359
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

[signature] [signature] Scott Halstead 37547

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 3-31-10 SHIFT: owl 1100 AM OR PM TO 300 AM OR PM ___ AM OR PM TO ___ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ___ No X By Whom ___ Time ___ AM or PM

Report received by: ___

Signed

BELTS	ACTION TAKEN	INT.
~~SOUTH 1~~ Ellis 4	cleaned TAil	CJ
~~NORTH 1~~ Ellis	cleand TAil cleaned take-up LC	CJ
NORTH 2		
NORTH 3		
NORTH 4	Cleaned TAil (Ground out) cleaned take up LC	GW BC JS
NORTH 5	Cleaned flow thru cleaned take up LC	GJ
NORTH 6	shoveled tail	BC
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		
TC 22 #2	SHOVEL V-Plow	JS

Checked outby Refuges 6-8-89 OK

SIGNED BY: [signature] 15397 [signature] 32476

Belt Examiners and Certificate Numbers

William Campbell 13544

Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ___ ___

Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT EXAMINATION OF BELT CONVEYORS

DATE 3-31-10 SHIFT: DAY ____ AM OR PM TO ____ AM OR PM 12:00 AM OR (PM) TO 3:00 AM OR (PM)
ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes ✓ No ___ By Whom John Bickford, John Neely Time 2:45 AM or (PM)

Report received by: Russell Gimme
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	Needs Dusted	RG	✓		
Ellis 5	Needs Dusted + Spot cleaned	RG	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Drive-Discharge needs Add. cleaning	RG JAB	✓		
NORTH NO. 5	Needs spot cleaned 60-Flow-Thru, Take-up needs Add. cleaning	JAB	✓		
NORTH NO. 6	Needs spot cleaned, Tail needs add. cleaning	JAB	✓		
NORTH NO. 7	Needs Dusting, flowthru Needs additional Cleaning	SH	✓		
Longwall	Needs Dusted RBK-Storage Unit	SH	✓		
GLORY HOLE					
TG-22 NO. 1	Tail needs add. cleaning, Needs Dusted				
TG-22 NO. 2	Needs Spot cleaned + Dusted, Tail needs add. cleaning				
HG-22 #1	Needs Dusted, 2 Belt Rails out 2½ bak outby Drive				

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH_4, 20.8% O_2, 0ppm CO at time of exam
Travelways, Power Centers, Chargers, D-Boxes OK at time of exam
Visual Check of CO monitors OK at time of exam

[signature] 1539A

[signature] 33476

SIGNED BY: Russell Gimme 1536-A
Belt Examiners and Certificate Numbers
John Bickford 26171
Belt Examiners and Certificate Numbers

Scott Halstead 37567
Johnny Neely 33472

COUNTERSIGNED BY T. [signature] 33357
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-31-10 SHIFT: DAY 6:00 AM TO 3:00 PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time__________AM or PM

Report received by: ______________________
Signed

BELTS	ACTION TAKEN	INT.
Ellis 4	Shoveled V-plow shoveled tail & Greased tail / Bobby	RG
Ellis 5	Shoveled V-plow (shoveled tail & Greased tail / Bobby	RG
NORTH 2		
NORTH 3		
NORTH 4	Shoveled v-plow, Ran duster at Tail, cleaned at tail + flow thru 5AB	RG
NORTH 5	Cleaned at Tail + flow thru	SAB
NORTH 6	cleaned + dusted at tail.	SAB
NORTH 7	Greased on tail Roller, Ran Duster	SH
LONGWALL	Cleaned around Drive Area, Greased on Drive Bearings	SH
GLORY HOLE		
TG-22 NO. 1	Clean Tail + on Flow Thru - Grease Holdup Roller	JN
TG-22 NO. 2	Clean on Tail	JN
HG-22 #1	Dust Drive Area - Work on Guards	JN

Refuge Chambers 6, 8, 9, 8 OK + phones working at time of exam

SIGNED BY: Russell Gunnoe 1536-A — Scott Halstead 37567
Belt Examiners and Certificate Numbers
John G. Beckford 26176 — Johnny Neely 33472
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore [illegible] 33309 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-31-10 SHIFT: EVE ______ AM OR PM TO ______ AM OR PM 8:00 AM OR PM TO 11:00 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No ✓ By Whom ______ Time ______ AM or PM

Report received by: ______
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
~~SOUTH NO. 1~~ E1115 #4	NEEDS DUSTED	GV	✓		
~~NORTH NO. 1~~ E1115 #3	NEEDS SPOT CLEAN & DUSTED	GV	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	DRIVE & DISCHARGE NEEDS Add CLEANING	GV	✓		
NORTH NO. 5	NEEDS SPOT CLEANING 60 BRK - FLOW THRU TAKE UP NEEDS CLEAN	GV	✓		
NORTH NO. 6	NEEDS SPOT CLEAN & TAIL NEEDS CLEAN & DUSTED	GV	✓		
NORTH NO. 7	NEEDS DUSTED	JS	✓		
~~NORTH NO. 8~~ 2 LONGWALL	NEEDS DUSTED	JS	✓		
GLORY HOLE					
LBB NO. 1					
LBB NO. 2					
TG22 #1	NEEDS SPOT CLEAN & DUSTED	JS	✓		
TG22 #2	NEEDS DUSTED & TAIL NEEDS Add CLEANING	JS	✓		
HG22 #1	NEEDS DUSTED	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

0% CH4, 0% CO, 20.8% O2 AT TIME OF EXAM

TRAVELWAYS, POWER CENTER, D-BOX, CHARGER OK AT TIME OF EXAM

SIGNED BY: [signature] 32476
Belt Examiners and Certificate Numbers

[signature] 15342
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

Use Indelible Pencil or Ink

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

DATE 3-31-10 SHIFT: EVE 600 AM OR PM TO 800 AM OR PM ____ AM OR PM TO ____ AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:________________________
Signed

BELTS	ACTION TAKEN	INT.
SOUTH 1		
NORTH 1		
NORTH 2		
NORTH 3		
NORTH 4	set Amps at Tail --	GU
NORTH 5	Cleaned TAil + Flow fans	GU
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked outby Refuges 6-8-89 OK

SIGNED BY: [signature] 15394
Belt Examiners and Certificate Numbers

____
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33357 ________ ________
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

PRE-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 4-1-10 SHIFT: OWL ______ AM OR PM TO ______ AM OR PM 300 AM OR PM TO 600 AM OR PM

ON-SHIFT EXAM. PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No X By Whom Brought out Time________ AM or PM

Report received by: ______________________
Signed

BELTS	VIOLATION AND OTHER HAZARDOUS CONDITIONS OBSERVED	EXAMINER	PRE-SHIFT	COUNT SIGN	*FIRE RUN
Ellis 4	none Observed	GU	✓		
Ellis 5	Needs spot cleaned & dusted	GU	✓		
NORTH NO. 2					
NORTH NO. 3					
NORTH NO. 4	Drive to Discharge needs Add cleaning; Tail needs Add cleaning	GU	✓		
NORTH NO. 5	Needs spot cleaned 60-Flow turn; Take up needs cleaned	GU	✓		
NORTH NO. 6	Needs spot cleaned at tail.	GU	✓		
NORTH NO. 7	Needs Dusted	JS	✓		
Longwall	Needs Dusted	JS	✓		
GLORY HOLE	D-Box & Pump ok	JS	✓		
T622 NO. 1	Needs spot cleaned & dusted	JS	✓		
T622 NO. 2	Needs Dusted, Tail Needs Add cleaning	JS	✓		
H622 #1	needs Dusted	JS	✓		

*FIRE RUN EXAMINATION: AFTER LAST PRODUCTION SHIFT OF WEEK, BEFORE HOLIDAY AND VACATIONS

(ITEMS NOT A HAZARD BUT NEEDING ADDITIONAL ATTENTION) REMARKS:

02CH4 O2 CO 20.8 0 0

PC'S, Chargers, D-Box, Pumps Travelways OK

SIGNED BY: [signature] 1554
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY [signature] 33359 ______ ______
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

[signature] 2617 [signature] 1536-A Scott Halstead 37567

ON-SHIFT
EXAMINATION OF BELT CONVEYORS

Use Indelible Pencil or Ink

DATE 4-1-10 SHIFT: owl 11:00 AM OR PM TO 3:00 (A)M OR PM ON-SHIFT EXAM. ______ AM OR PM TO ______ AM OR PM PRE-SHIFT EXAM.

Was this report phoned to outside Yes____ No____ By Whom________________ Time________ AM or PM

Report received by:______________________ Signed

BELTS	ACTION TAKEN	INT.
E11S4	worked on E11S4 on Hd Hole	GV
NORTH 2		
NORTH 3		
NORTH 4		
NORTH 5		
NORTH 6		
NORTH 7		
NORTH 8		
GLORY HOLE		
LBB NO. 1		
LBB NO. 2		

Checked out by Rotgers 6-8-89 OK

SIGNED BY: [signature] 15394
Belt Examiners and Certificate Numbers

[signature] 32476
Belt Examiners and Certificate Numbers

COUNTERSIGNED BY T. Moore [signature] 33309
Mine Foreman Certificate No. Superintendent Certificate No.

46543—BJW Printing & Office Supplies

APPENDIX AE

ADDITIONAL INFORMATION ON UBB MMU'S

APPENDIX AE

ADDITIONAL INFORMATION ON UBB MMU'S

U. S. Department of Labor

Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880-1000

UNDERGROUND MINE FILE
DATE FWD. 1/27/2010
INITIALS TW

This acknowledges receipt of the Methane and Dust control Portion of the Ventilation Plan required by Section 75.370 CFR or Respirable Dust Control Plan required by Section 71.300 CFR.

The Plan Dated 12/30/2009 is ☒ Approved

Mine ID No. ☐ General Dust Control Plan ☒ MMU ☐ Addendum

46-08436 ☐ DWP ☐ Designated Areas

Mine Name
Upper Big Branch Mine-South

Company Name
Performance Coal Company

Post Office Address of Mine Operator

Mr. Chris Blanchard
P. O. Box 69
Naoma, WV 25140

MSHA
MOUNT HOPE, WV
JAN 27 2010
RECEIVED
MOUNT HOPE FIELD

Remarks

☒ This Methane and Dust Control Plan received **12/30/2009** has been approved and consists of **MMU 029-0 Plan Revision**.

Note: This plan is approved for line curtain distance only. This does not give this operator permission to take extended cuts unless a roof control plan with an extended cut provision is in effect. Any MMU that has been restricted to a reduced cut and line curtain distance due to an excessive dust violation must continue in this phase of operation (reduced line curtain and cut depth) until compliance has been achieved on both operator and MSHA respirable dust surveys.

FIELD MINE FILE
DATE FILED 1/27/10
INITIALS SW

Date: 1/26/2010

Signature: Robert D. Hardman

Performance Coal Company

P.O. Box 69 Naoma, WV 25140

December 30, 2009

Mr. Robert G. Hardman
Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880

Re: Performance Coal Company
Upper Big Branch Mine
MSHA ID: 46-08436
State ID: U-3042-92
MMU 029-0 – Methane and Dust Plan

Dear Sir:

Enclosed for your review and approval please find an update to the MMU 029-0 plan for the Upper Big Branch Mine.

There is currently no miner's representative at the Upper Big Branch Mine. This plan will be posted at the mine office at time of submittal. If you have any questions or comments, feel free to contact me at (304) 854-3516.

Respectfully Submitted,
Performance Coal Company, Inc.

Eric Lilly
Mine Engineer

MSHA
MOUNT HOPE, WV
DEC 30 2009
RECEIVED
DISTRICT HEALTH

SECTION SPECIFIC METHANE DUST CONTROL PLAN

DATE: 01-22-2009 **Mine:** Upper Big Branch Mine **MINE ID:** 46-08436

MMU No.: 029-0 **SECTION NAME:** Unit No.1 **SEAM NAME:** Eagle Seam

METHOD OF MINING: Continuous (X) Longwall ( ) Other ( )

a. Make and Model of Mining Equipment: Two (2) Joy 12-12 Miners
   Serial Numbers : Primary : JM4918B Secondary : JM5811

b. Mining Height – approximately 78 - 96 inches

c. Type Water Spray System: Pressure Spray Nozzle (Hollow Cone #3 and #5)

d. Number of Sprays: 50 A minimum of 47 sprays will be operative at any time.
   Minimum Operating PSI: 75 psi

e. Location, angle and type of sprays: (See attached sketch)

f. Remote Control (X) Yes ( ) No If Yes, Type: Radio

SCRUBBER SYSTEM

a. CFM of Scrubber: 6,000

b. HP of Scrubber: 30 hp

c. Scrubber Screen Type: 30 Mesh (30 layer)
   The screen spray will be examined each shift, to insure it is operative and wetting the entire surface of the screen.

d. Sketch of Ductwork with size: (See attached sketch)

e. Scrubber maintenance Program: Frequency Screen cleaned Twice per shift when mining coal strata. Every 40ft of material mined when strata contains rock top, bottom or binder.

f. Frequency Ductwork Cleaned/Inspected: Ductwork will be cleaned out and washed each shift.

g. Scrubber operation is not required for pillar recovery mining when air is coursed away from the operator directly into the gob.

h. If scrubber becomes inoperative, the following minimum backup system will be used:
   Curtain Distance: 20 ft. Face Ventilation: Exhausting (X) Blowing ( )
   Minimum CFM*: 7,000 MEAV*: 60
   *Note: Whichever is Greater

i. The sump and demister will be cleaned out and washed weekly, and recorded with pitot tube in pre-shift exam book.

ROOF BOLTER:

a. Make and Model: Fletcher RR2 Single Head ( ) Dual (X)

b. Dust Control Method: Water through steel ( ) Permissible Dust Collector (X)

c. Is Roof Bolter operated in return of other equipment? (X) Yes ( ) No
   If Yes, Explain: The bolter will operate in the return a maximum of once per shift when not using a scrubber or three times per shift when the scrubber is in use.

d. Method of emptying dust collector: Dust collector will be emptied in the face where it can be scooped up during clean-up cycle or cleaned up with the miner.

e. CFM where roofbolter operating*: 3,500
   Line Curtain Configuration Exhausting If applicable, MEAV*: 45 LFM
   *Note: Whichever is Greater

FACE VENTILATION

MSHA
MOUNT HOPE, WV
JAN 22 2010
RECEIVED
HEALTH

a. Line curtain in each working place: Distance from Face 40 feet

b. Line curtain configuration:
   Under Split Ventilation: All Faces – Exhausting
   Under Sweep Ventilation: All Faces – Exhausting

c. Minimum CFM*: 7,000 cfm measured with scrubber off.
   MEAV* (if applicable): 60 LFM
   *Note: Whichever is Greater

d. When second mining with this miner, the required minimum quantity of air coursed over the miner into the gob will be equivalent to part (C) of the Face Ventilation Section.

e. A minimum of 3,000 CFM will be maintained in all idle faces.

f. The minimum amount of air in the last open break will be 15,000CFM

Safety Precautions

1. The inby end of the line curtain will not be advanced beyond the scrubber discharge when an exhausting line curtain is used.

2. The continuous miner will be operated by remote control only. In the event radio communications fail, the continuous miner will be utilized by remote control using an umbilical cord.

3. The continuous miner will be equipped with a strobe light that will flash when the methane concentrations reach 1.0% or a 2-inch digital readout methane monitor, which is easily and fully visible during deep cuts.

4. Where the face exceeds 5 feet from the last row of permanent roof support, tests for methane will be done using extendable probes or magnets attached to the miner while mining. The methane detectors to be used are CSE 102, CSE 102LD, or equivalent.

5. The line curtain shall be advanced to the next to last row of bolts during the bolting operations, until it is within 10 feet of the face.

6. If the methane warning light comes on during mining, the line curtain will be maintained to within 10 feet of the face until mining is completed in that working face.

7. When using an exhausting line curtain, the curtain will be placed on the same side as the scrubber discharge.

8. When open end pillaring without the use of the scrubber system, the airflow will be maintained across the top of the miner and into the gob when cutting.

9. At least 90 percent of the cutting bits will be maintained with carbon inserts intact and missing or damaged bit lugs and bit lug inserts will be replaced within 24 hours.

10. Miner operator will not advance inby the end of the exhaust line curtain while mining.

11. Line Curtain will be maintained to within 40 feet of the deepest point of penetration where the continuous miner is operated. Line Curtain distance measurement will be taken from the inby corner of the outby block.

12. When the average of five or more dust samples obtained by the operator or by MSHA in the same bimonthly sampling period exceeds the applicable standard and results in an excessive dust violation or respirable dust samples collected by MSHA or Operator contain in excess of 100 ug/m^3 silica (100 micrograms per cubic meter), the following remedial measures shall take effect immediately:

- The operator shall revert back to a twenty-foot curtain setback (ventilation plan) and twenty-foot cut (roof control plan).
- The operator shall achieve compliance on both operator samples (mining with 20 foot plans) and MSHA survey samples (surveyed with curtain set back and

deep cut) before normal extended cut operations can resume. The operator shall only utilize the line curtain setback and extended cut during the MSHA survey until compliance has been established.

- These requirements do not apply to pillar recovery mining.

13. Scrubber volumes will be measured weekly using the full traverse method and the scrubber volume will be recorded in the Pre-shift examination book. This book will be kept at the mine site and readily available for review.

14. The roof bolting machine vacuum pressure will be maintained to at least the minimum vacuum pressure listed on the machine permissibility tag in inches of mercury (inHg). The vacuum pressure will be measured at the drill chuck and will be checked at least once every operating shift as part of the dust control parameter examination required by 30 CFR 75.362 (a) (2).

15. The final cut-thru of crosscuts into entries or entries into crosscuts, will be accomplished from the intake side towards the return side, so that the air courses over and away from the miner operator. When adverse conditions or special mining projections occur requiring mining entries and/or crosscuts into intake air, a sufficient ventilation control to prevent an air exchange will be installed immediately prior to hole thru into the intake entry and/or crosscut to prevent a flow of air across where the continuous miner operator is positioned.

16. When using line curtain as a face ventilation control, the curtain will be installed with each new curtain overlapped a distance of at least one row of bolts in the direction of airflow.

17. At least one provision of the approved MMU plan will be discussed with each production crew prior to production of coal on this MMU. The discussion topic will be recorded in the on-shift record.

18. A modified cut will be utilized to cut rock to a free face when mining height permits.

19. A spare screen will be maintained so that the screen may be cleaned and fully dried each shift.

20. When mining extended cuts, pillars will be sized to avoid a cut sequence which would leave a final lift of less than 5 ft.

21. Only one miner per MMU will be operated at any given time.

PERFORMANCE COAL CO.

UPPER BIG BRANCH MINE

MSHA ID: 46-08436

STATE ID: U-3042-92

MMU 029-0

Joy 12-12 Miner

MSHA
MOUNT HOPE, WV

JAN 21 2010

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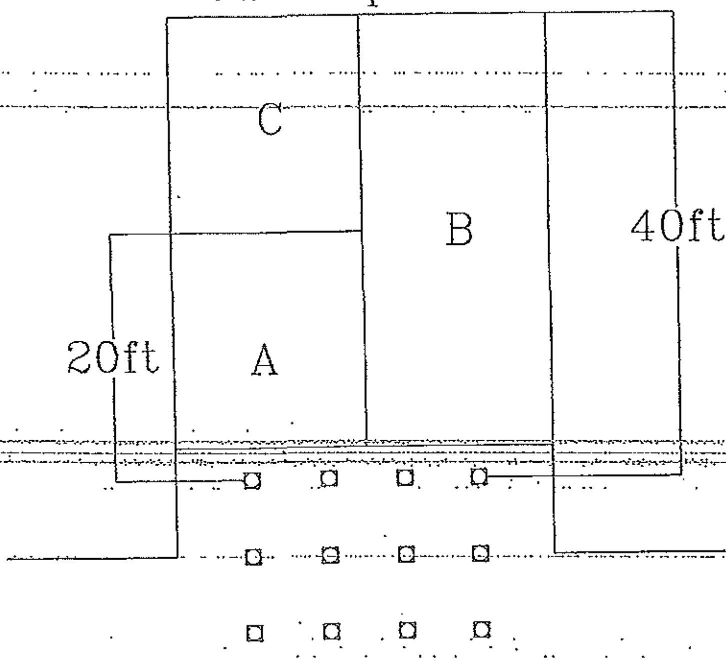
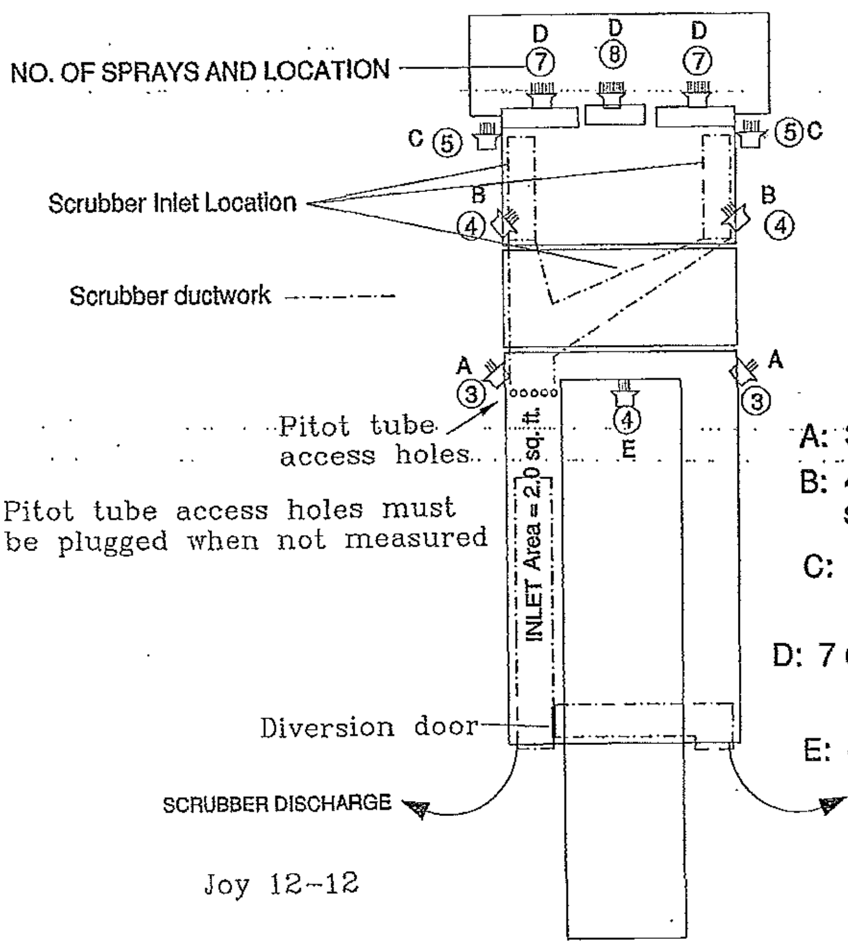
HEALTH

Cut Sequence



Cut sequence may be altered as indicated in the approved roof control plan. First cut will always start on the line curtain side.



Sprays are no. 3s and no. 5s
No. 5s produce 1.2 gpm @ 75 psi
No. 3s produce 0.7 gpm @ 75 psi
50 TOTAL SPRAYS
Total GPM = 57.0

A: 3, #3 sprays spraying toward rib

B: 4, #5 sprays located in conveyor pan spraying toward gathering pots

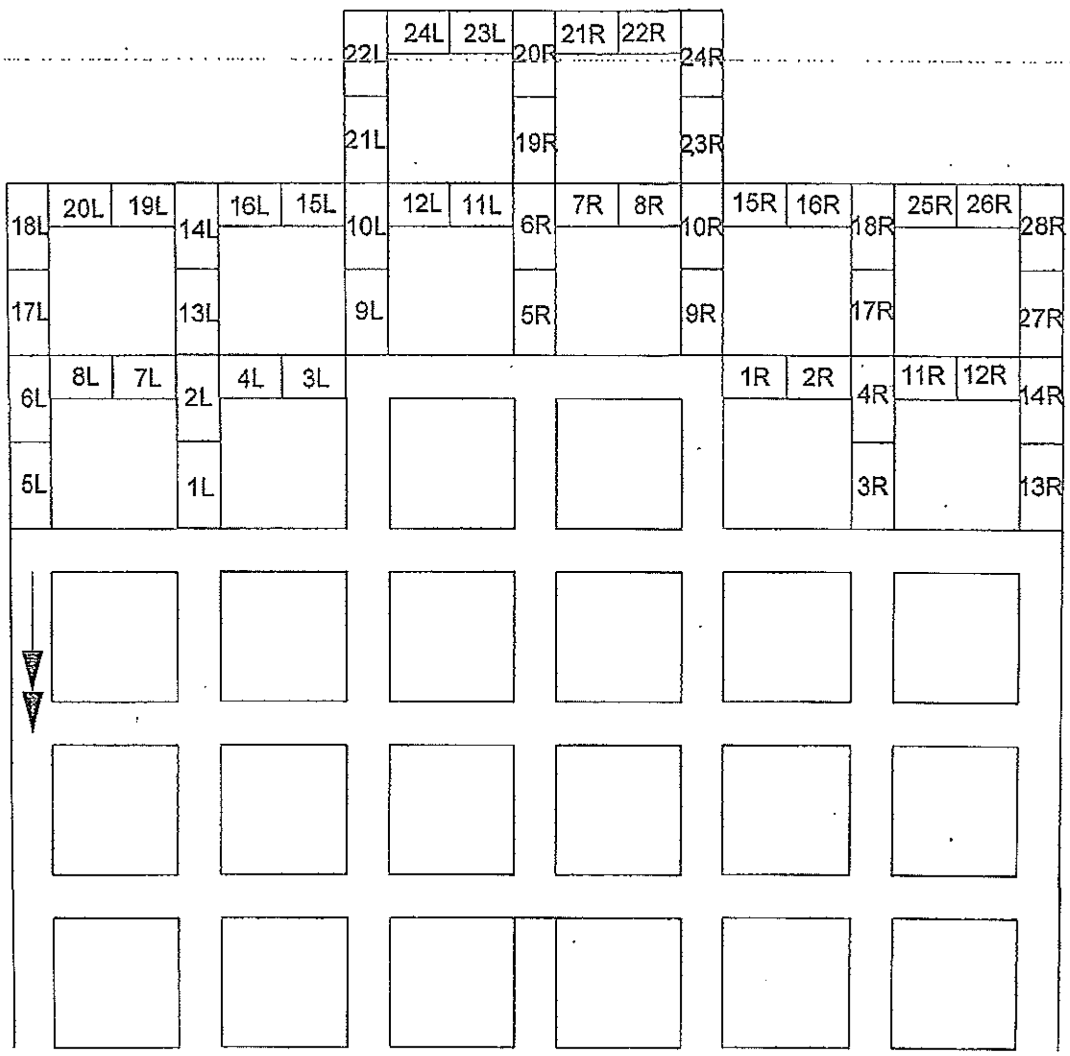
C: 5, #5 sprays spraying in a fan like arrangement at end of cutter drums

D: 7 or 8, #5 sprays spraying forward over top of cutter drums

E: 4, #5 sprays spraying down into conveyor

Massey Energy
Typical Cut Sequence

Using Sweep Ventilation



(Mirror image may apply.)

MSHA
MOUNT HOPE, WV

Return air

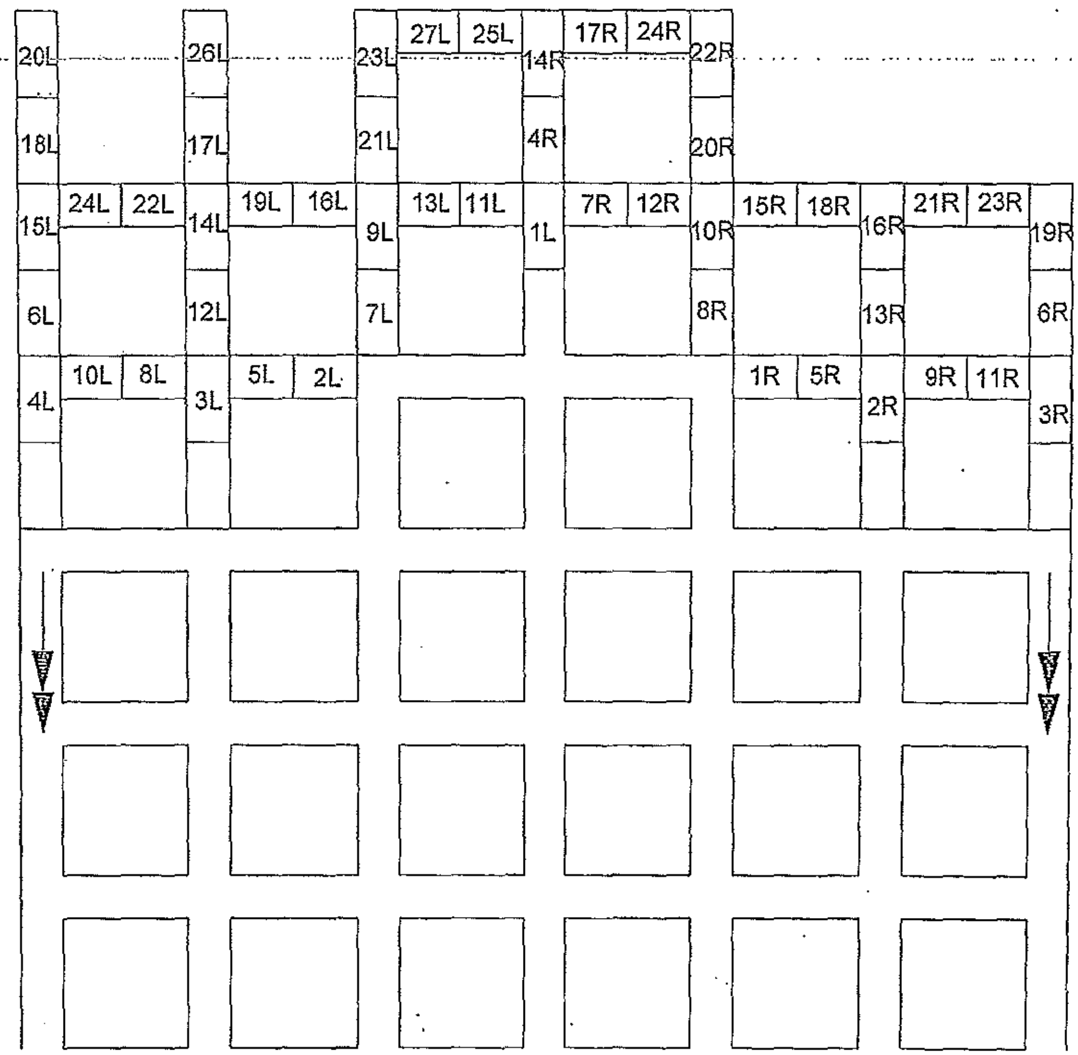
DEC 30 2009

RECEIVED
DISTRICT HEALTH

Cut Sequences may vary due to conditions.

Massey Energy
Typical Cut Sequence

Using Split Ventilation



MSHA
MOUNT HOPE, WV
DEC 30 2009
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DISTRICT HEALTH

Return air

Cut Sequences may vary due to conditions.

Performance Coal Company
P.O. Box 69 Naoma, WV 25140

October 22, 2009

Mr. Robert G. Hardman
Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880

Re: Performance Coal Company
Upper Big Branch Mine
MSHA ID: 46-08436
State ID: U-3042-92
MMU 040-0 – Methane and Dust Control Plan Revision

Dear Sir:

Please find the enclosed MMU 040-0 Methane and Dust Control Plan revision for the Upper Big Branch Mine for your review and approval.

There is currently no miner's representative at the Upper Big Branch Mine. This plan has been posted at the mine office at time of submittal. If you have any questions or comments, feel free to contact me at (304) 854-3516.

Respectfully Submitted,
Performance Coal Company, Inc.

Matthew Walker

Matthew Walker
Mine Engineer

SECTION SPECIFIC METHANE DUST CONTROL PLAN

DATE: 01-22-2009 **Mine:** Upper Big Branch Mine **MINE ID:** 46-08436

MMU No.: 040-0 **SECTION NAME:** Unit No.2 **SEAM NAME:** Eagle Seam

METHOD OF MINING: Continuous (X) Longwall ( ) Other ( )

a. Make and Model of Mining Equipment: (2) Joy 14-15 Miners
Serial No. Primary: JM6053 Secondary: JM5186

b. Mining Height – approximate 72 inches

c. Type Water Spray System: Pressure Spray Nozzle (Hollow Cone #5)

d. Number of Sprays: 33/33 Minimum Operating PSI: 75/75 psi

e. Location, angle and type of sprays: (See attached sketch)

f. Remote Control (X) Yes ( ) No If Yes, Type: Radio

SCRUBBER SYSTEM

a. CFM of Scrubber: 6,000

b. HP of Scrubber: 33 hp

c. Scrubber Screen Type: 30 Mesh (30 layer).
The screen spray will be examined each shift, to insure it is operative and wetting the entire surface of the screen.

d. Sketch of Ductwork with size: (See attached sketch)

e. Scrubber maintenance Program: Frequency Screen cleaned Twice per shift when mining coal strata. Every 40ft of material mined when strata contains rock top, bottom or binder.

f. Frequency Ductwork Cleaned/Inspected: Once per day/Once per shift and cleaned if obstructions are observed.

g. Scrubber operation is not required for pillar recovery mining when air is coursed away from the operator directly into the gob.

h. If scrubber becomes inoperative, the following minimum backup system will be used:
Curtain Distance: 20 ft. Face Ventilation: Exhausting (X) Blowing ( )
Minimum CFM*: 7,000 MEAV*: 60
*Note: Whichever is Greater

i. The sump and demister will be cleaned out and washed weekly, and recorded with pitot tube in pre-shift exam book.

ROOF BOLTER:

a. Make and Model: Fletcher RR2 Single Head ( ) Dual (X)

b. Dust Control Method: Water through steel ( ) Permissible Dust Collector (X)

c. Is Roof Bolter operated in return of other equipment? (X) Yes ( ) No
If Yes, Explain: The Roof Bolter will operate in the return of the miner a maximum of 3 times per shift when the scrubber is in use and once per shift when the scrubber is not in use.

d. Method of emptying dust collector: Dust collector will be emptied in the face where it can be scooped up during clean-up cycle

e. CFM where roofbolter operating*: 3,500
Line Curtain Configuration Exhausting If applicable, MEAV*: 45 LFM
*Note: Whichever is Greater

FACE VENTILATION

a. Line curtain in each working place: Distance from Face 40 feet

b. Line curtain configuration:
Under Split Ventilation: All Faces – Exhausting
Under Sweep Ventilation: All Faces – Exhausting

c. Minimum CFM*: 7,000 with scrubber off.
MEAV*: (if applicable) 60 LFM
*Note: Whichever is Greater

d. When second mining with this miner, the required minimum quantity of air coursed over the miner into the gob will be equivalent to part (C) of the Face Ventilation Section.

e. A minimum of 3,000 CFM will be maintained in all idle faces.

f. The minimum amount of air in the last open break will be 15,000CFM

MSHA
MOUNT HOPE, WV
JAN 22 2010
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HEALTH

Safety Precautions

1. The inby end of the line curtain will not be advanced beyond the scrubber discharge when an exhausting line curtain is used.

2. The continuous miner will be operated by remote control only. In the event radio communications fail, the continuous miner will be utilized by remote control using an umbilical cord.

3. The continuous miner will be equipped with a strobe light that will flash when the methane concentrations reach 1.0% or a 2-inch digital readout methane monitor, which is easily and fully visible during deep cuts.

4. Where the face exceeds 5 feet from the last row of permanent roof support, tests for methane will be done using extendable probes or a magnet cradling a methane detector while mining. The methane detectors to be used are CSE 102, CSE 102LD, or equivalent.

5. The line curtain shall be advanced to the next to last row of bolts during the bolting operations, until it is within 10 feet of the face.

6. If the methane warning light comes on during mining, the line curtain will be maintained to within 10 feet of the face until mining is completed in that working face.

7. When using an exhausting line curtain, the curtain will be placed on the same side as the scrubber discharge.

8. When open end pillaring without the use of the scrubber system the airflow will be maintained across the top of the miner and into the gob when cutting.

9. At least 90 percent of the cutting bits will be maintained with carbon inserts intact and missing or damaged bit lugs and big lug inserts will be replaced within 24 hours.

10. Miner operator will not advance inby the end of the exhaust line curtain while mining.

11. Line Curtain will be maintained to within 40 feet of the deepest point of penetration where the continuous miner is operated. Line Curtain distance measurement will be taken from the inby corner of the outby block.

12. When the average of five or more dust samples obtained by the operator or by MSHA in the same bimonthly sampling period exceeds the applicable standard and results in an excessive dust violation or respirable dust samples collected by MSHA or Operator contain in excess of 100 ug/m^3 silica (100 micrograms per cubic meter), the following remedial measures shall take effect immediately:

    - The operator shall revert back to a twenty-foot curtain setback (ventilation plan) and twenty-foot cut (roof control plan).

- The operator shall achieve compliance on both operator samples (mining with 20 foot plans) and MSHA survey samples (surveyed with curtain set back and deep cut) before normal extended cut operations can resume. The operator shall only utilize the line curtain setback and extended cut during the MSHA survey until compliance has been established.
- These requirements do not apply to pillar recovery mining.

13. Scrubber volumes will be measured weekly using the full traverse method and the scrubber volume will be recorded in the Pre-shift examination book. This book will be kept at the mine site and readily available for review.

14. The roof bolting machine vacuum pressure will be maintained to at least the minimum vacuum pressure listed on the machine permissibility tag in inches of mercury (inHg). The vacuum pressure will be measured at the drill chuck and will be checked at least once every operating shift as part of the dust control parameter examination required by 30 CFR 75.362 (a) (2).

15. The final cut-thru of crosscuts into entries or entries into crosscuts, will be accomplished from the intake side towards the return side, so that the air courses over and away from the miner operator. When adverse conditions or special mining projections occur requiring mining entries and/or crosscuts into intake air, a sufficient ventilation control to prevent an air exchange will be installed immediately prior to hole thru into the intake entry and/or crosscut to prevent a flow of air across where the continuous miner operator is positioned.

16. When using line curtain as a face ventilation control, the curtain will be installed with each new curtain overlapped a distance of at least one row of bolts in the direction of airflow.

17. At least one provision of the approved MMU plan will be discussed with each production crew prior to production of coal on this MMU. The discussion topic will be recorded in the on-shift record.

18. A modified cut will be utilized to cut rock to a free face when mining height permits.

19. When mining extended cuts, pillars will be sized to avoid a cut sequence which would leave a final lift of less than 5 ft.

PERFORMANCE COAL COMPANY, INC.
UPPER BIG BRANCH MINE
MSHA ID: 46-08436
STATE ID: U-3042-92
MMU 040-0
PRIMARY JM6053

MSHA
MOUNT HOPE, WV
DEC 3 0 2009
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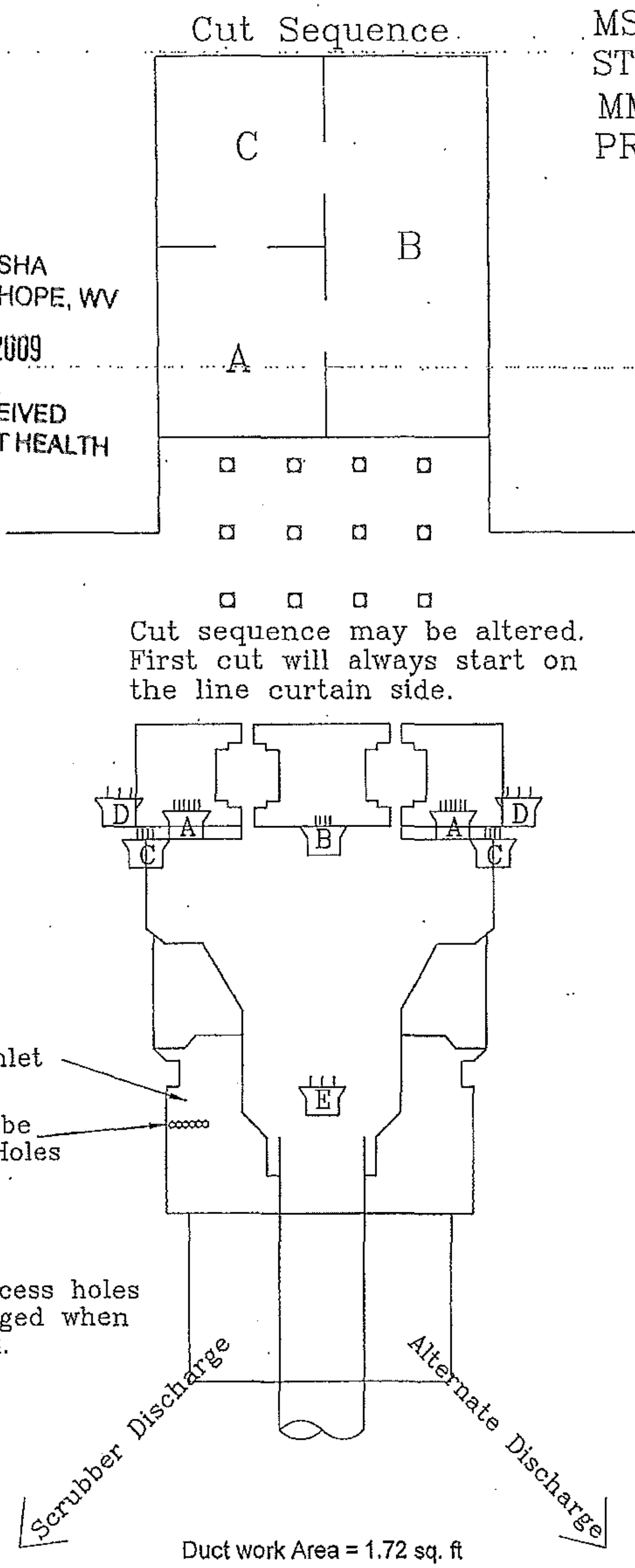
DISTRICT HEALTH



Pitot tube access holes must be plugged when not measured.

LEGEND

⊔	Water Spray and Location
N	Number of sprays in block
A	6 – #5 Sprays, top front edge of Cutter Boom, Sprays forward
B	4 – #5 Sprays, top front edge of Cutter Boom, Sprays forward
C	4 – #5 Sprays, Conveyor Pan spraying toward gathering pots
D	3 – #5 Sprays, Cutter Motor
E	3 – #6 Sprays, spraying down into conveyor

Number of Sprays:	33
Type of Sprays	#5
PSI of Sprays	75
GPM of Sprays	1.3
Total GPM	42.9

Note:

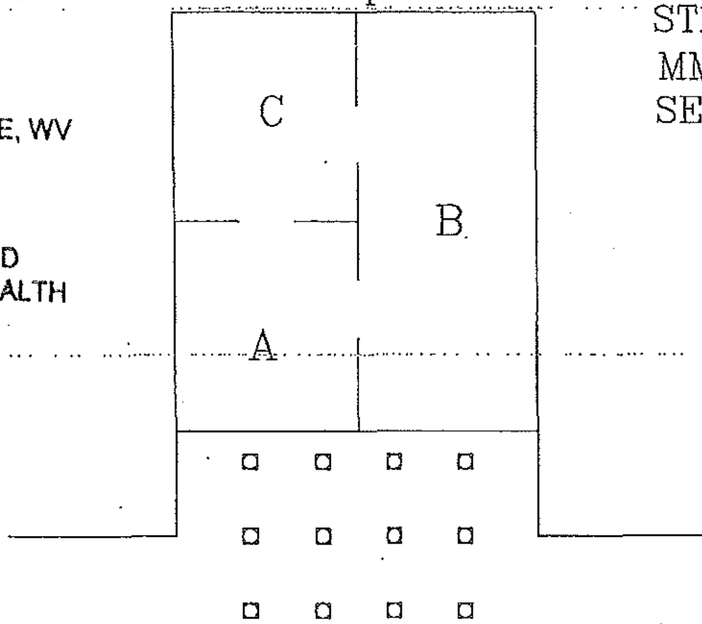
A minimum of 30 sprays will be operative at anygiven time.

No more than one spray per block will be inoperative at any time.

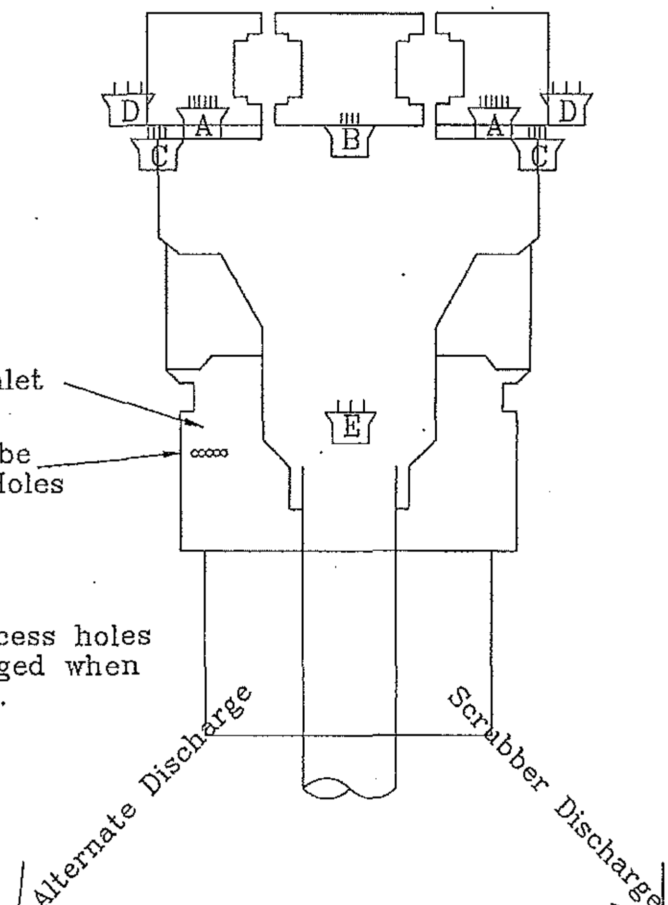
PERFORMANCE COAL COMPANY, INC.
UPPER BIG BRANCH MINE
MSHA ID: 46-08436
STATE ID: U-3042-92
MMU 040-0
SECONDARY JM5186

MSHA
MOUNT HOPE, WV
DEC 30 2009
RECEIVED
DISTRICT HEALTH

Cut Sequence



Cut sequence may be altered. First cut will always start on the line curtain side.



Pitot tube access holes must be plugged when not measured.

Duct work Area = 1.07 sq. ft

LEGEND

- Water Spray and Location
- N — Number of sprays in block
- A — 6 - #5 Sprays, top front edge of Cutter Boom, Sprays forward
- B — 4 - #5 Sprays, top front edge of Cutter Boom, Sprays forward
- C — 4 - #5 Sprays, Conveyor Pan spraying toward gathering pots
- D — 3 - #5 Sprays, Cutter Motor
- E — 3 - #5 Sprays, spraying down into conveyor

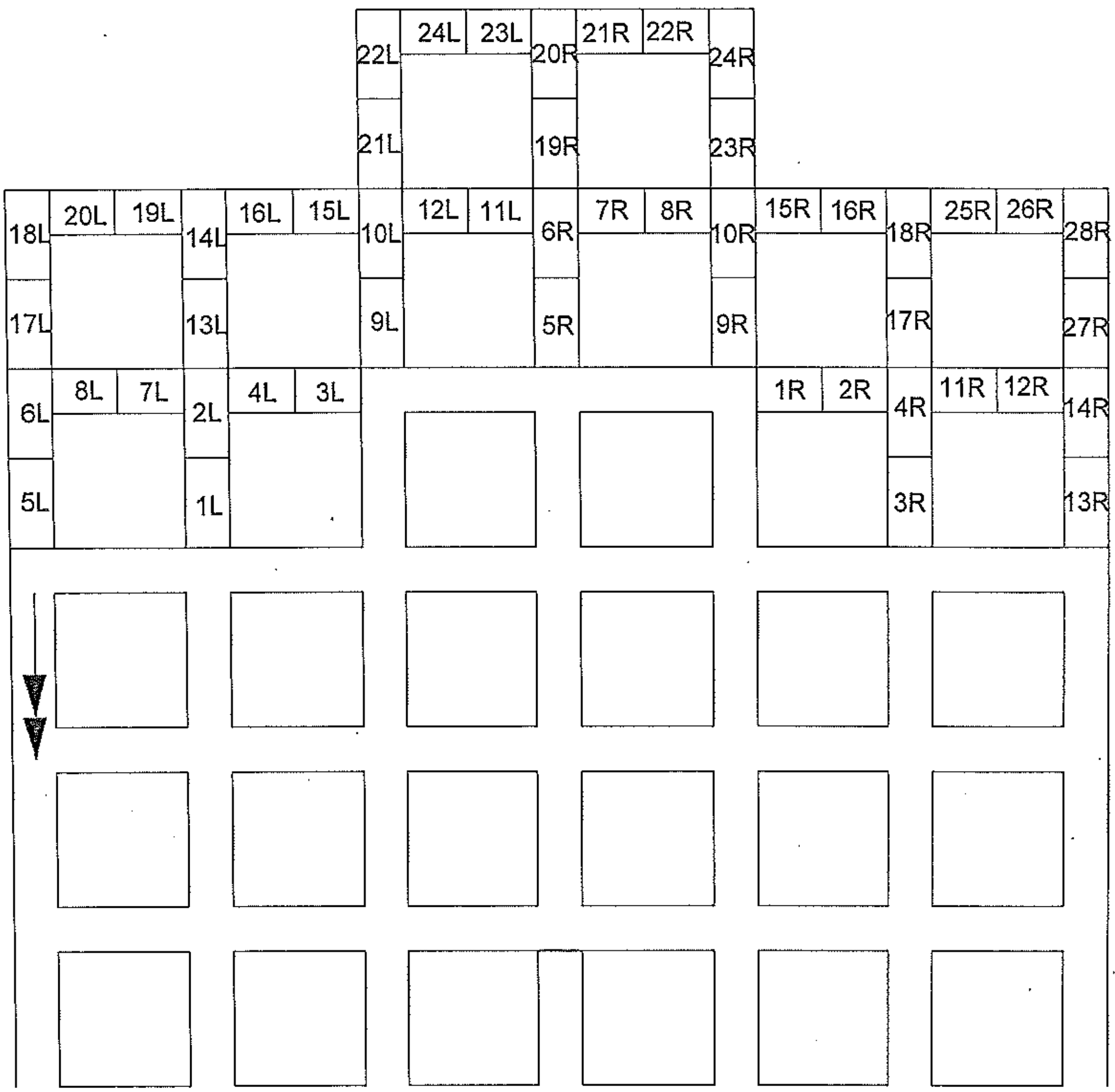
Number of Sprays:	33
Type of Sprays	#5
PSI of Sprays	75
GPM of Sprays	1.3
Total GPM	42.9

Note:
A minimum of 30 sprays will be operative at anygiven time.

No more than one spray per block will be inoperative at any time.

Massey Energy Typical Cut Sequence

Using Sweep Ventilation



(Mirror image may apply.)

MSHA
MOUNT HOPE, WV

OCT 2 0 2009

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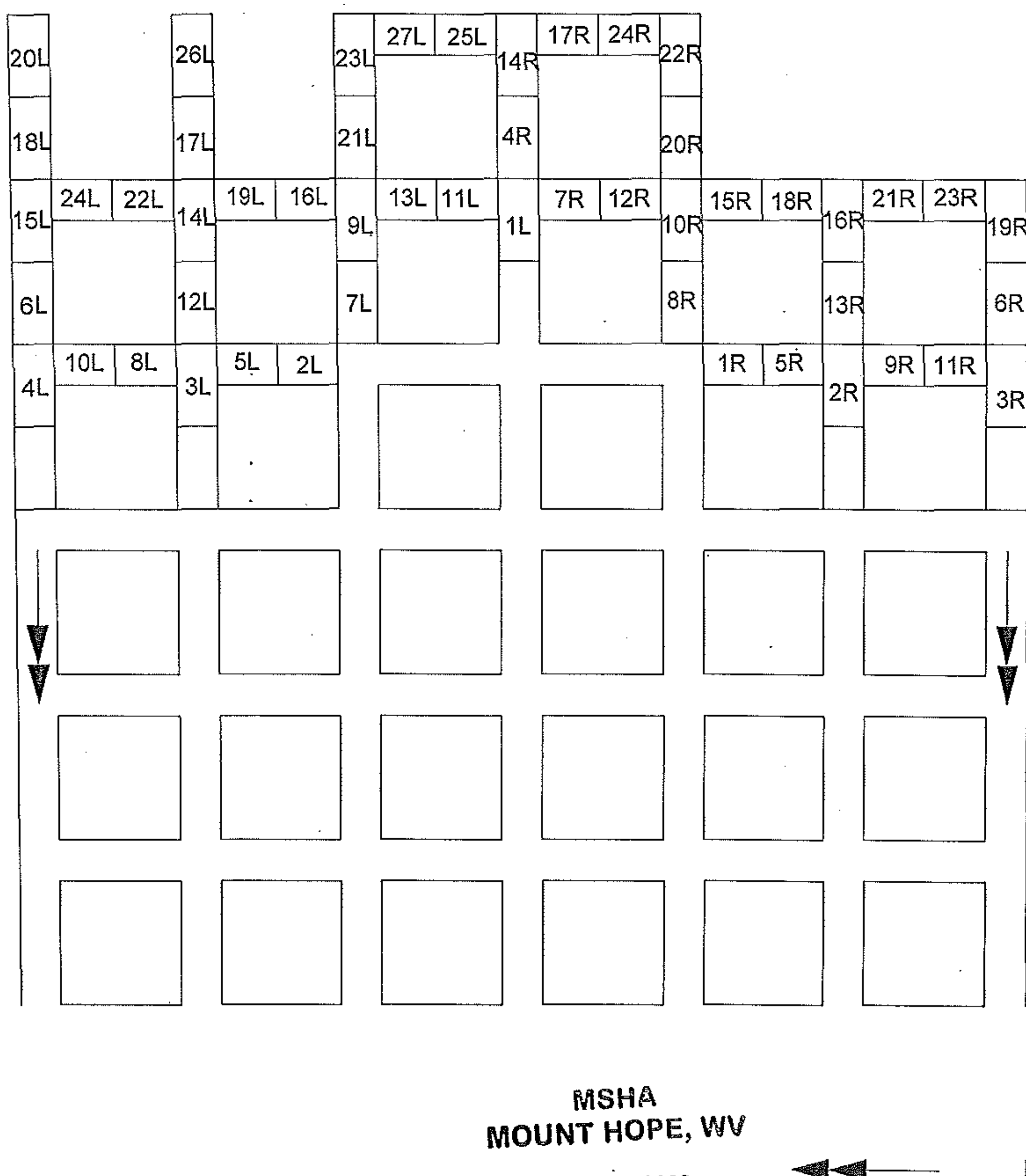
HEALTH

◄◄——— Return air

Cut Sequences may vary due to conditions.

Massey Energy
Typical Cut Sequence

Using Split Ventilation



Cut Sequences may vary due to conditions.

U. S. Department of Labor

Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880-1000

UNDERGROUND MINE FILE
DATE RVD. 11-13-08
INITIALS lm

This acknowledges receipt of the Methane and Dust control Portion of the Ventilation Plan required by Section 75.370 CFR or Respirable Dust Control Plan required by Section 71.300 CFR.

The Plan Dated **10/22/2008** is ☒ Approved

Mine ID No. ☐ General Dust Control Plan ☒ MMU ☐ Supplements

46-08436 ☐ DWP ☐ Designated Areas

Mine Name
Upper Big Branch Mine-South

Company Name
Performance Coal Company

Post Office Address of Mine Operator

Mr. Chris Blanchard
P. O. Box 69
Naoma, WV 25140

Remarks

☒ This Methane and Dust Control Plan received **10/22/2008** has been approved and consists of **062-0 MMU Plan**.

MSHA
MOUNT HOPE, WV
NOV 17 2008
RECEIVED
MOUNT HOPE FIELD

11/21/06

Date: 11/13/2008

Signature: Robert D. Hardman

PLAN APPROVAL SIGNATURE SHEET

Date Plan Received: **10/22/2008** | PN:

Type: Methane/Dust Control ☒ Hearing Conservation ☐ Part 90 ☐

Company Name: **Performance Coal Company**	Miners Rep: **No**
Mine Name: **Upper Big Branch Mine-South**	Copy Provided: **Yes**
Mine ID: **46-08436**	Plan Posted: **Yes**
Entity: **062-0 MMU Base Plan**	Office: **Mt. Hope (0401)** Work Group: **01**

Reviews:

Technical Program Specialist: Reba Ann Crawford Date: 11-10-08

☑ Recommend Approval/ ☐ Recommend Disapproval

Comments: Plan reflects new SOP's
2 Joy 14-15 CM 24 sprays @ 75 psi;
Face vent: all faces exhausting
6,000 cfm 60 MEAV 20' max. curtain

District Health Specialist: Reba Ann Crawford Date: 11-12-08

☑ Recommend Approval/ ☐ Recommend Disapproval

Comments: Reviewed with Roger Richmond, 02 Supervisor

ADM, Technical Programs: Larry E. Cook Date: 11/12/08

☑ Recommend Approval/ ☐ Recommend Disapproval

Comments:

Inspection Division ADM: L Selfe Date: 11/12/08

☑ Recommend Approval/ ☐ Recommend Disapproval

Comments:

Performance Coal Company
P.O. Box 69 Naoma, WV 25140

October 22, 2008

Mr. Robert G. Hardman
Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880

Re: Performance Coal Company
Upper Big Branch Mine
MSHA ID: 46-08436
State ID: U-3042-92
MMU 062-0/063-0 Submittal

Dear Sir:

Please find the enclosed MMU plans for the Upper Big Branch Mine for your review and approval. These plans are needed to allow a fourth unit to begin mining.

This mine currently has no miner's representative. This plan will be posted on the board at the mine at time of submittal. If you have any questions or comments, feel free to contact me at (304) 854-3516.

Respectfully Submitted,
Performance Coal Company, Inc.

Eric Lilly

Eric Lilly
Mine Engineer

MSHA
MOUNT HOPE, WV
OCT 22 2008
RECEIVED
DISTRICT HEALTH

SECTION SPECIFIC METHANE DUST CONTROL PLAN

DATE: 11-06-2008 **Mine:** Upper Big Branch Mine **MINE ID:** 46-08436

MMU No.: 062-0 **SECTION NAME:** Unit No.4 **SEAM NAME:** Eagle Seam

METHOD OF MINING: Continuous (X) Longwall ( ) Other ( )

a. Make and Model of Mining Equipment: (2 identical) Joy 14-15 Miner
b. Mining Height -- approximate 72 inches
c. Type Water Spray System: Pressure Spray Nozzle (BD#5)
d. Number of Sprays: 24/24 Minimum of 20 sprays must be operating at any time
Minimum Operating PSI: 75psi/75psi
e. Location, angle and type of sprays: (See attached sketch)
f. Remote Control (X) Yes ( ) No If Yes, Type: Radio

SCRUBBER SYSTEM -- Not applicable until curtain setback obtained.

ROOF BOLTER:

a. Make and Model: Fletcher RR2 Single Head ( ) Dual (X)
b. Dust Control Method: Water through steel ( ) Permissible Dust Collector (X)
c. Is Roof Bolter operated in return of other equipment? (X) Yes ( ) No
If Yes, Explain: Once per Shift.
d. Method of emptying dust collector: Dust collector will be emptied in the face where it can be scooped up during clean-up cycle
e. CFM where roofbolter operating 4500 CFM
Line Curtain Configuration Exhausting If applicable, MEAV 45 LFM

FACE VENTILATION

a. Line curtain in each working place: Distance from Face 20 feet
b. Line curtain configuration:
Under Split Ventilation: All Faces -- Exhausting
Under Sweep Ventilation: All Faces -- Exhausting

c. Minimum CFM 6000 CFM.
MEAV (if applicable) 60 LFM
d. A minimum of 3,000CFM will be maintained in all idle faces.

MSHA
MOUNT HOPE, WV

NOV 06 2008

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DISTRICT HEALTH

Safety Precautions

1. The continuous miner will be operated by remote control only. In the event radio communications fail, the continuous miner will be utilized by remote control using umbilical cord.

2. The continuous miner will be equipped with a strobe light that will flash when the methane concentrations reach 1.0% or a 2-inch digital readout methane monitor, which is easily and fully visible during deep cuts.

3. Where the face exceeds 5 feet from the last row of permanent roof support, tests for methane will be done using extendable probes or a magnet on remote control miner while mining.

4. The line curtain shall be advanced to the next to last row of bolts during the bolting operations, until it is within 10 feet of the face.

5. If the methane warning light comes on during mining, the line curtain will be maintained to within 10 feet of the face until mining is completed in that working face.

6. At least 90 percent of the cutting bits will be maintained with carbon inserts intact and missing or damaged bit lugs and big lug inserts will be replaced within 24 hours.

7. Line Curtain will be maintained to within 20 feet of the deepest point of penetration where the continuous miner is operated. Line Curtain distance measurement will be taken from the inby corner of the outby block.

8. The miner operator will not advance inby the end of the line curtain while mining.

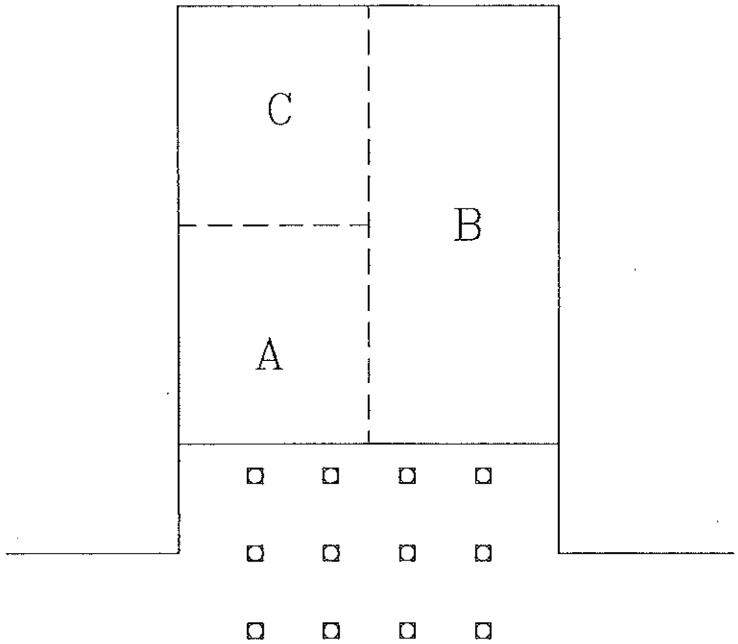
9. The final cuthrough of crosscuts in the entries or entries in the crosscuts, will be accomplished from the intake side towards the return side, so that the air courses over and away from the miner operator.

10. Only one miner per MMU will be operated at any time.

MARFORK COAL COMPANY, INC.

UPPER BIG BRANCH MINE

Cut Sequence



MSHA
MOUNT HOPE, WV

OCT 22 2008

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DISTRICT HEALTH

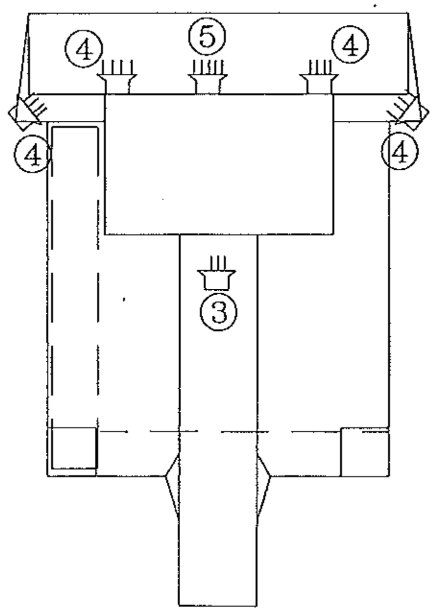
Cut sequence may be altered as indicated in the approved roof control plan. First cut will always start on the line curtain side.

(5) – Sprays Located at Top of Ripper Compartment (center).

(4) – Sprays Located at Top of Ripper Compartment (offset right and left).

(4) – Sprays Located at top of pan (spraying into pan).

(3) – Sprays Located above Chain Conveyor at Throat (spraying down).



Number of Sprays:	24
Type of Sprays	#5
PSI of Sprays	75
GPM of Sprays	1.3
Total GPM	31.2

NOTES

1. No more than one spray per block will be inoperative at any time.
2. A minimum of 20 Sprays must be operating at any time.

MMU 062–0

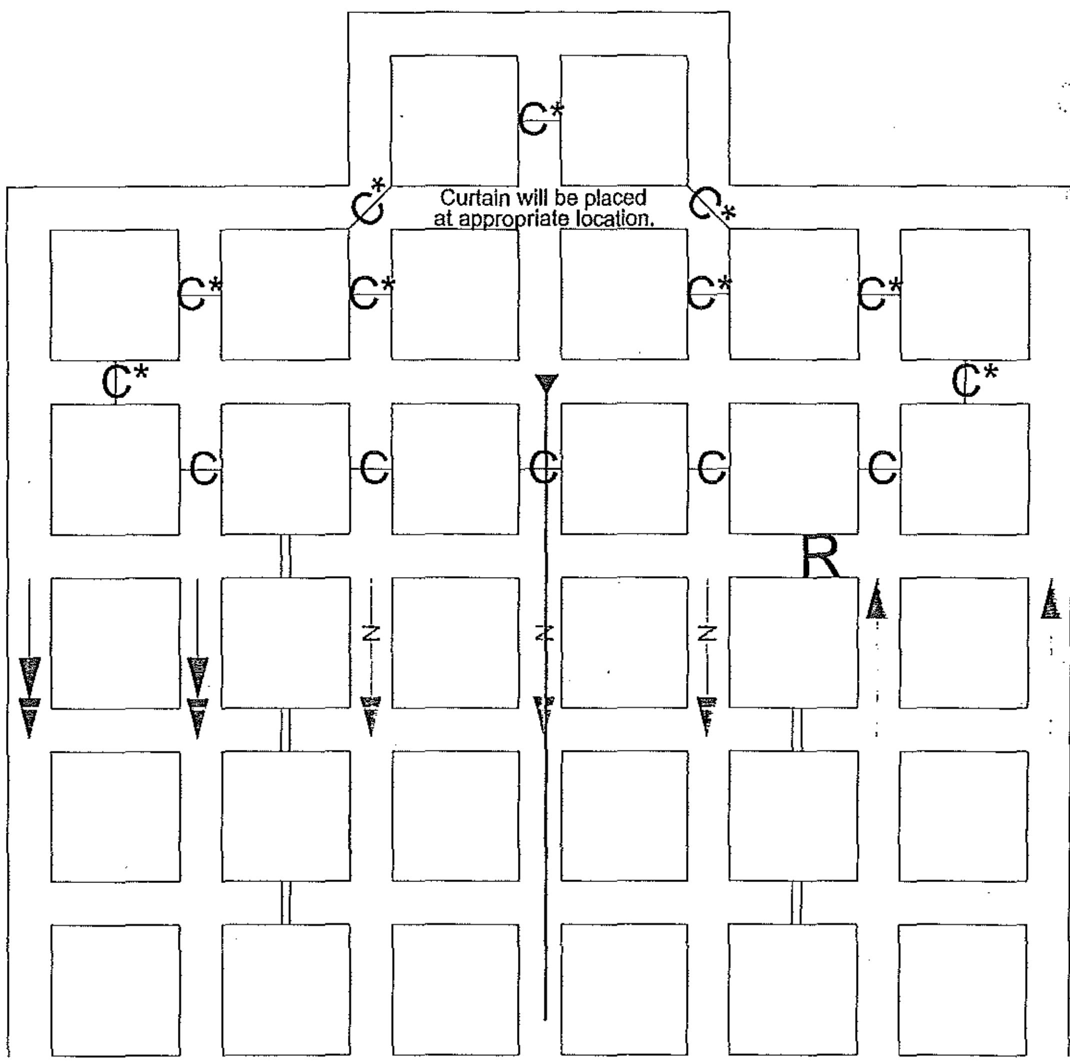
MSHA ID: 46–08436

STATE ID: U–3042–92

Joy 14–15

G:\Engineering\PCC Engineering\Mine Engineer\UBB\CH4 and Dust\UBB MMU 062-0 MINER DRAWING.dwg 10/22/2008 2:39:38 PM

Performance Coal Company, Inc.
Typical Section Advance
Sweep Ventilation
Upper Big Branch Mine



Symbol	Meaning
(arrow)	Intake air
(arrow with N)	Belt air
(double arrow)	Return air
(triangle)	Belt Tail piece
C	Check Curtain
R	Regulator
(line)	Stopping

* When mining, as many as two check curtains may be removed to allow haulage. At no time will curtains be removed to allow short short circuit from intake to return sides.

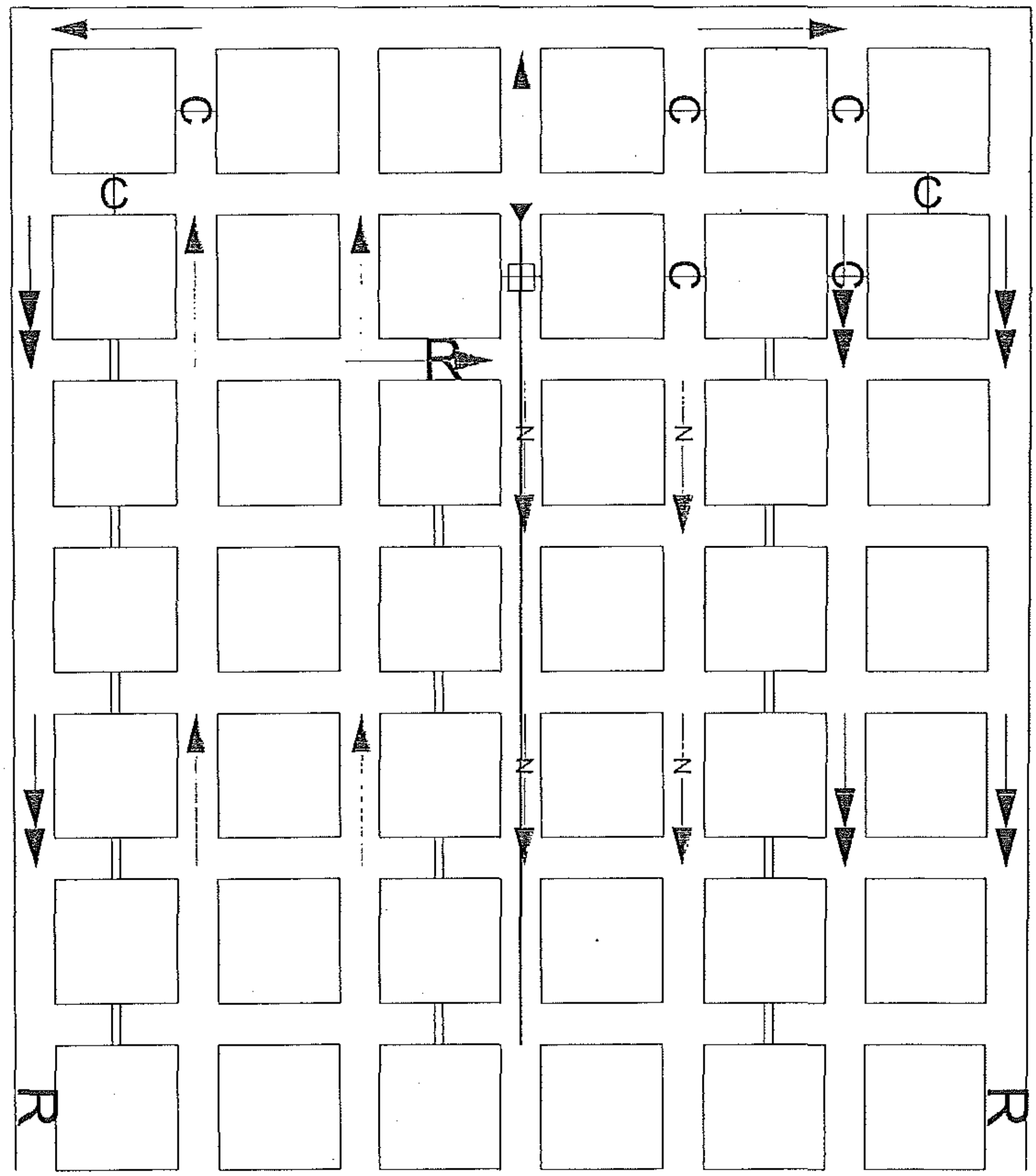
Typical Face Ventilation Plan

Typical development

Split Ventilation

Upper Big Branch Mine

(Mirror Image Can Apply)



Intake air	Check Curtain	
Belt air	R Regulator	
Return air	Stopping	
Belt Tail piece	Box Check	

Note: This plan can apply to development of panels with more or less entries.

Air splits are regulated by regulator located outby face area. (See Map)

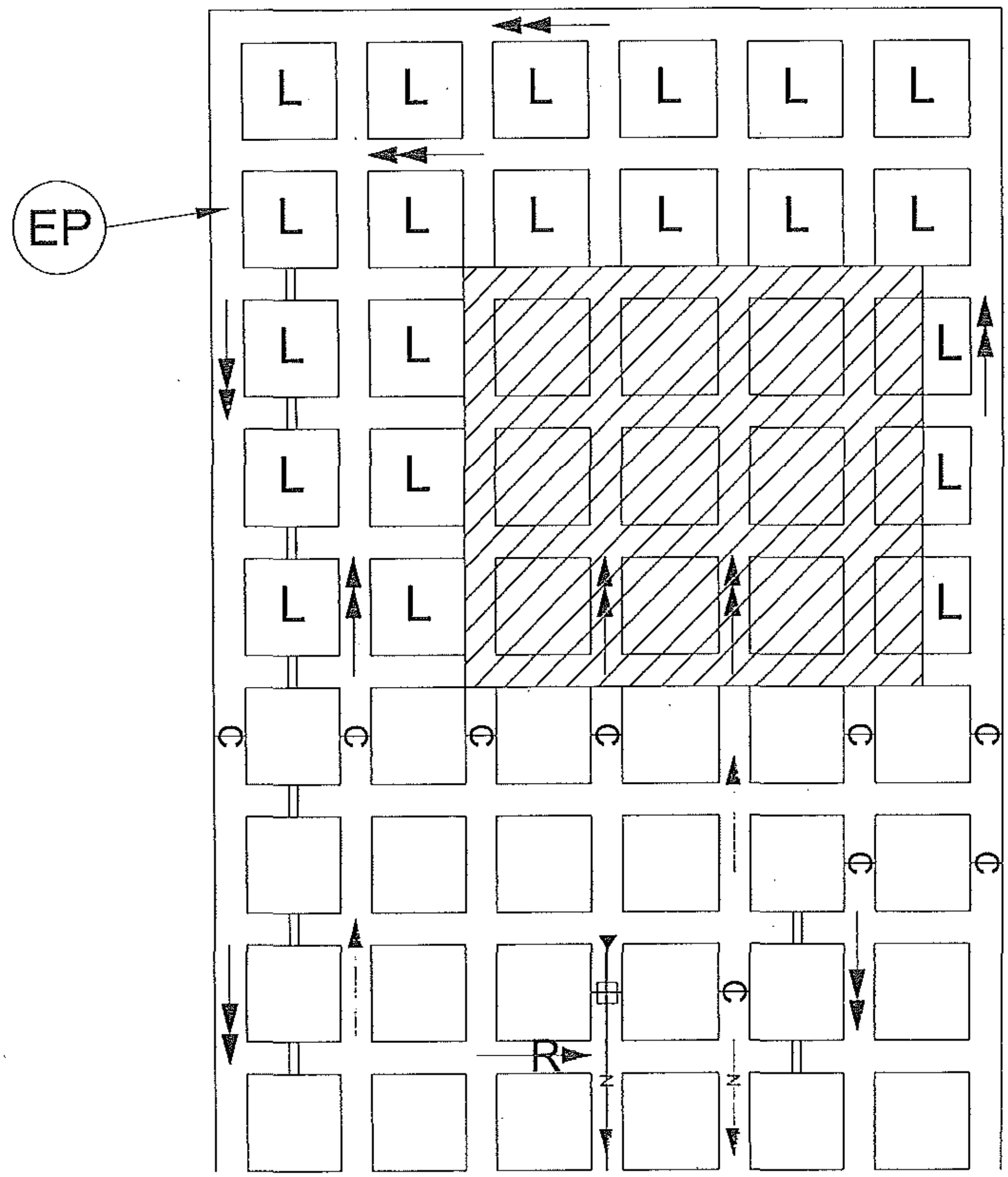
Typical Face Ventilation Plan

Full Pillar Recovery

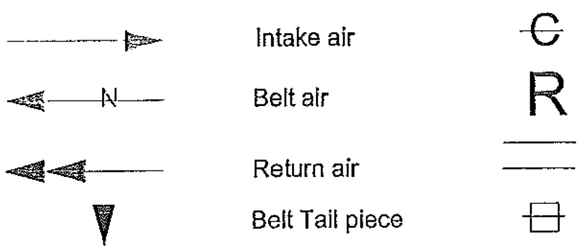
Initial Panel - Split System

Upper Big Branch Mine

(Mirror Image Can Apply)



Minimum cfm across continuous miner at pillar line = 6,000 cfm



Symbol	Meaning	Symbol	Meaning
(arrow)	Intake air	C	Check Curtain
(arrow) N	Belt air	R	Regulator
(double arrow)	Return air	(lines)	Stopping
(triangle)	Belt Tail piece	(box)	Box Check

Note: This plan can apply to second mining of more or less entries.
Second mining will comply with Approved Ventilation and Roof Control Plan.
Returns regulated outby section.

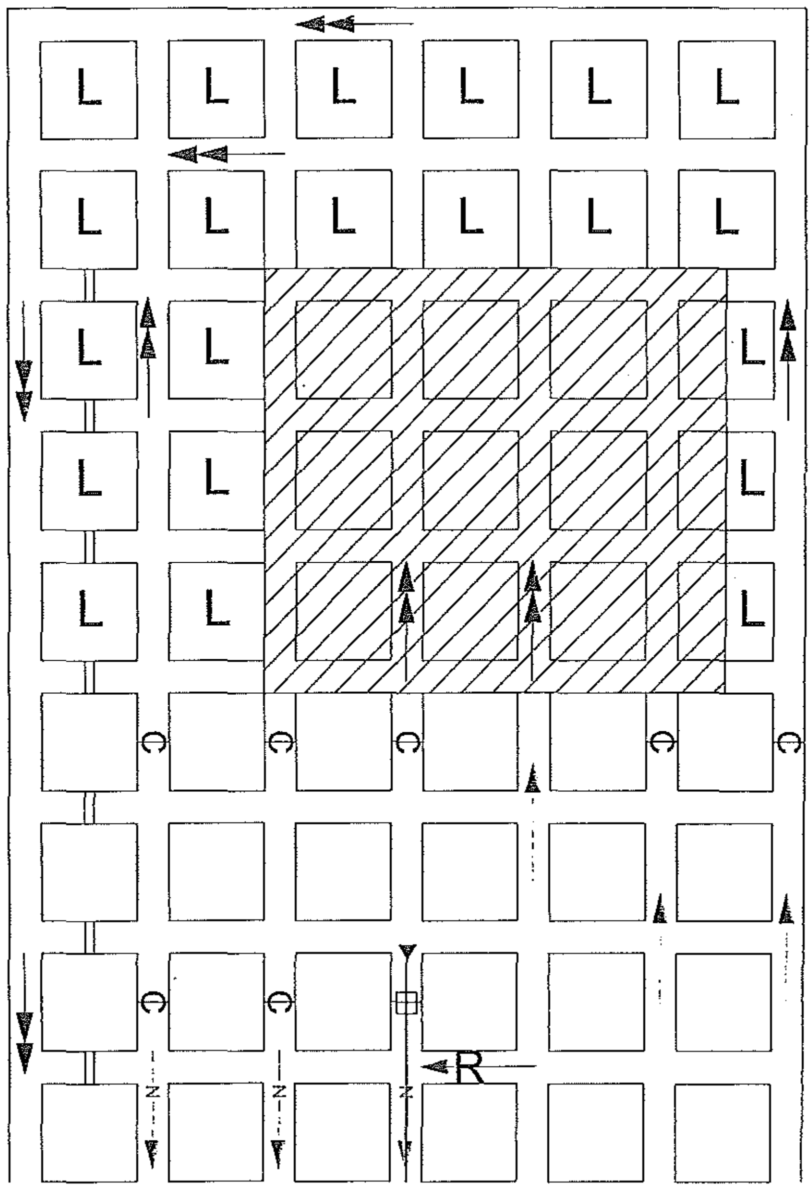
Typical Face Ventilation Plan

Full Pillar Recovery

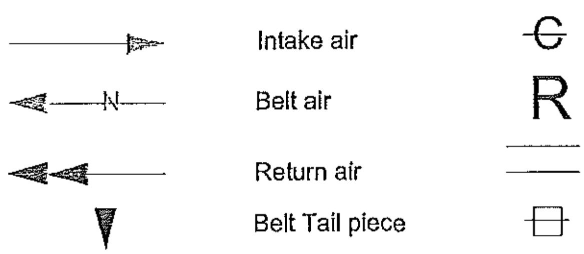
Initial Panel - Sweep System

Upper Big Branch Mine

(Mirror Image Can Apply)



Minimum cfm across continuous miner at pillar line = 6,000 cfm



Note: This plan can apply to second mining of more or less entries. Second mining will comply with Approved Ventilation and Roof Control Plan. Returns regulated outby section.

APPENDIX AF

METHANE AND DUST CONTROL - SAFETY PRECAUTIONS FROM VENTILATION PLAN

APPENDIX AF

METHANE AND DUST CONTROL - SAFETY PRECAUTIONS FROM VENTILATION PLAN

U. S. Department of Labor

Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880-1000

UNDERGROUND MINE FILE
DATE FWD. 6/17/09
INITIALS TW

This acknowledges receipt of the Methane and Dust control Portion of the Ventilation Plan required by Section 75.370 CFR or Respirable Dust Control Plan required by Section 71.300 CFR.

The Plan Dated **12/19/08** is ☒ Approved

Mine ID No. ☐ General Dust Control Plan ☒ MMU ☐ Supplements

46-08436 ☐ DWP ☐ Designated Areas

Mine Name
Upper Big Branch Mine-South

Company Name
Performance Coal Company

Post Office Address of Mine Operator

Mr. Chris Blanchard
P. O. Box 69
Naoma, WV 25140

MSHA
MOUNT HOPE, WV
JUN 17 2009
RECEIVED
MOUNT HOPE FIELD

Remarks

☒ This Methane and Dust Control Plan received **12/19/2008** has been approved and consists of **050-0 MMU Plan**.

FIELD MINE FILE
DATE FILED 6/18/09
INITIALS [illegible]

Date: 6/15/2009

Signature: Robert D. Hardman

DISTRICT 4 PLAN TRANSMITTAL SHEET

SECTION A: GENERAL INFORMATION

DATE RECEIVED FROM: ☐ OPERATOR ☐ MAIL ☐ OTHER DATE: 12/19/08 RECEIVED BY: RAC

S Plan Tracking No.

PLAN TYPE: 050-0 MMU PLAN

COMPANY NAME: PERFORMANCE COAL COMPANY

MINE NAME: UPPER BIG BRANCH MINE-SOUTH I.D. NO: 46-08436

FIELD OFFICE: ☒ Mt. Hope ☐ Mt. Carbon ☐ Summersville ☐ Princeton ☐ Pineville ☐ Madison ☐ Logan

PLAN SUMMARY / COMMENTS

SECTION B: ON-SITE REVIEW (IF APPLICABLE)

ON-SITE REVIEW CONDUCTED: ☐ YES, ☑ NO DATE OF REVIEW: ______

METHANE LIBERATION RATE (IF APPLICABLE): ______ CFD DATE OF SAMPLE: ______

COMMENTS: ______

- COMMENTS RECEIVED FROM MINER'S REPRESENTATIVE? ☐ YES ☐ NO ☑ NO REPRESENTATIVE

(See reverse)

SECTION C: PLAN COORDINATION and REVIEW

PLAN COORDINATED WITH (WHEN APPLICABLE): Please date and initial

☑ ADM FOR ENF L Selfe 6/15/09 ☑ FO SUPV mitH 6/10/09 ☐ CMI ASSIGNED TO MINE ______

☐ HEALTH ______ ☐ VENT ______ ☐ ROOF ______ ☐ TRAINING ______

☐ STATE ______ ☐ TECH SUPPORT ______ ☐ OTHER ______

COMMENTS:

SECTION D: DISTRICT REVIEW

DISTRICT SPECIALIST: DATE REVIEWED: 6-9-09 INITIALS: CW

RECOMMENDATION: ☒ APPROVAL ☐ DISAPPROVAL ☐ ACKNOWLEDGEMENT ☐ WAIVER GRANTED ☐ WAIVER DENIED ☐ FWD TO TS ☐ CONCUR WITH STATE ☐ OTHER

SPECIALIST SUPERVISOR: DATE REVIEWED: 6/9/09 INITIALS: O.M.

RECOMMENDATION: ☒ APPROVAL ☐ DISAPPROVAL ☐ ACKNOWLEDGMENT ☐ WAIVER GRANTED ☐ WAIVER DENIED ☐ FWD TO TS ☐ CONCUR WITH STATE ☐ OTHER

ASSISTANT DM (TECHNICAL): DATE REVIEWED: 6/10/09 INITIALS: RK

RECOMMENDATION: ☒ APPROVAL ☐ DISAPPROVAL ☐ ACKNOWLEDGMENT ☐ WAIVER GRANTED ☐ WAIVER DENIED ☐ FWD TO TS ☐ CONCUR WITH STATE ☐ OTHER

DISTRICT MANAGER: DATE: ______ INITIALS: ______

☐ APPROVED ☐ DISAPPROVED ☐ ACKNOWLEDGED ☐ WAIVER GRANTED ☐ WAIVER DENIED ☐ FWD TO TS ☐ CONCUR WITH STATE ☐ OTHER

SECTION E: DISTRIBUTION OF APPROVED PLANS NOTE: FIELD OFFICE - RETURN ORIGINAL TRANSMITTAL SHEET TO ENGINEERING SERVICES

TRACKING DATES (IF APPLICABLE): MSIS: _/_ (In --- out) SCANNED ______ UMF ______

PROVIDED TO OPERATOR & DISTRICT FILE: DATE: ______ INITIALS: ______

NOTIFICATION OF APPROVAL:

ASSISTANT DM (ENFORCEMENT) NOTIFIED BY - INITIALS: ______ DATE: ______ PHONE ☐ EMAIL ☐ IN PERSON ☐

FIELD OFFICE SUPERVISOR NOTIFIED BY - INITIALS: ______ DATE: ______ PHONE ☐ EMAIL ☐ IN PERSON ☐

INSPECTORNOTIFIED BY - INITIALS: ______ DATE: ______ PHONE ☐ EMAIL ☐ IN PERSON ☐

Performance Coal Company

P.O. Box 69 Naoma, WV 25140

May 28, 2009

Mr. Robert G. Hardman
Mine Safety and Health Administration
100 Bluestone Road
Mount Hope, WV 25880

Re: Performance Coal Company
Upper Big Branch Mine
MSHA ID: 46-08436
State ID: U-3042-92
MMU 050-0 Submittal

Dear Sir:

Please find the enclosed MMU plan for the Upper Big Branch Mine for your review and approval. This revision is for the addition of a longwall mining unit.

This mine currently has no miner's representative. This plan will be posted on the board at the mine at time of submittal. If you have any questions or comments, feel free to contact me at (304) 854-3516.

Respectfully Submitted,
Performance Coal Company, Inc.

Eric Lilly

Eric Lilly
Mine Engineer

SECTION SPECIFIC METHANE DUST CONTROL PLAN

DATE: 5-28-2009 **Mine:** Upper Big Branch **MINE ID:** 46-08436

MMU No.: 050-0 SECTION NAME: LW Unit #1 SEAM NAME: Eagle Seam

METHOD OF MINING: Continuous ( ) Longwall (X) Other ( )

a. Make and Model of Mining Equipment: Joy 7LS Shearer
b. Mining Height – Estimated 68" to 84"
c. Type Water Spray System: Pressure Spray Nozzle
d. Number of Sprays: 109 Minimum Operating PSI: 90psi at Spray Block
e. Location, angle and type of sprays: (See attached sketch)
f. Remote Control (X) Yes ( ) No If Yes, Type: Radio or cable remote may be operated from umbilical cord if radio remote becomes inoperative.
g. Jacks are typically operated through automatic functions.
h. Minimum operating PSI for crusher sprays: 60 psi

SCRUBBER SYSTEM

N/A

ROOF BOLTER

N/A

FACE VENTILATION

a. Volume of air at intake to longwall: 40,000 CFM
b. (1) Location on intake end of longwall where velocity is measured 50 ft off headgate at shield #9
Minimum velocity: 400 LFM
(2) Location on tail of longwall where velocity is measured 100 ft off tailgate at shield #160
Minimum velocity: 250 LFM

Safety Precautions

1. All persons working on the longwall production will be trained on the contents of the methane / dust control plan and limiting their dust exposure.

2. Deflector curtain will be maintained at all time when mining (see drawing) on intake side of the Longwall to maximize air velocities to the face.

3. All members in the face will be offered the use of Air Stream helmets: Maintenance for Air Stream Helmets as follows
   a) Battery packs shall be charged in accordance with manufacturers recommendations.
   b) Trained persons shall clean the units each shift
   c) Filters for each unit used shall be replaced each shift. Extra filters and batteries for each type of unit shall be stored on the section.
   d) Only manufacturers recommended battery packs shall be used.
   e) Trained persons on each shift shall perform a pre-operational inspection on each unit to be used. Damaged or missing components shall be repaired/replaced prior to placing the unit in service.
   f) A copy of the instruction/maintenance manual for each type of unit in use shall be kept in the mine office.

4. When cutouts at the headgate are made, the shear operator and jacksetters will locate themselves on the intake side utilizing the remote control.

5. Approved respirators will be maintained in accordance to the manufacturer's specifications. Filter type respirators will be changed prior to the start of each shift and as necessary during that shift. Additional respirators and filters will be kept on the section.

6. Shields will be washed weekly to prevent accumulation of dust. No one will be allowed to be within six shields during the cleaning process.

7. Two (2) sprays will be installed on the canopy tips of every 20 shields, to be manually activated, to control dust during mining operations.

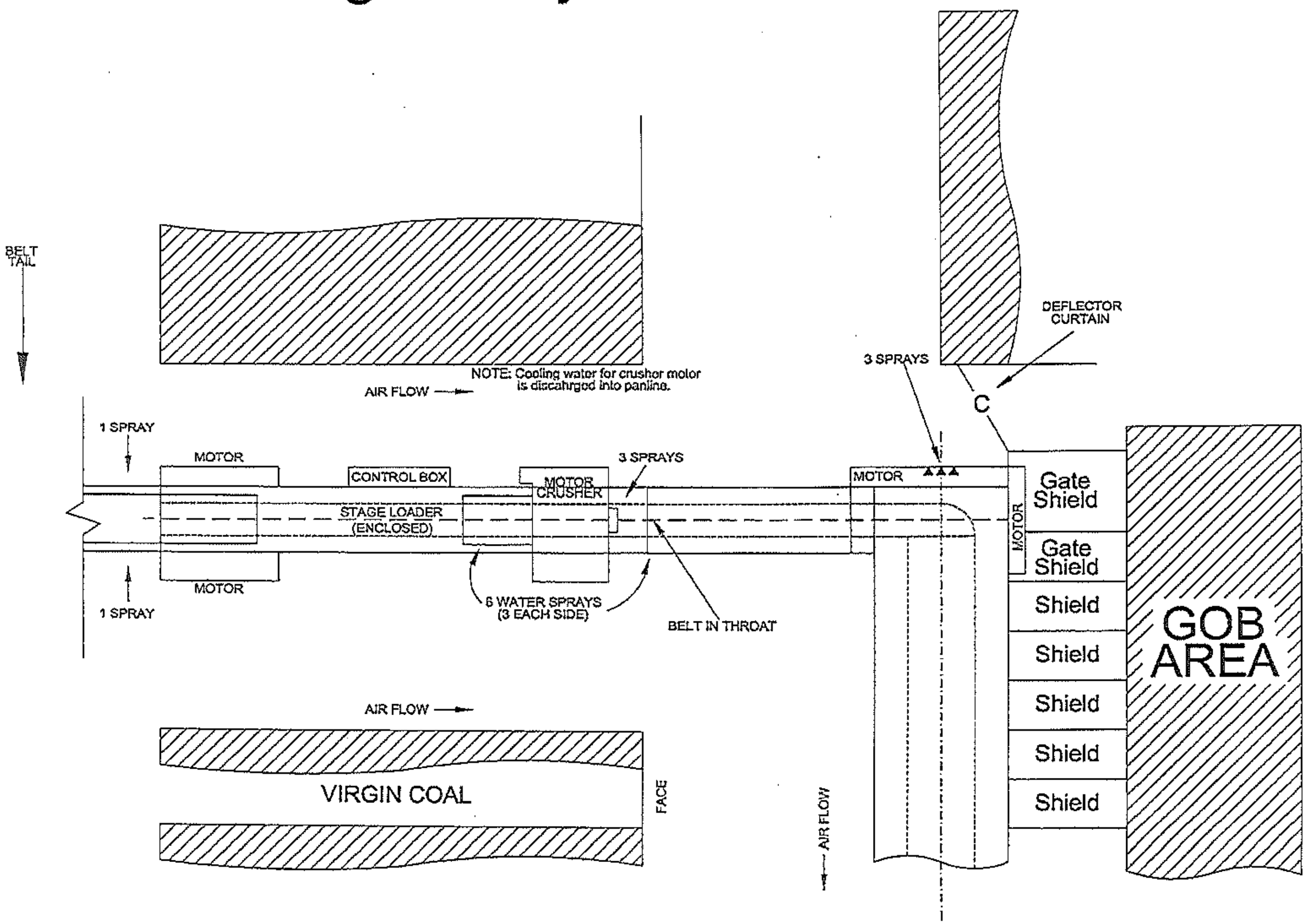
8. During cutting operations, no person shall be inby or downwind of the shear carriage when cutting.

   Exceptions*:

   Supervisors making examinations or correcting hazards.
   Electrician/Mechanic making examinations or minor repairs.

   *Limited to 30 minutes with the use of an approved respirator.

Performance Coal Company, Inc.
Upper Big Branch Mine (MSHA ID: 46-08436)
Headgate Layout MMU 050-0

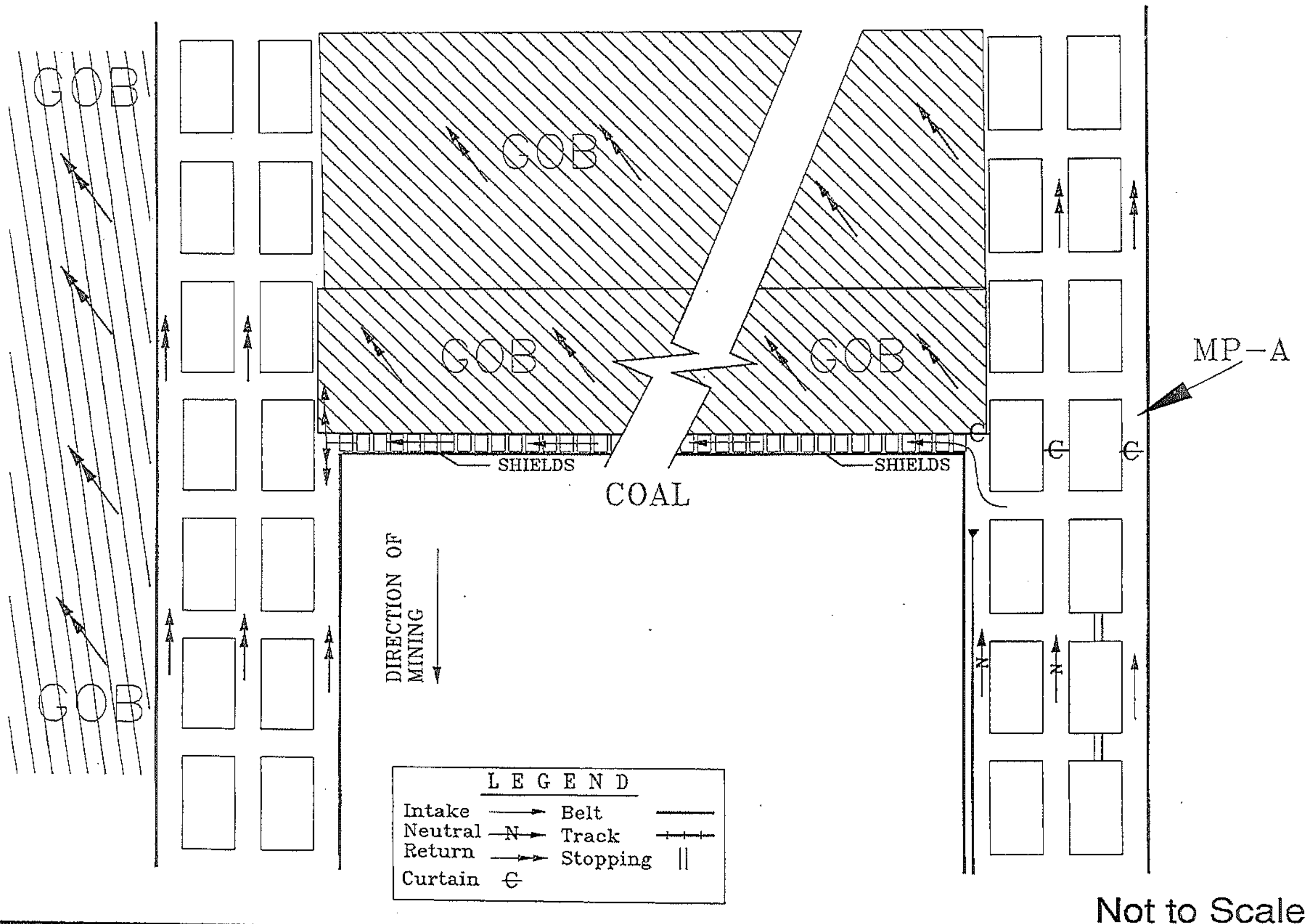


NOTE: RIGHT HAND FACE SHOWN, MIRROR IMAGE MAY APPLY

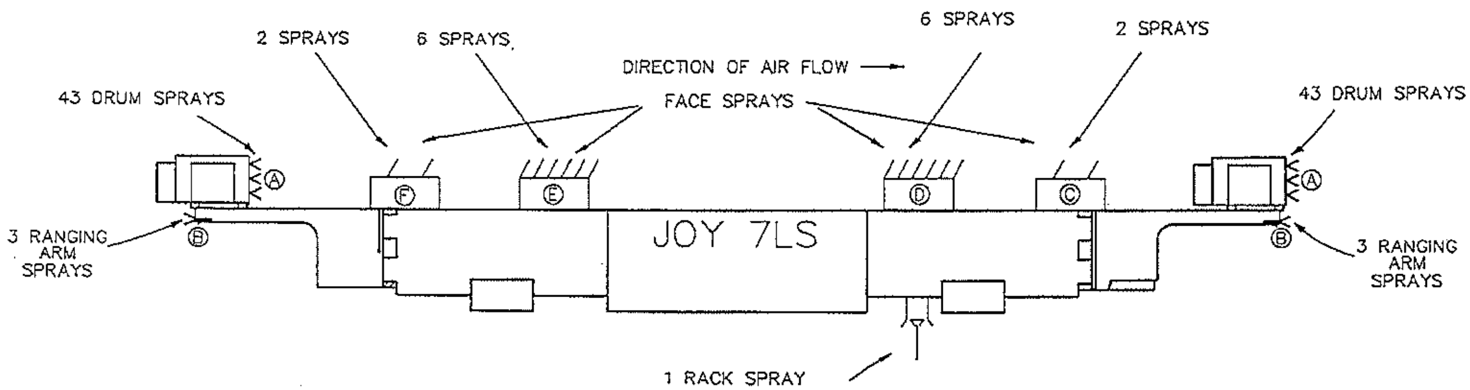
NOT TO SCALE

G:\Engineering\PCC Engineering\Mine Engineer\UBB\CH4 and Dust\MMU 050-0\UBB HG Design.dwg, 5/20/2009 10:22:40 AM, ollily

TYPICAL LONGWALL FACE VENTILATION
Performance Coal Company
Upper Big Branch Mine 46-08436 (U-3042-92)
Active Longwall Face Plan (Belt Air)



Performance Coal Company, Inc.
Upper Big Branch Mine
Spray Location Drawing



Sprays on shear are spraying to direct dust with ariflow drum and air sprays.

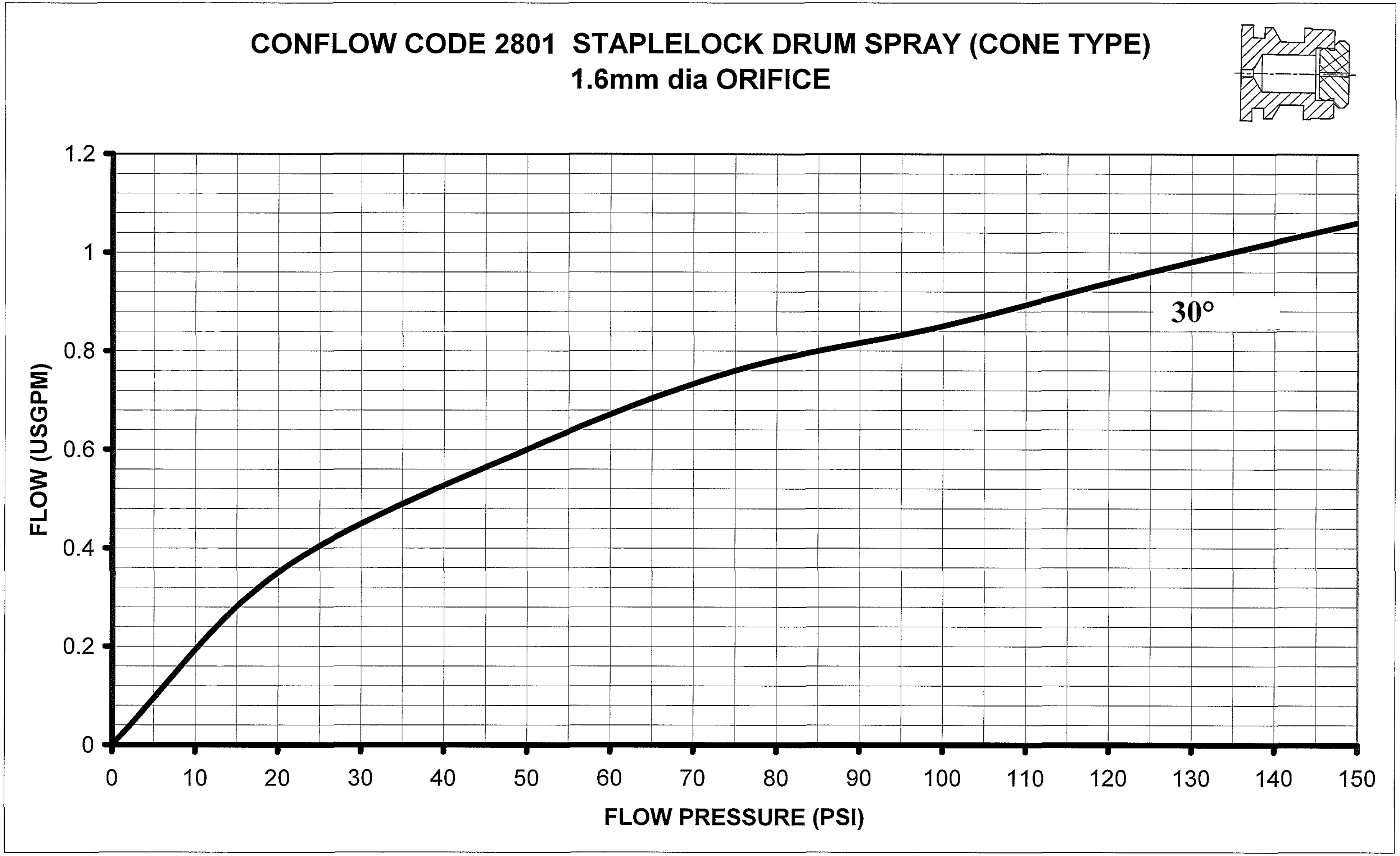
109 Conflow stapleslock650 2801CC or equivalent sprays.

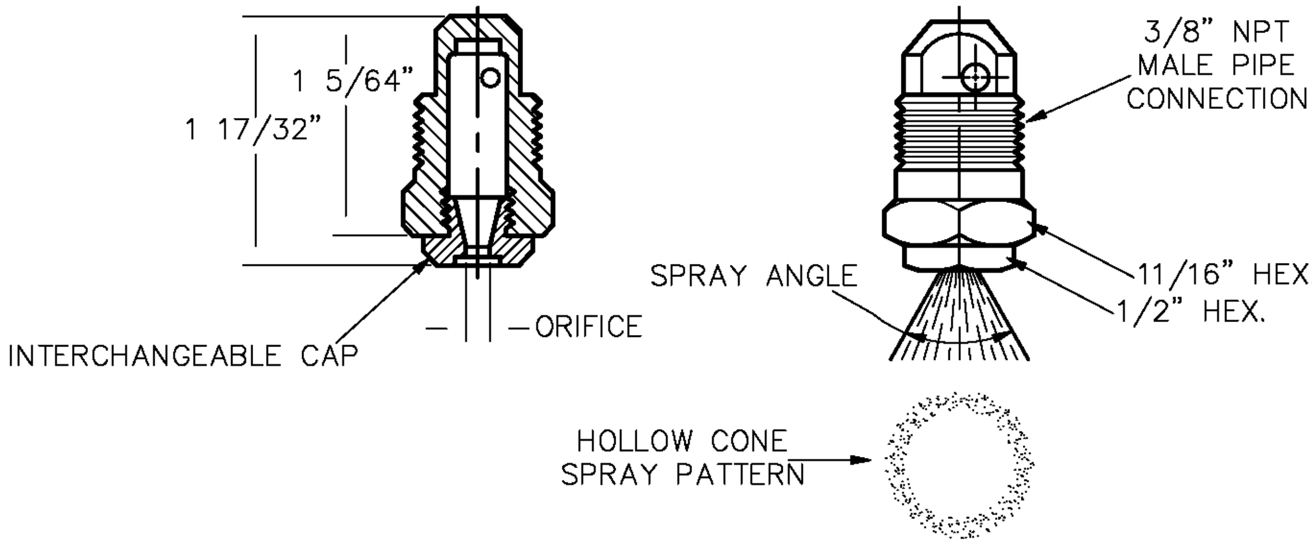
A – Drum Spray
B – Wrap Around Spray
C – Spray Block
D – Spray Block
E – Spray Block
F – Spray Block

Not To Scale

APPENDIX AG

SPECIFICATIONS OF WATER SPRAYS


CONFLOW CODE 2801 STAPLELOCK DRUM SPRAY (CONE TYPE)
1.6mm dia ORIFICE
FLOW (USGPM)
1.2
1
0.8
0.6
0.4
0.2
0
30°
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
FLOW PRESSURE (PSI)



NOZZLE No.	BODY SIZE	ORIFICE DIA.	CAP No.	CAPACITY G.P.M. (GALLONS PER MINUTE) AT P.S.I. (Lbs. PER SQUARE INCH)													SPRAY ANGLE		
				10 PSI	20 PSI	40 PSI	60 PSI	80 PSI	100 PSI	120 PSI	140 PSI	150 PSI	200 PSI	300 PSI	400 PSI	500 PSI	20 PSI	100 PSI	500 PSI
3/8BD 2-1	2	.063"	1	–	.16	.22	.27	.31	.36	.38	.41	.43	.51	.62	.72	.80	55°	65°	50°
3/8BD 2		.078"	2	.20	.28	.40	.49	.57	.63	.69	.75	.77	.89	1.1	1.3	1.4	60°	69°	62°
3/8BD 2-3		.094"	3	.24	.34	.52	.59	.68	.76	.83	.90	.93	1.1	1.3	1.5	1.7	67°	76°	68°
3/8BD 2-5		.125"	5	.34	.48	.68	.83	.96	1.1	1.2	1.3	1.3	1.5	1.9	2.2	2.4	81°	87°	77°
3/8BD 2-8		.156"	8	.36	.51	.72	.88	1.0	1.1	1.2	1.3	1.4	1.6	2.0	2.3	2.6	87°	90°	82°
3/8BD 2-10		.172"	10	.41	.58	.82	1.0	1.2	1.3	1.4	1.5	1.6	1.8	2.2	2.6	2.9	93°	97°	90°
3/8BD 3-1	3	.063"	1	–	.18	.26	.32	.37	.40	.45	.49	.50	.57	.70	.81	.90	49°	60°	47°
3/8BD 3-2		.078"	2	.22	.31	.44	.54	.62	.69	.76	.82	.85	.98	1.2	1.4	1.6	57°	68°	58°
3/8BD 3		.094"	3	.30	.42	.59	.73	.85	.94	1.0	1.1	1.2	1.3	1.6	1.9	2.1	64°	75°	64°
3/8BD 3-5		.125"	5	.34	.48	.68	.83	.96	1.1	1.2	1.3	1.3	1.5	1.9	2.2	2.4	80°	86°	76°
3/8BD 3-8		.156"	8	.41	.58	.82	1.0	1.2	1.3	1.4	1.5	1.6	1.8	2.3	2.6	2.9	84°	89°	81°
3/8BD 3-10		.172"	10	.46	.65	.92	1.1	1.3	1.5	1.6	1.7	1.8	2.1	2.5	2.9	3.3	92°	96°	89°
3/8BD 5-1	5	.063"	1	–	–	.35	.43	.49	.55	.61	.65	.68	.78	.96	1.1	1.2	35°	47°	36°
3/8BD 5-2		.078	2	–	.38	.54	.66	.76	.85	.94	1.0	1.0	1.2	1.5	1.7	1.9	50°	61°	51°
3/8BD 5-3		.094"	3	–	.52	.74	.91	1.2	1.2	1.3	1.4	1.4	1.7	2.0	2.3	2.6	59°	66°	58°
3/8BD 5		.125"	5	.50	.71	1.0	1.2	1.4	1.6	1.7	1.9	1.9	2.2	2.7	3.2	3.5	73°	78°	72°
3/8BD 5-8		.156"	8	.55	.78	1.1	1.3	1.6	1.7	1.9	2.1	2.1	2.5	3.0	3.5	3.9	79°	83°	78°
3/8BD 5-10		.172"	10	.65	.92	1.3	1.6	1.8	2.1	2.3	2.4	2.5	2.9	3.6	4.1	4.6	84°	88°	82°
3/8BD 8	8	.156"	8	.80	1.1	1.6	2.0	2.3	2.5	2.8	3.0	3.1	3.6	4.4	5.1	5.7	65°	64°	–
3/8BD 10	10	.172"	10	1.0	1.4	2.0	2.4	2.8	3.1	3.5	3.7	3.9	4.4	5.4	6.2	6.9	70°	69°	62°
3/8BD 20-10	20	.172"	10	1.4	1.9	2.7	3.4	4.0	4.3	4.8	5.2	5.4	6.0	7.4	8.5	9.6	61°	60°	49°

DESCRIPTION:

3/8BD--
WHIRLJET NOZZLES

Spraying Systems Co.®
Spray Nozzles and Accessories
P.O. Box 7900 - Wheaton, Il. 60187-7901

Rev. No. 4

Ref.

Data Sheet No.
14889
SHEET OF

FLOW TECHNOLOGIES COMPANY

P.O. Box 800
Daniels, WV 25832
Work (304) 255-2224
Home (304) 763-2634

Fluid Filtration & Spray Controls • Made in USA

SPRAY DATA SHEET ON 3/8" NPT HOLLOW CONE NOZZLES

Spray No.	Body Inlet Dia. Inches	Orifice Dia Inch	Capacity GPM 40PSI	Angle	Capacity GPM 60PSI	Angle	Capacity GPM 80 PSI	Angle	Capacity GPM 100 PSI	Angle
#3-2	3/32"	5/64"	.44	60°	.60	70°	.60	72°	.70	73°
#3-3	3/32"	3/32"	.62	70°	.74	76°	.84	82°	.96	78°
#5-3	7/64"	3/32"	.70	65°	.81	65°	.94	66°	.1.12	68°
#5-5	7/64"	1/8"	.84	80°	1.04	80°	1.22	86°	1.42	85°

SPRAY DATA SHEET ON 1/2" NPT HOLLOW CONE NOZZLES

#3-2	3/32"	5/64"	.44	60°	.60	70°	.60	72°	.70	73°
#3-3	3/32"	3/32"	.44	70°	.60	70°	.84	82°	.86	78°
#5-3	7/64"	3/32"	.70	65°	.81	65°	.94	66°	1.12	68°

FLOW TECHNOLOGIES COMPANY

P.O. Box 800
Daniels, WV 25832
Work (304) 255-2224
Home (304) 763-2634
cel (304) 575-9646

Fluid Filtration & Spray Controls • Made in USA

FLOW CHART ON STAINLESS STEEL STAPLE LOCK INSERTS CONE TYPE

FTC NO.	CONFLOW NO.	ORIFICE DIAMETER	FLOW RATE @ 100 PSI
791C 1MM	2801SC	1 mm .039	.4 GPM
791C 1/16"	2801CC	1.58MM ,062	.8 GPM
791C 3/32"	2801DC	2.38MM .093	1.4 GPM
791C 1/8"	2801TC	3.17MM .125	2.1 GPM

FLOW CHART ON STAINLESS STEEL WHIRL JET TYPE

791W 1 MM	2801SW	1 MM .039	.5 GPM @ 100 PSI
791W 1/16"	2801CW	1.58MM .062	.86 GPM @ 100 PSI
791W 3/32"	2801DW	2.38MM .093	1.78GPM @ 100 PSI
791W 1/8"	2801TW	3.17MM .125	2.84GPM @ 100 PSI

FLOW CHART ON STAINLESS STEEL FULL JET TYPE

791J 1/16"	2801AJ	1.58MM .062	.86GPM @ 100 PSI
791J 3/32"	2801BJ	2.38MM ..093	1.78 GPM @ 100 PSI
791J 1/8"	2801TJ	3.17MM .125	2.84 GPM @ 100 PSI

DIAMETER	FLOW RATE	VENTURI TYPE	FTC #	CONFLOW #
.090 2.38MM	1.2 GPM @ 100 PSI		9540-1	650-1912-1
.125 3.1MM	2.36GPM @ 100 PSI		9540-2	650-1912-2
.142 3.6MM	3.16GPM @ 100 PSI		9540-3	650-1912-3
.158 4.1MM	4.4GPM @ 100 PSI		9540-5	650-1912-5

SAM FORINASH PROD/ENG

Sam Forinash

FLOW
TECHNOLOGIES
COMPANY

P.O. Box 800
Daniels, WV 25832
Work (304) 255-2224
Home (304) 763-2634

Fluid Filtration & Spray Controls • Made in USA

MANUFACTURING TECHNIQUE

ENCLOSED IS A PROCEDURE FOR WHAT WE DO. INCLUDING THE SPRAY SIZE AND ORIFICE SIZE AND THE DIFFUSER (DELRIN)

THE SUPPLIER WHO SUPPLIES THE DELRIN AND MOST OF THE SPRAYS IS B & D MACHINE IN ALLIANCE, OHIO DON BURKE IS THE MANAGER ALSO SALEM SPECIALTIES IN SALEM, VA Ronnie Shepherd is Manager MY VENTURI'S ARE MANUFACTURED IN ELLISTON, VA NOLEN SHIPP IS THE METALLERIGICAL ENGINEER THERE.

We drill the various sizes of Delrin on Jett high speed drills including the whirl jet and hollow cone.

Delrin is drilled in the hollow cone center hole is 1MM the side holes are 3/64" and is on a 67 angle. The whirl jet is 1/8" on the side of delrin.

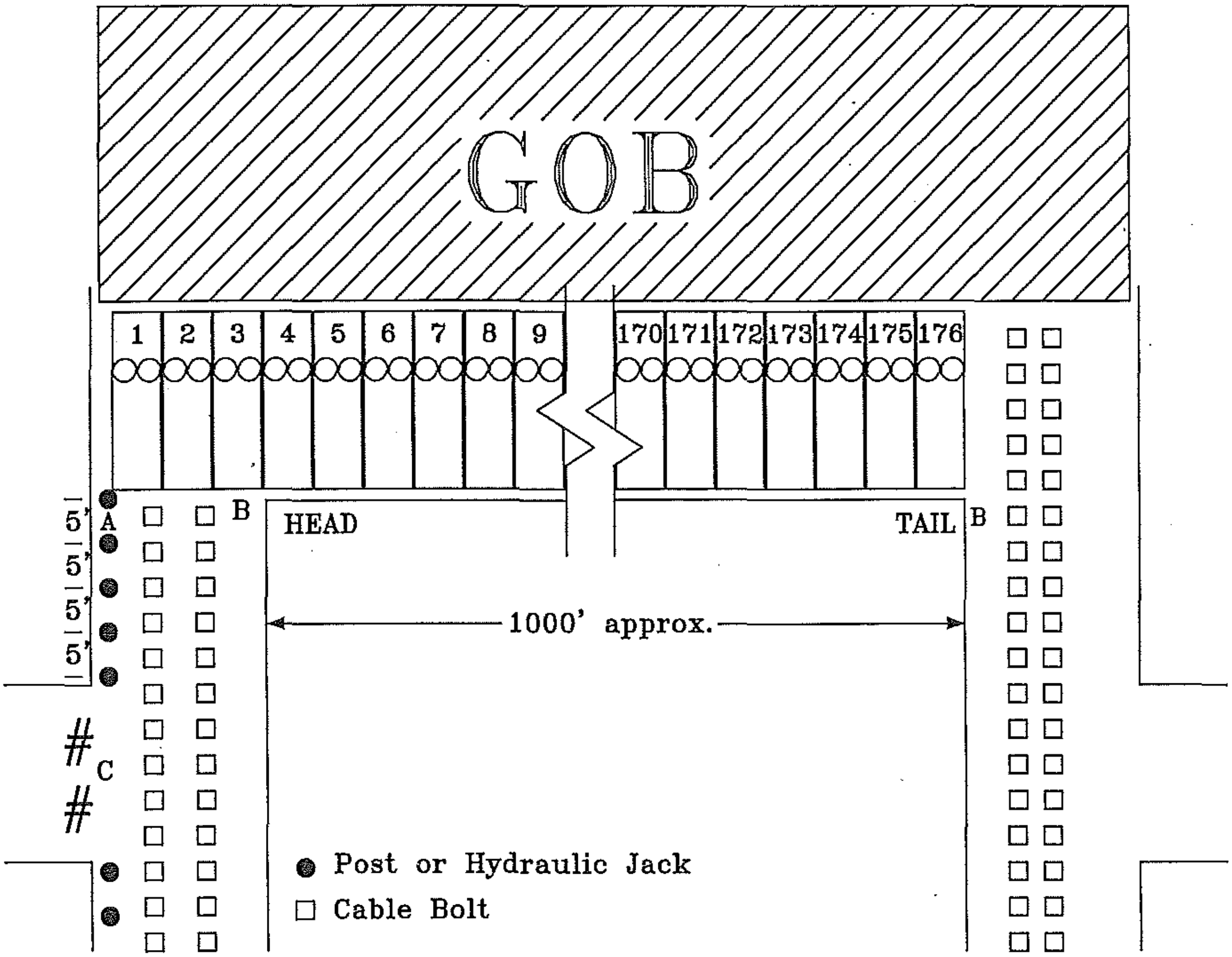
SAM FORINASH PRODUCT/ENGINEER

[signature]

APPENDIX AH

ROOF CONTROL PLAN - HEADGATE AND TAILGATE SUPPORT

ROOF CONTROL PLAN DIAGRAM NO. 8
LONGWALL FACE, HEAD, AND TAIL ENTRY SUPPORT



Joy/American Longwall shields shall be installed on approximately 5.75 ft. centers along the longwall face and maximum spacing between the shields shall not exceed twelve inches.

Notes: Right hand face shown. Both right and left hand faces may be used.

The headgate entry shall be supported at Location A for a minimum of 50 feet with a minimum of one row of posts and/or hydraulic jacks on 5-foot centers. The location of the row is optional. Two cribs shall be installed at location C near each intersection in lieu of the posts.

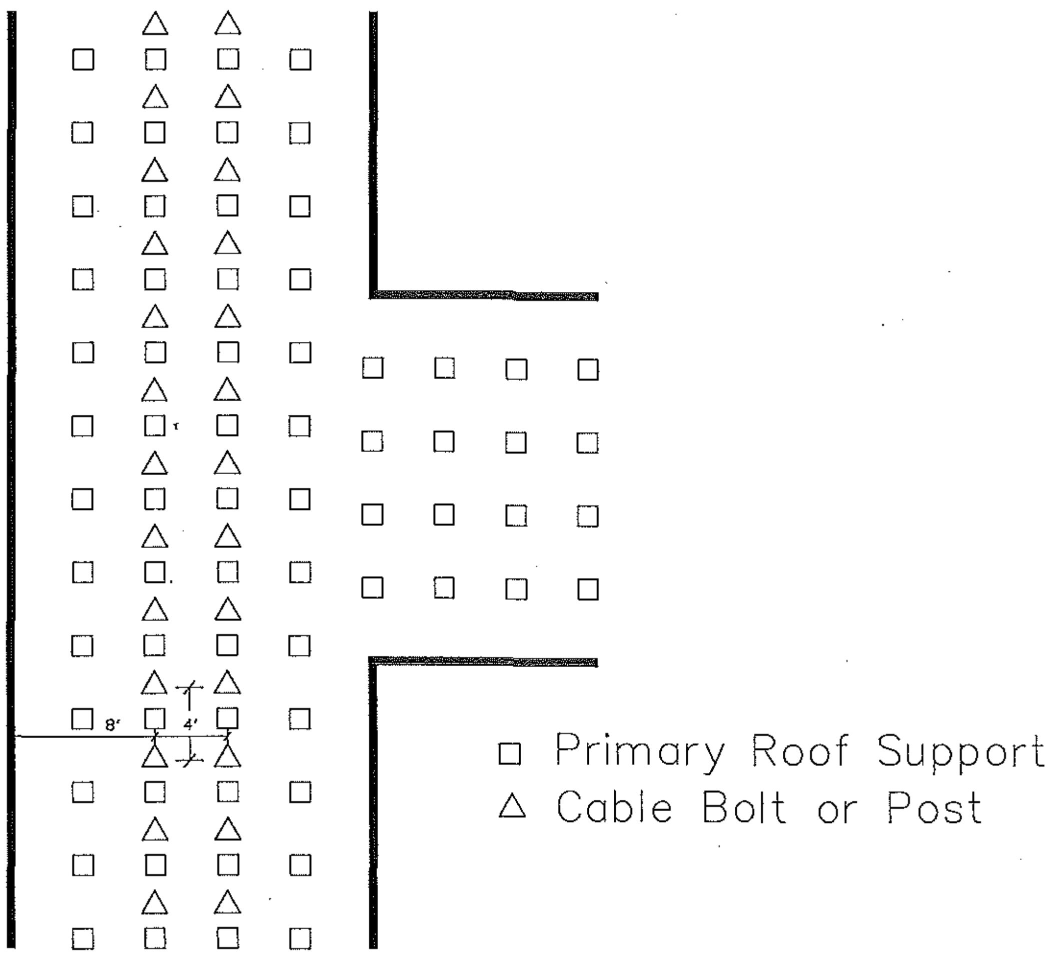
Person(s) shall not be permitted in area (B) during active longwall development in the face. When men are required to travel in and around the tailgate or stageloader to maintain and service the equipment, additional posts or jacks shall be installed on 5-foot centers in area (B) and maintained to protect the workmen. (IF the area is not supported by shields)

In a case if spacing between the coal rib and the #1 shield exceeds 5ft, upplemental support will be provided in the form of Jacks or Cribs at 4ft intervals.

NOT TO SCALE

ROOF CONTROL PLAN DIAGRAM NO. 9

SUPPLEMENTAL SUPPORT IN TAILGATE ENTRY



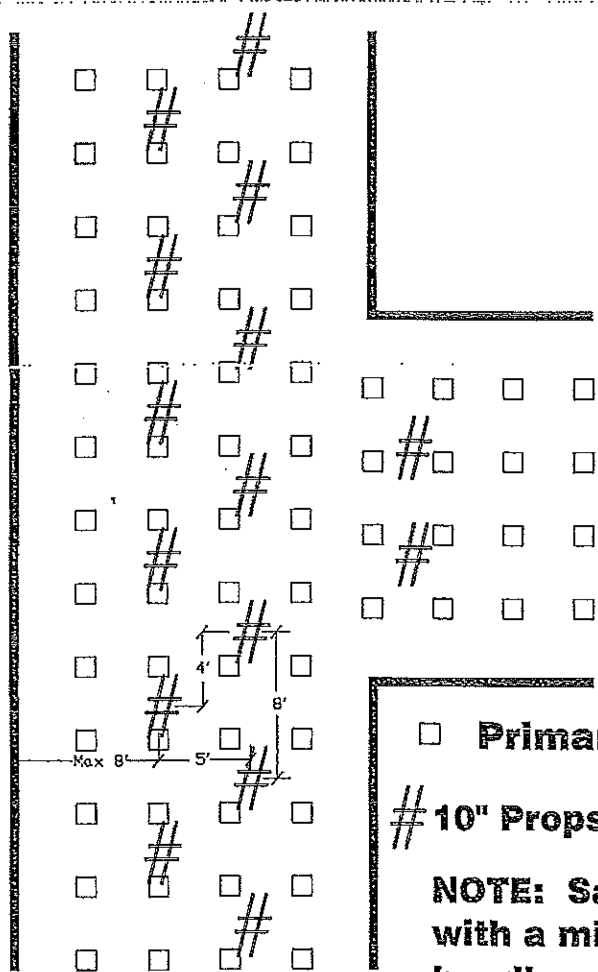
In Longwall development entries of initial longwall panels, the Tailgate Entry will have supplemental support in the form of two (2) 8' Cable Bolts or Posts installed between primary support.

This supplemental support shall be maintained 1000' outby the longwall face at all times.

PERFORMANCE COAL COMPANY, INC.	
UPPER BIG BRANCH MINE	
MSHA ID NO. 46-08436 WV State # U-3042-92	
ROOF CONTROL PLAN DIAGRAM NO. 9	
SUPPLENTAL SUPPORT IN TAILGATE ENTRY	
DATE: 10-27-08	SCALE: 1" = 10'

ROOF CONTROL PLAN DIAGRAM NO. 10A

SUPPLEMENTAL SUPPORT IN ADJACENT TAILGATE ENTRIES
(IN AREAS HAVING LESS THAN 1000' COVER)



□ **Primary Roof Support**

10" Propsetter, Sand Prop or 4-Point Crib

NOTE: Sand Props will be installed with a minimum 2" thick by 10" by 10" headboard and footboard.

In Longwall development entries with longwall gob on one side and less than 1000 feet of cover, the tailgate entry shall be supported as follows:

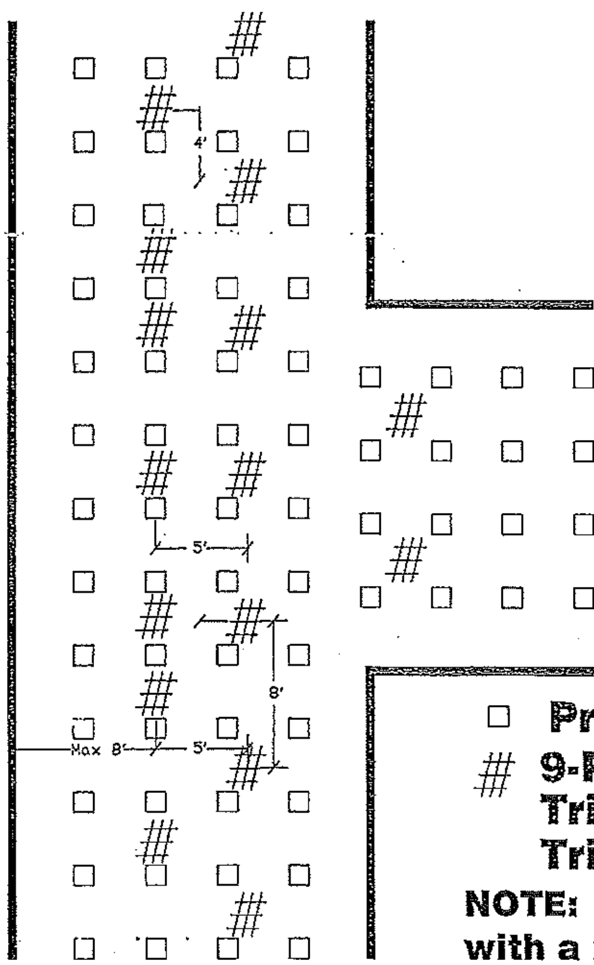
a) Adjacent tailgate entry shall be supported with either two rows of 10" Propsetters (with headboards and footboards), two rows of 4-point cribs or two rows of Sand Props. The two rows of 10" Propsetters two rows of 4-point cribs or two rows of Sand Props shall be set on eight-foot lengthwise centers and five-foot crosswise centers with a four-foot lengthwise stagger between the rows. Also, two 10" Propsetters, two Sand Props or two cribs shall be set in the intersection 200' outby the Longwall face for Panel #11(12RT Gate) Only.

b) Supports will be maintained 50 feet outby the retreating longwall face for the future adjacent tailgate entry.

Scale: 1" = 10'

ROOF CONTROL PLAN DIAGRAM NO. 10B

SUPPLEMENTAL SUPPORT IN ADJACENT TAILGATE ENTRIES
(IN AREAS HAVING GREATER THAN 1000' COVER)



□ **Primary Roof Support**

9-Point Crib, Link-n-Lock, Tri-Set Propsetter or Tri-Set Sand Prop

NOTE: Sand Props will be installed with a minimum 2" thick by 10" by 10" headboard and footboard.

In Longwall development entries with longwall gob on one side and greater than 1,000ft of cover, the following shall apply:

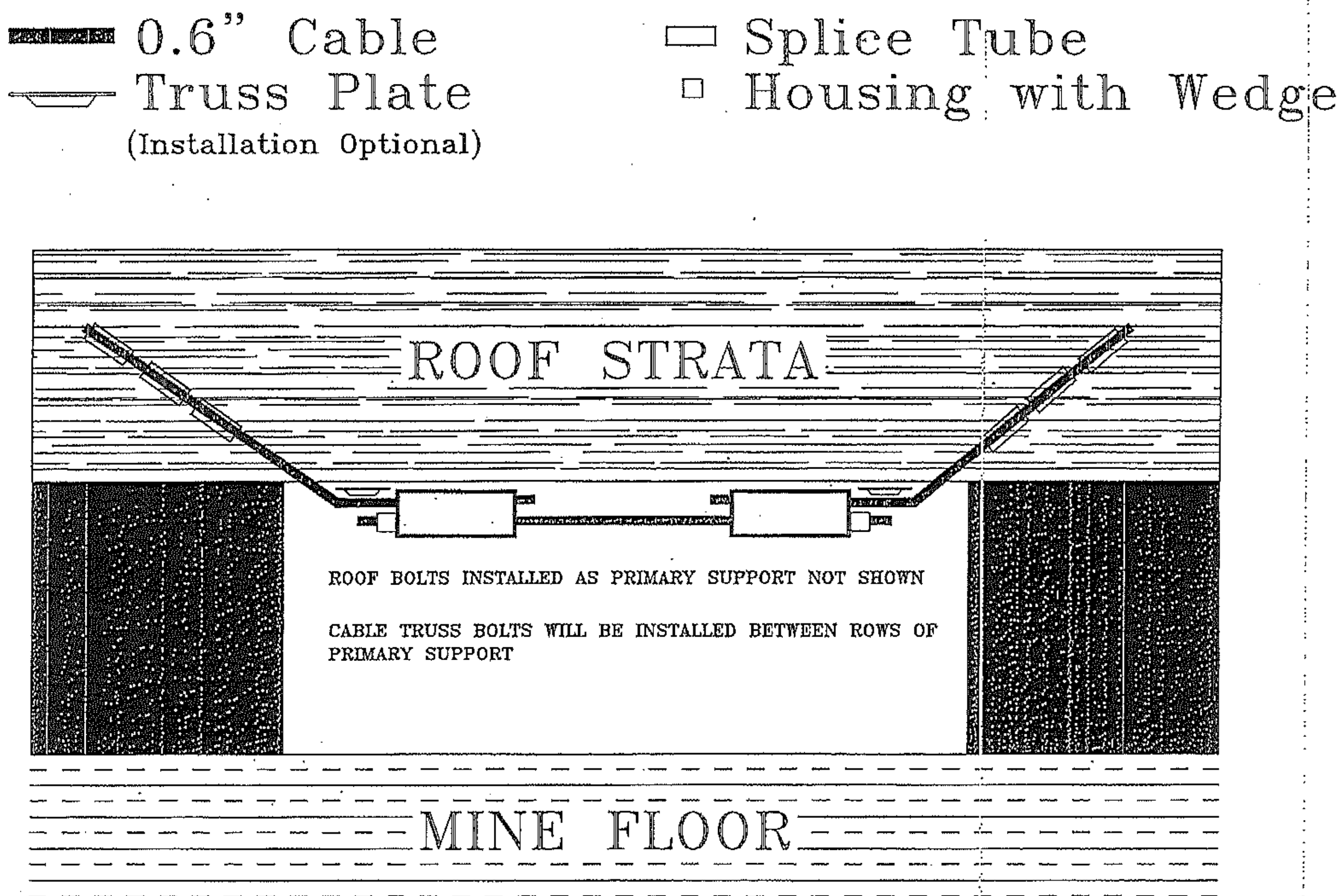
a) Adjacent tailgate entry shall be supported with two rows of 9-point cribs. The 9-point cribs shall be set on eight-foot lengthwise centers and five-foot crosswise centers with a four-foot lengthwise stagger between the rows. Intersections shall be supported as shown. Supports of this capacity shall be installed one break inby and outby of the 1000 feet cover areas.

b) Supports will be maintained 50 feet outby the retreating longwall face for the future adjacent tailgate entry.

Link-n- Locks Crib Systems, Tri-Set 10" Propsetters on 3' centers or Tri-Set Sand Props on 3' centers can be used in lieu of 9 point cribs in intersections.

Scale: 1" = 10'

J.M.S. CABLE TRUSS SKETCH



APPENDIX AI

STABILITY ANALYSIS OF GATEROAD DESIGN

APPENDIX AI

STABILITY ANALYSIS OF GATEROAD DESIGN

Appendix AI
Stability Analysis of Gateroad Design

Because of witness testimony regarding extensive floor heave in Headgate 1 North, experienced particularly on development but noted behind the longwall face, analyses of the gateroad pillar design was undertaken for Headgate 1 North, the HG 22, and the 'new' TG 22. The analyses were performed using the NIOSH software AMSS (Analysis of Multiple Seam Stability). Review of mine map overlays in conjunction with the following stability analyses indicates that the 1 North Panel was not adequately designed for the overburden and multiple seam conditions that were encountered. It appears that although the mine had longwalled beneath Powellton longwall panels near the end of the previous district, the overburden was less, and the old-style longwall panels in the overlying seam were narrower (500 feet). Even a cursory review of mine map overlays indicates that the 1 North Panel, the first in the new district, would pass perpendicularly beneath gob/solid and remnant pillar configurations, defined by longwall panels in the overlying Powellton seam. This should have prompted the incorporation of an even higher margin of safety in the panel design. However, as discussed below, the gateroad design did not even meet the minimum Pillar Stability Factors recommended by NIOSH in areas of combined multiple seam interaction and high overburden. It should be further noted that even though the pillars as shown on the mine map were of inadequate size, underground observations revealed that entries were commonly mined even wider (23 feet), with resulting pillars that were even smaller than portrayed on maps. Using the actual as-mined dimensions would result in even lower Pillar Stability Factors than portrayed in the design.

Headgate 1 North

Headgate 1 North was developed as a 3-entry gateroad beginning by November 2008, utilizing 100-foot crosscut centers, with 95-foot centers from the #1 to #2 entry, and 105-foot centers from the #2 to #3 entry. Prior to this, the section had been begun from the 6 North Belt as a 5-entry section in July 2008. The 1 North Panel was the first to be developed beneath Powellton seam longwalls since May 2005, at the end of the previous district, when Panel 20 crossed diagonally beneath a 500-foot wide longwall panel. Maximum overburden, based on comparison with structure contours for the Eagle seam provided by the company and a standard USGS topographic map, is 1,290 feet. Headgate 1 North passes beneath several gateroads in the Powellton seam, located 170 feet above, which represent a gob/solid boundary between crosscuts 60-65, with gateroads between mined-out longwall panels interpreted to represent remnant pillars farther west. For purposes of AMSS analyses, the 4-entry gateroads are treated as a single barrier, the width of which is measured to the outside ribs of the outside pillars, a distance of 160 feet. A long barrier between adjacent room-and-pillar workings may represent a remnant pillar configuration near crosscut 45, particularly if the floor has been softened in the Powellton seam, or if pillar extraction has been performed.

CMS&H District 4 provided a copy of an AMSS analysis for Headgate 1 North, dated December 14, 2009, which was conducted by District 4 personnel following deterioration of the headgate. The analysis indicated that the Pillar Stability Factor for tailgate loading essentially met the NIOSH recommended value of 1.13, utilizing a gob/solid boundary beneath the Powellton seam longwall panels, and assuming 990 feet of overburden. The Accident Investigation team reviewed the analysis and conducted its own analysis for purposes of comparison. Based on field visits to the Powellton and Eagle seams in this area, the Accident Investigation team analysis used different values for seam height than indicated in the submitted analysis. The submitted analysis appears to address the vicinity of Crosscut 60-65, beneath the gob/solid boundary represented by the Powellton longwall. Based on the analysis seam height of five feet, the 1 North Panel headgate appears to meet the NIOSH recommended value of 1.13. However, field experience indicates that a more realistic value of seam height is seven feet, which substantially reduces the Pillar Stability Factor to 0.82 for tailgate loading conditions, and no longer meets the NIOSH recommended value. The Accident Investigation team's analysis indicated that in order for the gateroad design to meet the NIOSH recommended Pillar Stability Factor of 1.13, the pillars would have to be increased to 125-foot crosscut and entry centers, compared to the current 100-foot crosscut and 95- to 105-foot entry centers.

Although the gateroads were subjected only to headgate loading conditions, an AMSS analysis conducted by the Accident Investigation team indicates that it should have been apparent that the gateroad design was not robust enough to meet the recommended stability factors beneath the deepest overburden in combination with Powellton gateroad crossings. The Accident Investigation team represented the Powellton gateroad crossings as remnant pillars 160 feet wide, surrounded by adjacent longwall gob 620 feet in width that, at 1,290 feet of overburden, resulted in pillar stability factors under headgate loading conditions of only 0.93 (0.52 for tailgate loading conditions, which were not encountered). This not only does not meet the NIOSH recommended value of 1.13, but generates a “condition yellow” warning (“A major interaction should be considered likely unless a pattern of supplemental roof support such as cable bolts or equivalent is installed; rib instability is also likely”) for development, and a “condition red” warning (“A major interaction should be considered likely even if a pattern of supplemental roof support is installed; it may be desirable to avoid the area entirely”) for tailgate loading. In the vicinity of Crosscut 45, the 1 North Panel Headgate passed beneath an 80-foot barrier between two room-and-pillar sections, at 1,260 feet of overburden. The AMSS calculated Pillar Stability Factor for the headgate is only 0.93 following the interpretation that the pillars in the Powellton Seam are no longer carrying load, either due to floor softening from water or undersized pillars that have crushed out or were retreat mined. The value of 0.93 does not meet the NIOSH recommended value of 1.13.

It was recorded in inspector's notes and documented by witness testimony that a water inundation occurred on the 1 North Panel on November 16, 2009, which forced the panel to be shut down for nearly two weeks while water was pumped out, due to the restrictive effect on the ventilation system between the longwall face and the Bandytown fan. Based on review of mine maps, the longwall was between 1 North Headgate Crosscuts 61 to 52 during that period, with the face located at Crosscut 55 in mid-November. This area is significant in that it occurs beneath the transition in the overlying Powellton Seam from a series of longwall panels to room-and-pillar workings, separated by a 220-foot wide barrier. At best, the transition represents a gob/solid boundary and, if the room-and-pillar workings were retreat mined or if floor softening allowed pillar punch, at worst represents a wide barrier between two gobs. Overburden in this area is up to 1,180 feet. Thus, it is plausible that differential subsidence above the 1 North Panel occurred beneath the barrier, causing joints or fractures to increase their aperture sufficiently to allow communication between the Eagle and Powellton seams.

1 North Panel Tailgate

The 1 North Panel tailgate was developed using five entries, utilizing 100-foot crosscut and 80-foot entry center spacing, resulting in 80 x 60-foot rectangular pillars. It should be noted that because the 1 North Panel was the first panel in the new longwall district, the tailgate would never be subjected to tailgate loading, and instead would be subjected to only headgate loading conditions. However, according to witness testimony and review of the 2008 Annual Ventilation Map, dated 1/15/2009, what became the 1 North Panel tailgate was originally developed as a 7-entry submains configuration, a non-standard gateroad design, although mine management subsequently elected to use this configuration as a longwall tailgate when the longwall equipment was forced to return earlier than expected from the Logan's Fork Mine due to encountering adverse geologic conditions (cutting sandstone roof). The 7-entry submains configuration began to be developed from the Glory Hole Mains in January 2008 and continued until October 2008 when the two left-hand entries were dropped, continuing as a 5-entry submains configuration by December 2008. Stability analysis using AMSS indicates that beneath the remnant pillar configuration of overlying Powellton Seam gateroads flanked by 620-foot wide longwall gobs, at depths approaching 1,200 feet such as was encountered during the November 2009 water inundation, the 1 North Panel 5-entry tailgate is characterized by a Pillar Stability Factor of only 0.95, which does not meet the NIOSH recommended value of 1.13. At the longwall face position at the time of the April 5, 2010 explosion, the Pillar Stability Factor of 1.11 was slightly less than the recommended value of 1.13, with the tailgate beneath 970 feet of overburden and a remnant pillar configuration in the overlying Powellton Seam. If the 1 North Tailgate had remained a submains, and not been subjected to longwall loading conditions, the pillar stability factors would have exceeded the values recommended by NIOSH even when subjected to the worst combination of overburden depth and multiple seam interaction.

22 Headgate

Following mining of the 1 North Panel Headgate, the 22 Headgate was developed toward the west under similar conditions of overburden and multiple seam interaction. However, pillar sizes were increased to 120-foot crosscut and entry centers, while the panel face was decreased to 890 feet due to having to drive a parallel "new 22 Tailgate" following failure of the 1 North Headgate. Because the gateroads would only be subjected to headgate loading, the larger pillars would be expected to offer better stability than the 1 North Panel gateroads, represented by a Pillar Stability Factor of 1.47 even assuming a gob/solid boundary in the overlying Powellton Seam. If the boundary is represented as a remnant pillar flanked by gob, the Pillar Stability Factor for headgate loading conditions is reduced to 1.30, which still exceeds the NIOSH recommended value of 1.13 but is lower than the 1.35 required by the company's P-2 Guidelines (Section II, Page 4).

<u>22 Tailgate</u>

Following deterioration of the 1 North Headgate when subjected only to headgate loading conditions, CMS&H District 4 required the mine to drive a new gateroad to serve as the tailgate for the proposed 22 Panel. The 'new TG 22' was begun parallel to the 1 North Headgate, separated by an 80-foot barrier and reducing the proposed 22 Panel from 1,000 feet in width to only 890 feet in width. In order to eliminate side abutment stress from the 1 North Panel, the barrier would have to have been 335 feet wide, a distance defined by 9.3 times the square root of the 1,300-foot overburden. The use of the wider barrier is justified because the adjacent 1 North Panel headgate was in failure and would have offered little or no protection from side abutment stress. The 'new TG 22' utilizes the same pillar size as the failed 1 North Headgate, represented by 100-foot crosscut centers with 95-foot centers from the #1 to #2 entry, and 105-foot centers from the #2 to #3 entry. Therefore, the result in terms of stability should not have been expected to be different from that experienced on the 1 North Headgate, although the narrower panel width would be expected to improve stability. Beneath the greatest overburden of 1,300 feet, between Crosscuts 75-80, which coincides with a Powellton gateroad crossing, the Pillar Stability Factor for headgate loading conditions is only 0.93, which does not meet the NIOSH recommended value. Thus, it can be concluded that despite driving a new tailgate for the 22 Panel, the design was not modified in any way, and should have still been expected to allow degraded ground conditions in the anticipated high cover and multiple seam conditions.

APPENDIX AJ

OPERATION OF THE MINECOM UHF LEAKY FEEDER SYSTEM, PYOTT-BOONE TRACKING, AND PYOTT-BOONE CARBON MONOXIDE MONITORING SYSTEM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
TECHNICAL SUPPORT

INVESTIGATIVE REPORT

Operation of the Minecom UHF Leaky Feeder System, Pyott-Boone Tracking, and Pyott-Boone Carbon Monoxide Monitoring System at Performance Coal Company

Upper Big Branch Mine-South (MSHA ID 46-08436)
Montcoal (Raleigh County), WV

April 5, 2010

PAR 98747

Prepared By:
Juliette Hill, Mining Engineer

November 04, 2011

-Originating Office-
Approval and Certification Center
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1 ABSTRACT

The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted an investigation related to the post-accident communications and tracking system and the carbon monoxide monitoring system installed in the Upper Big Branch Mine (UBB) prior to the explosion on April 5, 2010. The investigation included:

A. The operation of the leaky feeder, tracking, and carbon monoxide (CO) monitoring systems in place at the UBB mine prior to the explosion, including an issue with a fuse in the leaky feeder amplifier circuit; and
B. An estimation of the time interval between the explosion and the time the CO monitoring system indicated a problem. Additionally, data was collected to apply a correction of the clock on the computer in use at UBB to GPS time.

The communications and tracking systems consisted of a MineCom Model MCA 2000 UHF leaky feeder system and Pyott-Boone Model Tracker Boss tracking system. Tracking data was displayed by the MineBoss software package. These systems were not fully installed according to UBB's approved Emergency Response Plan (ERP) at the time of the explosion. Of the 48 readers displayed on the tracking map within MineBoss, the histories of only 21 of them indicate they were operational on April 5, 2010. Some tags were not assigned to an individual in the database, so unless the mine maintained a list outside the electronic tracking system, the miners associated with these tags were not tracked.

After the explosion, only the readers nearest the North and South portals remained operational. The system layout did not take advantage of installing an additional Head End Unit at the existing Ellis Portal. This would have provided more redundancy in the systems and might have allowed additional portions of the communication and tracking system to remain operational after the explosion. Data available indicates that the portions of the post-accident communications and tracking systems that were in use at UBB prior to the explosion were not maintained in a serviceable manner.

The event log indicates that several components of the CO monitoring system were in a fluctuating status prior to the explosion on April 5, 2010, and that the entire CO monitoring system was disabled as a result of the explosion. It cannot be determined from the event log whether the entire system was rendered inoperable immediately after the explosion, or whether portions of the system lost functionality over time, because all components did not report or communicate their status in the event log at the same time.

Pyott-Boone Electronics (Pyott-Boone) has addressed the leaky feeder system amplifiers with opened fuses in the field. Pyott-Boone subsequently modified the Model 1950 barrier to the Model 1950A barrier so that the modified barrier reduces

the susceptibility of the fuse in the amplifier. Minecom has submitted a design change to their approval to address the susceptible fuse in the amplifier.

Calculations based upon data within the configuration of MineBoss indicate that the event that interrupted communications between CO monitor 88 and the monitoring and control system (MCS) computer occurred approximately 1 minute 48 seconds prior to 15:08:01. Given the location of CO monitor 88, that event is assumed to be the explosion that occurred on April 5, 2010.

The time estimate between the event that initiated the COMMUNICATIONS DEAD status of CO Monitor 88 and its record into the event log can be applied to the PC clock to obtain a corrected time with respect to the GPS clock. Applying the 1 minute 48 second interval to the corrected CO Monitor 88 COMMUNICATIONS DEAD status time, using data taken in April 2010, indicates the event that initiated the status reached CO Monitor 88 at 15:00:31 on April 5, 2010. Applying the 1 minute 48 second time to the corrected CO Monitor 88 COMMUNICATIONS DEAD status time, using data taken between August and September 2011, shows that the event that initiated the status reached CO Monitor 88 at 15:00:28 on April 5, 2010.

The data collected in April 2010 (prior to the PC's removal from the mine) is believed to be more reliable than the data collected after the PC was returned to the mine. However, the maintenance of the tracking system (refer to §2.8), unknown scanning priority at the time of the explosion (refer to §3.4.3), the approximations of the CO monitoring system specifications (refer to §3.4.5), and the unknown status of the actual PC (refer to §3.5.3) combine to introduce uncertainty in both the time estimate between the explosion and the status change of CO Monitor 88 in the event log, and the time difference calculated between the PC clock and reference time. Additionally, time drift analyses based on other equipment recovered from the mine (the DVR and multi-gas detectors) indicate the explosion occurred at approximately 3:02 pm on April 5, 2010. Based on the maintenance, configuration, and conditions of the MineBoss PC and in comparison with other time calculations, both corrected times of 15:00:31 and 15:00:28 are not being considered accurate estimates.

Information presented in this report is based upon data obtained from an electronic copy of the event log database of the system in use at UBB from September 2009 to April 2010. This report also includes information received from the UBB accident investigation team.

2 THE OPERATION OF THE LEAKY FEEDER, TRACKING, AND CO MONITORING SYSTEMS IN PLACE AT THE UBB MINE PRIOR TO THE EXPLOSION.

2.1. **Communications System**. The post-accident communications system approved in UBB's ERP is an ultra high frequency (UHF) leaky feeder system manufactured by Minecom. The Model MCA 2000 UHF Leaky Feeder System holds MSHA approval 23-A090001-0 and operates at a frequency of approximately 450 MHz. The Minecom leaky feeder system is comprised of the following components:

Head End Unit (4 input)
HEB1 barriers
UMLAD-BAT UHF in-line amplifiers
VBU1 and VBU2 splitters
VPC power couplers
VTB cable termination
VJB in-line connector/splice
Radiating (leaky feeder) cable
Pyott-Boone Model 1925 24 V_{dc} power supplies
Pyott-Boone Model 1950 power barriers
Pyott-Boone Model 1955 amplifier
Battery backup (12 V lead-acid gel cell)

The leaky feeder communication system is a distributed antenna system that provides two-way voice communications throughout the mine and to the surface. Radio frequency is transmitted to and radiates from the coaxial (leaky feeder) cable distributed in the mine from the Head End Unit installed at the surface. UMLAD-BAT UHF in-line amplifiers placed at regular intervals along the coaxial cable periodically boost the signal. When within range of the leaky feeder system, miners use separately approved, portable UHF radios to communicate throughout the mine and with the surface. In their ERP, UBB calls out Motorola HT750 radios, MSHA approval number 23-A080007-0, for use with the Minecom leaky feeder system.

The leaky feeder system is intrinsically safe when operated on standby power. Equipment that may be operated in permissible areas is segregated by HEB1 barriers and VPC power couplers. The Pyott-Boone Model 1955 amplifier battery backup is rated to provide 96 hours of standby power.

2.2. **Tracking System**. The post-accident tracking system approved in UBB's ERP is a radio frequency identification (RFID) system manufactured by Pyott-Boone. The Model Tracker Boss Tagging System holds MSHA approval 23-A090011-0. The Pyott-Boone tracking system is comprised of the following components:

Model 1981 UHF Tag Readers with antennas
Model 1925 120VAC/24VDC Power Supplies
Minecom HEB1 barriers
Model 1980 RFID Tracking Tags (MSHA Approval No. 23-A080004-0)

Readers are placed throughout the mine at known locations, so tags within range of a particular reader are associated with that location. Antennas may be extended to permissible areas when segregated by HEB1 barriers. Readers collect location data from tracking tags in the 900 MHz frequency band. The readers transmit the location data over the leaky feeder system, but there is no electrical connection between the two systems. The tracking data uses the leaky feeder system as a backbone to get the data to the surface, which then interfaces with the computer and associated hardware and software.

The tracking system is intrinsically safe when operated on standby power. The lead-acid gel cell battery housed in the reader is rated to supply 96 hours of standby power. The total duration depends upon how much activity the reader is exposed to while operating under battery power, but the condition and state of charge of the battery when line power is removed also affects the operation.

2.3. **MineBoss**. Pyott-Boone provides the MineBoss software package (MineBoss) at the monitoring and control system (MCS) computer at the surface to interface with various systems in use at a mine. MineBoss provides event driven data logging (an event log) that monitors the systems integrated into the mine. At the time of the explosion, the systems at UBB monitored by MineBoss included the CO monitoring, belt monitoring, and tracking systems, which are all manufactured by Pyott-Boone.

The MineBoss event log records events with the CO monitoring system such as the status of communications, warnings, calibrations, the status of uninterrupted power supplies, alarms, etc. Belt starts and stops are monitored in the Belt Boss system. With respect to the tracking system, MineBoss records events such as a reader coming online or offline, and advisories and panics associated with tags in the event log. However, the event log does not record a tag's reception at a reader. Each reader maintains an individual history in the MineBoss report database which may be accessed via report functions.

In addition to the event log for each of the systems, MineBoss provides maps for the systems it monitors. The respective system components are displayed along representations of the conveyor belts installed throughout the mine. The readers' histories and other data can be accessed from the tracking map screen by clicking on the reader icons. Similar to the tracking map, the CO monitor icons can be clicked for information as well. There are also buttons on the mapping displays for navigating to other screens within MineBoss.

Information presented in this report is based upon data obtained from an electronic copy of the MineBoss software and event log database of the system in use at UBB from September 2009 to April 2010.

2.4. **Communications and Tracking Systems**. The leaky feeder communication system is a distributed antenna with amplifiers placed periodically to boost the RF signal. The system is provided with standby power in the event that line power is disrupted. The tracking system is comprised of readers placed throughout the mine; each reader has a standby power source as well. Although there is no electrical connection between the communications and tracking systems, the readers use the leaky feeder as the backbone to send location data to the MCS. So even though there is no connection between the two systems, the performance of the tracking system is entirely dependent upon the operation of the leaky feeder communications system. Pyott-Boone representatives state the readers could continue to function (store location data) if the leaky feeder system ceased functioning. However, the tracking data collected during this time would be lost if the leaky feeder system were not restored to service before the standby power of the readers was depleted.

2.5. **Installation of the Communication and Tracking Systems**. The Minecom leaky feeder and Pyott-Boone tracking systems were not completely installed according to UBB's approved ERP on April 5, 2010.

2.5.1. The accident investigation team reported that leaky feeder cable was attached to each of the four inputs of the Head End Unit. The inputs were labeled: North Track, North Intake, South Track, and South Intake. With some exceptions, the post-accident communications and tracking systems were not yet installed on the working sections to provide the coverage as described in Appendices A and B of the mine's approved ERP.

2.5.2. The accident investigation team reported that the leaky feeder was installed 12 crosscuts outby Headgate 22 in the primary and secondary escapeways. The leaky feeder went up to the stageloader on the longwall (just outby the face) in the secondary escapeway and up to the mule train in the primary escapeway. Additionally, the leaky feeder extended to the mouth of the Tailgate 22 area.

2.5.3. No readers were installed on working sections. The accident investigation team reported that the tracking system stopped at the mouth of Headgate 1 north of the current longwall face.

2.5.4. Aside from the two different areas of the mine (North and South), it is not known which branch of the leaky feeder system (track or intake) with which the readers were associated.

2.6. **Operation of the Communication and Tracking Systems Prior to the Explosion**. Between January 1, 2010, and April 10, 2010, the MineBoss database shows that 251 tags were tracked underground. Many of the tracking tags detected within the system did not have names associated with them in the database. The tracking system was configured such that readers at the North, South, and Ellis portals could read tags that were on the surface. The result is the all 251 tags may not have gone underground at UBB between January 1, 2010, and April 10, 2010. Refer to the Appendix for a listing of these tags.

2.6.1. One hundred eighteen (118) tags were detected by the tracking system on April 5, 2010. As stated previously, this may include tags that were near portals but did not go underground on April 5, 2010. Refer to the Appendix for a listing of these tags.

2.6.2. The event log lists 58 readers at the time of the explosion. The 18 readers on the bottom left corner of the tracking map described as spares are <u>not</u> included in this count. There are 50 readers displayed on the tracking map. **The following**

information is reported assuming that the readers displayed on the tracking map were located accordingly underground. The 58 readers are comprised of:

- Two of the readers on the tracking map (111 & 112) were designated as test readers and as such are not part of the tracking system installation.
- Forty-eight (48) of the 50 readers displayed on the tracking map comprise the electronic tracking system throughout the mine.
- The remaining eight (8) readers are listed in the event log but are <u>not</u> displayed on the tracking map.
    - Four of these readers (34, 59, 67, and 96) have histories in the report database, although the latest date any of these four readers reported a tag is March 23, 2010. There is no indication of where these readers may have been located underground. It is not known if any of them were intended as part of the tracking system installation.
    - The other four readers (35, 48, 57, and 80) listed in the event log but not displayed on the tracking map are not listed in the report database. A reader that is not listed in the report database would not have a tracking history. It is likely that these readers were not linked to the report database, although it is now known if they were ever linked or when the link to the database may have been disconnected. While these four readers may have been reading tags and even reporting location data to the surface, no tracking data was available in the report database from these readers. As such, they are considered inoperable.

2.6.3. The tracking map display in MineBoss shows 48 readers positioned along the conveyor belts. Map 1 in Appendix A shows the layout of the tracking system in use at UBB at the time of the explosion. Table 1 sorts the readers by the last date a tag was read, as indicated by the individual reader histories.

Table 1 Reader Operability as Indicated by Reader History

Readers Not Operating on April 5, 2010				*Readers Operating on April 5, 2010*			
	reader ID	**location description in MineBoss**	**last date a tag was read**		**reader ID**	**location description in MineBoss**	**last date a tag was read**
1	**3.44**	4 Brk on East Mains Track	02/27/10		**3.18**	5 North Belt Starter	04/05/10
2	**3.98**	East Mains Punchout	02/27/10		**3.20**	52 Brk Track	04/05/10
3	**3.79**		03/17/10		**3.30**		04/05/10
4	**3.26**	22Brk on Track	03/18/10		**3.32**	64 Brk Intake	04/05/10
5	**3.17**	25 Brk In 4 Sect Intake	03/22/10		**3.5**	76 Brk on Track	04/05/10
6	**3.50**	24 Brk In 3 Sect Intake	03/22/10		**3.56**		04/05/10
7	**3.45**	2 BRK on 4 Section Track	03/24/10		**3.58**	31 Brk on North Track	04/05/10
8	**3.74**	2 Section Intake Split	03/24/10		**3.62**	58 Brk on track	04/05/10
9	**3.94**	Ellis Punchout Intake	03/24/10		**3.70**	62 Brk on track	04/05/10
10	**3.15**		03/25/10		**3.72**	3 brks inby ellis switch	04/05/10
11	**3.53**	4 Brk South Track	03/25/10		**3.75**	6 North Starter Box	04/05/10
12	**3.97**	13Brk East Mains Track	03/25/10		**3.76**	2 Brk on 4 section track	04/05/10
13	**3.22**	Ellis Switch	03/29/10		**3.82**	83 Brk on Track	04/05/10
14	**3.37**	3Section 1 Head Starter	03/31/10		**3.92**	Ellis Punchout Track	04/05/10
15	**3.65**	3 Brk on 3 Section Track	03/31/10		**3.99**	2Brks Outby Switch Ellis	04/05/10
16	**3.10**	100 Brk Intake	04/01/10		**3.43**	3 Brk Intake	04/06/10
17	**3.16**	60 Brk Intake	04/01/10		**3.9**	North Fan	04/06/10
18	**3.54**	2Brks Inby Intake Split	04/01/10		**3.1**	North Track Portal	04/10/10
19	**3.66**	49 Brk Intake	04/01/10		**3.11**	11Brk on North Track	04/10/10
20	**3.23**	Ellis Intake Split	04/03/10		**3.47**	3 Brk on North Track	04/10/10
21	**3.55**	83 Brk Intake	04/03/10		**3.87**	South Track Portal	04/10/10
22	**3.90**	Ellis Intake Split UBB Side	04/03/10				
23	**3.19**	1 Brk Inby 2 Section 1 Head	no history				
24	**3.25**	20 Brk In Intake	no history				
25	**3.71**	100 Brk Track	no history				
26	**3.8**	South Fan	no history				
27	**3.83**	4 Brk South Intake	no history				

- Twenty-one (21) of the readers were operational on April 5, 2010 as indicated by tags reported in their tracking histories. This indicates that the leaky feeder system was operational in these areas of the mine and outby to the head end because the tracking system uses the leaky feeder system as a backbone to transmit location data to the surface.
- Searches of the report database within MineBoss indicate that 27 of the 48 readers on the tracking map did not read a tag on April 5, 2010. This could indicate that no tags were within range of any of these readers on April 5, 2010. However, this is viewed as unlikely for many of these readers because as shown in the table, the tracking histories indicate that it was at least two days and in many cases several weeks since the last time a tag was read. If system(s) or components were inoperable, this could result from either problems with the individual readers or with the leaky feeder system (either the track or intake branches in each of the North and South areas of the mine). Reader 30 is shown as the most inby reader on the tracking map and was operational on April 5, 2010. This indicates that at least one branch of the leaky feeder system was operational as far inby as the longwall section in the North area of the mine.

- Five (5) of the 27 readers determined inoperable on April 5, 2010 (8, 19, 25, 71, 83) but displayed on the tracking map had no tracking history available in MineBoss. Similar to readers 35, 48, 57, and 80 above, these five readers do not appear linked to the report database and are therefore considered inoperable.

2.6.4. In the South area of the mine, only reader 87 described as South Track Portal reports a tracking history up to and after April 5, 2010. The latest date any of the other 12 readers shown on the tracking map in the South area of the mine is March 25, 2010 by readers 15, 53, and 97. Given that reader 87 was located near a portal, it would not be as susceptible to issues that might interfere with its operation as readers installed in more inby areas of the mine. Other than reader 87, the 12 readers displayed on the tracking map in the South area of the mine last report histories between 02/27/10 to 03/25/10. While it can be assumed that the leaky feeder system was operational until 02/27/10 in the South area of the mine, there is no indication in the MineBoss database whether the readers stopped reporting location data due to problems with the readers themselves, or if the leaky feeder system for this entire area of the mine inby reader 87 ceased functioning on or after 03/25/10.

2.6.5. Reader 1 (North Track Portal) detected a panic button pressed on Tag 176 twice at 06:55 on April 5, 2010. Tag 176 did not have a name assigned to it in the tag database. Tag 176 was tracked at Reader 1 twice at 06:55:27. Tag 176 was cleared in the event log at 07:46:40.

2.6.6. In the days immediately prior to the explosion, Reader 82 described as 83 Brk on track came ALIVE and went DEAD repeatedly in the event log. Readers report as ALIVE when first picked up by a starting master station, or when beginning communications with the master station after the leaky feeder was repaired. Conversely, readers report DEAD when communications with the master station is disrupted. The status of reader 82 changed sometimes over the span of a couple of hours on a particular day (April 4, 2010), and sometimes throughout the duration of a day (April 1, 2010). The event log shows this continued in the early morning hours until 14:54:42 on April 5, 2010. Reader 82 did report location data for tags during this time.

2.7. **Operation of the Communication and Tracking Systems After the Explosion**. The explosion at UBB occurred shortly after 3:00 pm on April 5, 2010.

2.7.1. According to the MineBoss clock, between 15:11:14 and 15:11:44 on April 5, 2010, 14 readers reported as DEAD in the event log. Three more readers reported as DEAD between 16:35:25 and 16:35:56. A total of 17 readers reported as DEAD in the event log shortly after the explosion.

2.7.2. The following six readers continued to report location data after the explosion on April 5, 2010: 1; 11; 43; 47; 87; and 9. The tracking map indicates that these readers are all located at or near a mine portal. (Note: The first location data reported by reader 9 on April 5, 2010 was at 15:49:45. Prior to the explosion on April 5, 2010, reader 9 last reported location data on April 1, 2010.) MAP 2 in Appendix A shows the status of the readers after the explosion on April 5, 2010 by the event log.

2.7.3. Between 19:02:49 and 19:05:52, 57 of the 58 readers in the event log came ONLINE. Readers are reported as ONLINE as a result of user configuration changes at the master station at the surface. Eight of the readers reporting as coming ONLINE at this time are not shown on the MineBoss tracking map. These are the same eight readers described previously as listed in the event log but not displayed on the tracking map. Two readers that came ONLINE are the test readers 111 and 112. The remaining 47 readers that came ONLINE are displayed on the tracking system map.

2.7.4. Reader 99 described as 2Brks Outby Ellis Switch did not report ONLINE in the event log with the other 57 readers beginning at 19:02:49 on April 5, 2010. Reader 99 was in the report database and reported location data in the days before and up to 14:51:30 on April 5, 2010 as indicated by its reader history. The only status reported in the event log for Reader 99 on April 5, 2010 was DEAD with the other 16 readers shortly after the explosion at 15:11:36.

2.7.5. There is no activity in the event log tracking system between 16:35:56 and 19:02:49. The accident investigation team indicated that around this time on April 5, 2010 representatives of Pyott-Boone on site at UBB offered their assistance in monitoring the MineBoss system.

2.7.6. Between 19:02:50 and 19:04:40 on April 5, 2010, six readers (1, 9, 11, 43, 47, and 87) came ALIVE in the event log. As stated earlier, readers report as ALIVE when first picked up by a starting master station, or when beginning communications with the master station after the leaky feeder was repaired. The six readers that came ALIVE are located at or near a portal and are the same six readers that continued to operate after the explosion.

2.7.7. At 21:50:45 and 21:50:51 on April 5, 2010, Reader 87 (South Track Portal) reported in the event log that Tag 701 pressed PANIC. Tag 701 is assigned to Jim Bowyer in the MineBoss database. After the two PANIC reports, the only other listing in the event log for Reader 87 is that it reported DEAD at 19:09:42 on 04/10/10. Tag 701 was last tracked at 23:43:35 on April 5, 2010 at Reader 87. Since Reader 87 is located near a portal, it is unknown if Tag 701 was actually underground at the time the PANIC alarms were initiated.

2.8. **CONCLUSION**. When compared with each other prior to the explosion, the event log and the tracking map within MineBoss indicate inconsistencies in the electronic tracking system at UBB. Some readers included on the tracking map were not operational on April 5, 2010, and some readers in the report database were not on the tracking map and vice versa. Some tags were not assigned to an individual in the database, so unless the mine maintained a list outside the electronic tracking system, the miners associated with these unassigned tags were not tracked. Of the 48 readers displayed on the tracking map within MineBoss, the histories of only 21 of them indicate they were operational on April 5, 2010. This resulted in gaps in the coverage of the electronic tracking system, the largest being the entire South area of the mine inby Reader 87. After the explosion, only the readers nearest the North and South portals remained operational. The system layout did not take advantage of installing an additional Head End Unit at the existing Ellis Portal. This would have provided more redundancy in the systems and might have allowed additional portions of the communication and tracking system to remain operational after the explosion. Data available from MineBoss indicates that the portions of the post-accident communications and tracking systems that were in use at UBB prior to the explosion were not maintained in a serviceable manner.

2.9. DESCRIPTION OF FUSE ISSUE WITH LEAKY FEEDER LINE AMPLIFIERS

2.9.1. As previously described, the leaky feeder communication system is a distributed antenna with amplifiers placed periodically to boost the RF signal. The leaky feeder system has standby power supplied by batteries which are charged during normal operation. When line power is interrupted, the leaky feeder system continues to operate using the standby power source, which is the Pyott-Boone Model 1955 12 volt lead-acid Line Amplifier Battery Backup (1955 battery). Although the standby power source for the tracking system is a battery housed within each reader enclosure, the operation of the tracking system during loss of line power is also dependent upon the standby power source for the leaky feeder system because the tracking data is transmitted to the surface over the leaky feeder system.

2.9.2. Each amplifier in the leaky feeder system has its own 1955 battery backup unit. Amplifiers receive power over the leaky feeder cable from power couplers which are in line with a power supply. The 1955 battery is charged from DC voltage that travels over the leaky feeder cable, through the amplifier circuit, and through the four conductor cable to the 1955 battery charge circuit as shown in Figure 1.

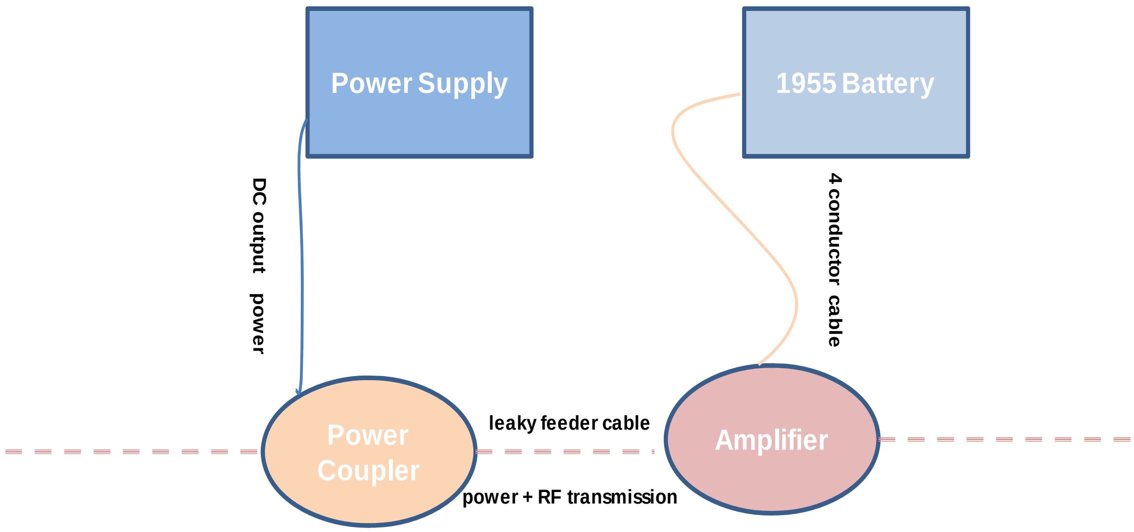

Figure 1 Sketch of Part of the Power Path for the Leaky Feeder System

2.9.3. The amplifier circuit includes a non-replaceable (soldered to the printed circuit board) fuse. Reports from field installations indicate that this fuse is susceptible to opening, reportedly due to voltage spikes from the line power source. Even when a 1955 battery is fully charged, an open fuse renders the amplifier inoperable, so communications inby the inoperable amplifier are severed. Although the operation of the tracking readers would be unaffected by the open fuse in the amplifier because they could continue to function on their own standby power source, they would not be able to transmit tracking data to the surface because the open fuse in the amplifier disrupts the operation of the leaky feeder system.

2.9.4. As stated previously, the open fuse in the amplifier renders it inoperable. As a result, communications via the leaky feeder system inby any amplifier with an open fuse is disrupted. This also results in an interruption of the electronic tracking system, because the tracking system uses the leaky feeder as a backbone to transmit tracking data to the surface. It was noted in a previous section of this report that there were areas of the mine where the tracking system was shown as installed but MineBoss did not have tracking data for weeks prior to the accident. As reported by members of the accident investigation team, efforts to reinstall the communications and tracking system after the accident indicate that open fuses in amplifiers interfered with the performance of the electronic tracking system.

2.9.5. The problem of the fuse being susceptible to voltage fluctuations was recognized soon after the approval for the leaky feeder system was issued. The A&CC subsequently received questions from mine operators who wanted to be able to replace the fuse themselves. However, the design of the amplifier required that the fuse be replaced by the manufacturer only. An alternative solution to the problem might be to replace the amplifier, but some operators report this to be burdensome for several reasons: the occurrence of the fuses opening is frequent; and, replacing the amplifier requires keeping a significant amount of inventory on hand.

2.9.6. **CONCLUSION**. Pyott-Boone, as Minecom's distributor, has addressed the amplifiers with opened fuses in the field. Pyott-Boone modified the Model 1950 barrier to the Model 1950A barrier. The design of the modified barrier reduces the susceptibility of the fuse in the amplifier. Minecom has submitted a design change to their approval to address this issue.

3 OPERATION OF THE CO MONITORING SYSTEM.

3.1. **Operation of the CO Monitoring System Prior to the Explosion**.

3.1.1. The MineBoss Station 1 Scanner in the CO monitoring system lists 126 components as online in the system. This includes 18 components for the belt boss system.

3.1.2. In the 24 hours prior to the explosion on April 5, 2010, there were several dozen entries to the event log for six components within the CO monitoring system at UBB. **The following information is reported assuming that the components of the CO monitoring system displayed on the CO monitoring map in MineBoss were located accordingly underground.**

3.1.3. Component 21 described as Eastmains UPS GAINED COMMUNICATIONS and reported DEAD COMMUNICATIONS. GAINED COMMUNICATIONS indicates that the component is communicating with the master station. DEAD COMMUNICATIONS indicates that communication between the master station at the surface and the component is disrupted.

3.1.4. CO Monitor 26 described as Ellis #4 Tail reported several warnings, alarms, relaunches, etc. for CO. The warnings indicate a CO concentration that ranged up to 28 ppm.

3.1.5. CO Monitor 45 described as 500 From Face GAINED COMMUNICATIONS and reported DEAD COMMUNICATIONS over three dozen times.

3.1.6. CO Monitor 63 described as BLUE OUT had several status changes, some of which were: alarm relaunched (0 ppm); alarm latch set (0 ppm); warning latch set (0 ppm); alarm latch resets (0 ppm); warning latch reset (0 ppm); and maximum CO value obtained during alarm condition was (0 ppm).

3.1.7. Component 71 described as SMART REMOTE ELLIS 5 HEAD reported CO Monoxide Warning (4, 5, and 6 ppm); CO Monoxide Warning CLEARED (3 and 4 ppm); and Warning Latch Set and Reset over 2 dozen times.

3.1.8. Component 100 described as Analog Scanner had several status changes related to remote switch, winch, gob switch, fire, AC power, and sequence.

3.1.9. The last record in the CO monitoring system event log prior to 3:00 pm on April 5, 2010 is for CO Monitor 71 “Carbon Monoxide Warning CLEARED (4 ppm),” which was reported at 14:46:21.

3.1.10. The map in Mineboss for the CO monitoring system consists of 70 components (CO monitors, UPSes, a test CO monitor, etc.) configured along representations of the conveyor belts.

3.2. **Operation of the CO Monitoring System After the Explosion**.

3.2.1. CO monitor 88 reported COMMUNICATIONS DEAD at 15:08:01 on April 5, 2010. Fifty-one (51) other components of the CO monitoring system reported COMMUNICATIONS DEAD between 15:08:01 and 15:25:59. Forty-nine (49) of the 52 components were displayed on the CO map in MineBoss. MAP 3 in Appendix A shows the status of the CO monitoring system after the explosion on April 5, 2010 as indicated by the event log.

3.2.2. CO Monitor 118 described as 5 North at Flow Thru reported an alarm of 105 ppm at 15:11:58. In addition to CO Monitor 118, seven other CO monitors alarmed with high concentrations of CO between 15:12:29 and 15:12:49 (77; 82; 83; 84; 85; 86; and 120). These eight CO monitors alarmed and relaunched alarms more than two dozen times from 15:11:58 to 17:56:42.

3.2.3. There is no activity in the event log for the CO monitoring system between 17:56:42 and 19:02:52. As stated previously, the accident investigation team indicated that at this time on April 5, 2010, representatives of Pyott-Boone on site at UBB offered their assistance and began monitoring the MineBoss system.

3.2.4. The event log indicates that 69 CO monitors reported COMMUNICATIONS DEAD status between 19:03:25 and 22:01:05 on April 5, 2010. During this time, the Component 21 Eastmains UPS indicated an ALARM status.

3.2.5. Several CO monitors, including two monitors that are displayed on the CO map in the North area of the mine (41 and 96), did not report COMMUNICATIONS DEAD with the other 52 components of the system before 15:25:59. However, the event log indicates that the components in the entire CO monitor system reported COMMUNICATIONS DEAD by 22:01:05 on April 5, 2010.

3.3. **CONCLUSION.** The event log indicates that several components of the CO monitoring system were in a fluctuating status prior to the explosion on April 5, 2010. After the explosion, the continuously relaunching CO monitors and the absence of information from the CO system that appeared to remain operational indicate problems with the operation of the system. After the assistance from representatives of Pyott-Boone, the event log indicates that the CO monitoring system was disabled in the entire North area of the mine and then throughout the entire mine as a result of the explosion. It cannot be determined from the event log whether the entire system was rendered inoperable immediately after the explosion, or whether portions of the system lost functionality over time, because all components did not report or communicate their status in the event log at the same time.

3.4. **Estimation of the time interval leading to the "COMMUNICATIONS DEAD" status of CO Monitor 88 at 15:08:01 in the event log**.

3.4.1. The event log generated by the MineBoss software indicates that CO Monitor 88 reported COMMUNICATIONS DEAD at 15:08:01 on April 5, 2010. Given the layout of the CO monitors in place at UBB and the extent of the area affected by the explosion, an assumption can be made that this was the first CO monitor to successfully communicate an event to the event log as a consequence of the explosion. Based on that assumption and with the assistance of representatives from Pyott-Boone, an estimate of the time between the events that initiated the COMMUNICATIONS DEAD status of CO Monitor 88 and its record into the event log can be calculated. The following is an estimation of the time required by MineBoss to report the status of CO Monitor 88 as COMMUNICATIONS DEAD at 15:08:01 on April 5, 2010after the event that caused the COMMUNICATIONS DEAD status.

3.4.2. MineBoss indicates that 126 units were online for the MineBoss Station 1 Scanner in the Pyott-Boone CO Monitoring System. (The Station 1 Scanner is the scanner within MineBoss used for the CO monitoring system.) The system scans components based on an election scheme that takes multiple variables into account to develop a priority scanning profile, in addition to parameters that are configured within MineBoss at the MCS. Some of these variables are alarms, successful prior communications, unsuccessful prior communications, the number of screens open in MineBoss at a time, etc. As a result, the scanning profile constantly changes.

3.4.3. MineBoss does not offer information on the scanning priority present in the system prior to the explosion. However, the time between an event that interrupts a component's communications and the time that COMMUNICATIONS DEAD is recorded in the event log can be estimated based on the configuration of the system and data obtained from the event log.

3.4.4. The event log indicates that 52 components within the CO monitoring system recorded a COMMUNICATIONS DEAD status in the event log beginning at 15:08:01 on April 5, 2010. Using this data and an approximation of the specifications of the system as configured at UBB, the calculations in Table 2 estimate that approximately 1 minute and 48 seconds elapsed between the event that stopped communications with CO Monitor 88 and the resulting COMMUNICATIONS DEAD status that was recorded in the event log.

Table 2 Calculation of Elapsed Time

Description	Time, s
time required for a successful communication	0.141
total time for 74 successful communications	**10.406**
time required for an unsuccessful communication	0.069
time required for a port timeout w/no response	0.210
total time required for an unsuccessful communication	0.279
total time for 52 unsuccessful communications	**14.495**
total time for all devices to communicate	**24.901**
total time for communication w/ all devices prior to priority downgrade	249.013
Weighted Average Time (52 units are dead; 74 units operational)	0.198
number of cycles required to reach communications fail	36.000
average time required to reach communications fail	7.115
AVERAGE TIME TO COMMUNICATION DEAD STATUS:	**107.515**

3.4.5. Table 3 shows some of the specifications of the CO monitoring system that were used in the above calculations. However, these specifications are approximated, because it is unknown what configuration existed in MineBoss at the time of the explosion.

Table 3 CO Monitoring System Specifications

System Specifications		
Baud	320	
bits required for successful communication	45	
bits required for an unsuccessful communication	22	
size of scanner queue (# of scan cycles)	4	
# of time intervals between the retry count (10 scans)	9	
channel dead countdown	100	seconds
uncertainty figure	0.4	seconds
time for channel dead countdown	10	seconds
time required for a port timeout w/no response	0.210	seconds

3.4.6. These calculations were based upon data from the CO monitoring system. Data from the tracking system would yield a less reliable time estimate than the CO monitoring system because of the use subchannels within the tracking system.

3.4.7. **CONCLUSION.** Calculations based upon an approximation of the configuration of MineBoss indicate that the event that interrupted communications between CO Monitor 88 and the MCS occurred approximately 1 minute 48 seconds prior to 15:08:01, which is the time according to the MineBoss system on April 5, 2010. Given the location of CO Monitor 88, that event is assumed to be the explosion that occurred on April 5, 2010.

3.5. **Time drift measurements on the UUB personal computer (PC).**

3.5.1. Following the explosion on April 5, 2010, the time difference between the PC clock in use at UBB for the Pyott-Boone Tracking, CO Monitoring, and BeltBoss Systems was compared to GPS time.

3.5.2. Three data points were taken in April 2010. However, the data point recorded on April 5, 2010 at 19:45 did not include seconds; this data point was not included in the drift calculation. This left two data points from April 15 (time difference of 00:05:48) and April 29 (time difference of 00:05:56). The time drift calculates to 0.576 seconds/day over approximately 14 days. The drift was calculated by Microsoft Excel's 'Linear Trendline' function. The resulting slope (drift) and y-intercept were used to determine the corrected COMMUNICATIONS DEAD status time. If this correction is applied to the time recorded in the event log when CO Monitor 88 reported a COMMUNICATIONS DEAD status, this adjusts the time stamp from 15:08:01 to 15:02:19.

3.5.3. The accident team indicated that the Federal Bureau of Investigation confiscated the subject PC and subsequently returned it to the mine after the collection of the initial set of time drift data. It is also reported that the MineBoss software was upgraded after the PC was returned to the mine. It is unknown what other changes may have occurred to the PC.

3.5.4. Additional time drift data points were taken at seven day intervals (with the exception that the last interval was six days) between August 26 and September 15, 2011. The time differences noted were 00:59:04 on August 26; 00:59:06 on September 2; 00:59:08 on September 9; and 00:59:10 on September 15. The time drift calculates to 0.30 seconds/day over approximately 20 days using these data points. The drift was calculated by Microsoft Excel's 'Linear Trendline' function. The resulting slope (drift) and y-intercept were different from the data taken in April 2010. Since the exact environmental, hardware, or software conditions could not be verified, the data was used with conditions set by the initial data points taken in April 2010. The resulting slope (drift) was used with the y-intercept from the April 2010 data to determine the corrected COMMUNICATIONS DEAD status time. If this correction is applied to the time recorded in the event log when CO Monitor 88 reported a COMMUNICATIONS DEAD status, this adjusts the time stamp from 15:08:01 to 15:02:16.

3.5.5. There is a difference of three seconds between the times calculated using the respective time drift rates calculated with the two sets of data. Since the environmental, hardware, and software conditions could not be accounted for by MSHA after the evidence was returned to the mine, the difference in the data taken between August and September 2011and the data taken in April 2010 cannot be accurately determined. These circumstances indicate that the time drift calculated prior to the removal of the PC from UBB is more reliable than the time drift calculated after the PC was returned to the mine.

3.5.6. **CONCLUSION**. An assumption is asserted that CO Monitor 88 was successfully able to record to the event log at 15:08:01 a change in its status as a result of the explosion that occurred on April 5, 2010. With the assistance of Pyott-Boone, the estimate of the time (including the approximations of the MCS configurations) between the event that initiated the COMMUNICATIONS DEAD status of CO Monitor 88 and its record into the event log was calculated to be approximately 1 minute 48 seconds.

Two sets of data were collected to evaluate the time difference between the PC clock in use at UBB and a reference time, which is established by GPS time. The data collected in April 2010 results in a GPS time of 15:02:19; the data collected beginning August 2011, when used in conjunction with data taken in April 2010, results in a GPS time of 15:02:16.

The time estimate between the event that initiated the COMMUNICATIONS DEAD status of CO Monitor 88 and its record into the event log can be applied to the PC clock to obtain a corrected time with respect to the GPS clock. Applying the 1 minute 48 second interval to the corrected CO Monitor 88 COMMUNICATIONS DEAD status time, using data taken in April 2010, indicates the event that initiated the status reached CO Monitor 88 at 15:00:31 on April 5, 2010. Applying the 1 minute 48 second time to the corrected CO Monitor 88 COMMUNICATIONS DEAD status time, using data taken between August and September 2011, shows that the event that initiated the status reached CO Monitor 88 at 15:00:28 on April 5, 2010.

The data collected in April 2010 (prior to the PC's removal from the mine) is believed to be more reliable than the data collected after the PC was returned to the mine. However, the maintenance of the tracking system (refer to §2.8), unknown scanning priority at the time of the explosion (refer to §3.4.3), the approximations of the CO monitoring system specifications (refer to §3.4.5), and the unknown status of the actual PC (refer to §3.5.3) combine to introduce uncertainty in both the time estimate between the explosion and the status change of CO Monitor 88 in the event log, and the time difference calculated between the PC clock and reference time. Additionally, time drift analyses based on other equipment recovered from the mine (the DVR and multi-gas detectors) indicate the explosion occurred at approximately 3:02 pm on April 5, 2010. Based on the maintenance, configuration, and conditions of the MineBoss PC and in comparison with other time calculations, both corrected times of 15:00:31 and 15:00:28 are not being considered accurate estimates.

APPENDIX A Tracking and CO Monitoring System Documents

- List of 251 tracking tags tracked between January 1 and April 10, 2010, 8 pages; Section 2.6
- List of 118 tracking tags tracked on April 5, 2010, 4 pages; Section 2.6.1
- Map1 Tracking system map in MineBoss at the time of the explosion; Section 2.6.3
- Map 2 Status of the readers after the explosion as indicated by the event log; Section 2.7.2
- Map 3 Status of CO monitors after the explosion as indicated by the event log; Section 3.2.1

List of 251 Tags in Database

	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
1	0	2/26/2010 3:38	15420.3.47..0				3 Brk on North Track
2	4	3/24/2010 18:58	15420.3.1..0	personnel	Clamme	Michael	North Track Portal
3	13	3/9/2010 14:26	15420.3.87..0				South Track Portal
4	102	3/30/2010 10:12	15420.3.87..0				South Track Portal
5	103	4/5/2010 16:22	15420.3.87..0	personnel	Earls	Clifton	South Track Portal
6	105	4/5/2010 20:05	15420.3.1..0	personnel	Baker	Bobby	North Track Portal
7	107	4/5/2010 7:29	15420.3.92..0	personnel	Mills	Nate	Ellis Punchout Track
8	108	4/5/2010 16:08	15420.3.87..0	personnel	Reed	Jeremy	South Track Portal
9	110	4/5/2010 8:18	15420.3.92..0				Ellis Punchout Track
10	112	4/1/2010 14:05	15420.3.92..0	personnel	Adkins	Bobby	Ellis Punchout Track
11	113	2/25/2010 12:17	15420.3.1..0				North Track Portal
12	115	3/12/2010 16:56	15420.3.92..0	personnel	Blevins	Tommy	Ellis Punchout Track
13	116	3/26/2010 20:54	15420.3.87..0	personnel	Cullop	Gregg	South Track Portal
14	117	3/26/2010 21:58	15420.3.87..0	personnel	Davis	James	South Track Portal
15	118	4/5/2010 16:25	15420.3.87..0	personnel	Bishop	Bobby	South Track Portal
16	121	4/5/2010 14:35	15420.3.92..0	personnel	Halstead	Scott	Ellis Punchout Track
17	122	4/5/2010 14:30	15420.3.92..0	personnel	Hagar	Everett	Ellis Punchout Track
18	123	3/8/2010 8:56	15420.3.1..0	personnel	Browning	Kevin	North Track Portal
19	128	4/5/2010 15:05	15420.3.92..0	personnel	Plumley	Ralph	Ellis Punchout Track
20	130	4/5/2010 15:06	15420.3.92..0	personnel	Jackson	Eric	Ellis Punchout Track
21	132	4/3/2010 6:51	15420.3.92..0	personnel	Irvin	Cody	Ellis Punchout Track
22	134	4/3/2010 6:50	15420.3.92..0	personnel	Mcfalls	Dave	Ellis Punchout Track
23	135	4/2/2010 7:23	15420.3.92..0	personnel	Martin	Scott	Ellis Punchout Track
24	137	4/3/2010 7:30	15420.3.92..0	personnel	Plumley	Jon	Ellis Punchout Track
25	138	3/26/2010 14:30	15420.3.18..0	personnel	Williams	Michael	5 North Belt Starter
26	141	4/3/2010 7:29	15420.3.92..0	personnel	Gillenwater	John	Ellis Punchout Track
27	145	4/5/2010 15:07	15420.3.75..0	personnel	Woods	James	6 North Starter Box
28	150	3/26/2010 14:41	15420.3.18..0	personnel	Honaker	Wes	5 North Belt Starter
29	160	3/11/2010 8:36	15420.3.99..0				2Brks Outby Switch Ellis
30	176	4/5/2010 6:55	15420.3.1..0				North Track Portal
31	224	3/23/2010 23:46	15420.3.1..0				North Track Portal
32	226	4/5/2010 9:29	15420.3.1..0	personnel	Daniel	Roger	North Track Portal
33	230	4/5/2010 13:50	15420.3.92..0	personnel	Weeks	Jerry	Ellis Punchout Track

	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
34	231	4/5/2010 12:27	15420.3.1..0	personnel	Semenske	Charles	North Track Portal
35	271	2/24/2010 10:09	15420.3.34..0				Eunice Intake
36	283	4/5/2010 21:08	15420.3.87..0				South Track Portal
37	285	4/1/2010 7:29	15420.3.92..0	personnel	Sims	Dennis	Ellis Punchout Track
38	286	4/2/2010 12:58	15420.3.92..0	personnel	Lilly	Harold	Ellis Punchout Track
39	287	4/5/2010 6:04	15420.3.1..0	personnel	Brackett	Bruce	North Track Portal
40	289	3/31/2010 16:32	15420.3.1..0	personnel	Hansford	Jerry	North Track Portal
41	300	4/5/2010 6:33	15420.3.56..0	personnel	Morgan	Adam	
42	301	3/26/2010 15:50	15420.3.18..0	personnel	Jarrell	Kory	5 North Belt Starter
43	303	4/5/2010 5:32	15420.3.92..0	personnel	Bickford	John	Ellis Punchout Track
44	304	4/5/2010 16:32	15420.3.87..0	personnel	Lambert	Kevin	South Track Portal
45	305	4/5/2010 6:33	15420.3.56..0	personnel	Napper	Josh	
46	306	4/5/2010 15:44	15420.3.87..0	personnel	Rife	Jeremy	South Track Portal
47	307	3/31/2010 14:55	15420.3.92..0	personnel	Lilly	Eric	Ellis Punchout Track
48	308	3/26/2010 16:05	15420.3.87..0	personnel	Salazar	N	South Track Portal
49	309	3/27/2010 16:35	15420.3.5..0	personnel	Ross	Dustin	76 Brk on Track
50	310	4/5/2010 15:43	15420.3.87..0	personnel	Foster	Eddie	South Track Portal
51	313	4/5/2010 15:50	15420.3.87..0	personnel	Williams	Danny	South Track Portal
52	314	3/26/2010 15:45	15420.3.87..0	personnel	Campbell	Randall	South Track Portal
53	315	3/26/2010 8:17	15420.3.87..0	personnel	McKinney	Donald	South Track Portal
54	316	4/5/2010 15:40	15420.3.87..0	personnel	Brown	Ricky	South Track Portal
55	317	3/30/2010 1:13	15420.3.1..0	personnel	Campbell	Ricky	North Track Portal
56	319	4/5/2010 15:12	15420.3.87..0	personnel	Gray	Charles	South Track Portal
57	320	3/27/2010 8:24	15420.3.87..0	personnel	Cook	John	South Track Portal
58	321	4/2/2010 1:15	15420.3.1..0	personnel	William	May	North Track Portal
59	322	3/8/2010 8:36	15420.3.1..0	personnel	Legansky	Luke	North Track Portal
60	323	4/5/2010 15:44	15420.3.87..0	personnel	Holdren	Travis	South Track Portal
61	324	4/5/2010 15:44	15420.3.87..0	personnel	Curry	Wes	South Track Portal
62	325	4/2/2010 1:18	15420.3.87..0	personnel	Harold	Gary	South Track Portal
63	327	4/5/2010 15:58	15420.3.87..0	personnel	Lucas	James	South Track Portal
64	329	4/5/2010 7:51	15420.3.87..0	personnel	Sciculuna	Cliff	South Track Portal
65	330	4/5/2010 15:45	15420.3.87..0	personnel	Cadle	Chris	South Track Portal
66	331	4/5/2010 7:55	15420.3.87..0	personnel	McAlpine	Kevin	South Track Portal

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	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
67	332	3/23/2010 3:53	15420.3.1..0	personnel	Ball	Adam	North Track Portal
68	334	3/22/2010 15:17	15420.3.92..0	personnel	Price	James	Ellis Punchout Track
69	352	3/25/2010 9:29	15420.3.53..0				4 Brk South Track
70	353	3/25/2010 8:58	15420.3.1..0				North Track Portal
71	354	3/25/2010 9:30	15420.3.1..0				North Track Portal
72	368	3/25/2010 9:30	15420.3.1..0				North Track Portal
73	369	3/25/2010 8:58	15420.3.1..0				North Track Portal
74	388	3/25/2010 9:24	15420.3.1..0				North Track Portal
75	455	2/21/2010 18:24	15420.3.1..0				North Track Portal
76	501	4/5/2010 6:41	15420.3.56..0	personnel	Payne	Boone	
77	502	4/5/2010 6:34	15420.3.5..0	personnel	Marcum	Joe	76 Brk on Track
78	503	3/26/2010 5:45	15420.3.18..0	personnel	Tolliver	Jeremy	5 North Belt Starter
79	504	4/5/2010 15:46	15420.3.87..0	personnel	Lynch	Melvin	South Track Portal
80	510	4/3/2010 7:30	15420.3.92..0	personnel	Andrew	Bennett	Ellis Punchout Track
81	511	4/5/2010 12:55	15420.3.92..0				Ellis Punchout Track
82	512	3/1/2010 7:59	15420.3.87..0	personnel	Welch	Brad	South Track Portal
83	513	4/5/2010 5:38	15420.3.92..0	personnel	Neely	John	Ellis Punchout Track
84	515	4/2/2010 1:03	15420.3.92..0	personnel	Hulgan	Morris	Ellis Punchout Track
85	518	4/2/2010 1:03	15420.3.92..0	personnel	Derek	Williams	Ellis Punchout Track
86	519	4/5/2010 8:18	15420.3.92..0	personnel	Dicken	Mike	Ellis Punchout Track
87	526	4/5/2010 6:41	15420.3.56..0	personnel	Chapman	Kenny	
88	527	4/2/2010 0:50	15420.3.87..0	personnel	McCallister	Danny	South Track Portal
89	528	4/3/2010 23:55	15420.3.99..0	personnel	Kortaa	Hall	2Brks Outby Switch Ellis
90	529	4/3/2010 13:38	15420.3.92..0	personnel	Moore	Terry	Ellis Punchout Track
91	530	4/5/2010 8:18	15420.3.92..0	personnel	Nutter	Kevin	Ellis Punchout Track
92	535	4/4/2010 0:07	15420.3.92..0	personnel	Davis	Daniel	Ellis Punchout Track
93	536	3/4/2010 6:24	15420.3.99..0	personnel	Cozart	Arless	2Brks Outby Switch Ellis
94	537	4/5/2010 6:53	15420.3.92..0	personnel	Tilley	Joe	Ellis Punchout Track
95	539	4/3/2010 23:54	15420.3.99..0	personnel	Bowling	Brandon	2Brks Outby Switch Ellis
96	540	4/5/2010 6:33	15420.3.56..0	personnel	Persinger	Dewey	
97	543	4/3/2010 7:30	15420.3.92..0	personnel	Smith	James	Ellis Punchout Track
98	545	4/5/2010 17:00	15420.3.87..0	personnel	Smith	Mike	South Track Portal
99	547	4/5/2010 6:33	15420.3.56..0	personnel	Quarles	Gary	

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	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
100	548	3/29/2010 8:06	15420.3.87..0	personnel	Spence	Justin	South Track Portal
101	549	4/3/2010 7:29	15420.3.92..0	personnel	Plumbley	Josh	Ellis Punchout Track
102	550	4/4/2010 0:06	15420.3.92..0	personnel	Hutchens	Rick	Ellis Punchout Track
103	552	4/3/2010 7:30	15420.3.92..0	personnel	Pettry	Derek	Ellis Punchout Track
104	554	4/2/2010 8:00	15420.3.1..0	personnel	Meadows	Greg	North Track Portal
105	556	4/3/2010 23:47	15420.3.92..0	personnel	Woodrum	Kenny	Ellis Punchout Track
106	557	4/1/2010 5:48	15420.3.92..0	personnel	Visitor 1		Ellis Punchout Track
107	559	4/5/2010 21:47	15420.3.87..0	personnel	Stewart	Lacy	South Track Portal
108	560	4/5/2010 7:42	15420.3.87..0	personnel	Stanley	Jeff	South Track Portal
109	561	4/1/2010 7:29	15420.3.92..0	personnel	Doss	Jacob	Ellis Punchout Track
110	562	4/4/2010 0:06	15420.3.92..0	personnel	Pauley	Bobby	Ellis Punchout Track
111	563	4/1/2010 5:45	15420.3.92..0	personnel	Visitor 2		Ellis Punchout Track
112	564	4/5/2010 6:32	15420.3.56..0	personnel	Lane	Rick	
113	565	3/13/2010 13:33	15420.3.1..0	personnel	Cantley	Roger	North Track Portal
114	567	4/5/2010 7:42	15420.3.87..0	personnel	Jerry	Martin	South Track Portal
115	568	3/26/2010 6:46	15420.3.18..0	personnel	Aldermin	Alvis	5 North Belt Starter
116	569	4/5/2010 15:07	15420.3.92..0	personnel	Shears	Dave	Ellis Punchout Track
117	570	4/5/2010 6:33	15420.3.56..0	personnel	Bell	Chris	
118	571	4/2/2010 1:03	15420.3.92..0	personnel	Racer	Brent	Ellis Punchout Track
119	572	4/2/2010 1:03	15420.3.92..0	personnel	Stanley	Stewart	Ellis Punchout Track
120	573	4/5/2010 16:57	15420.3.87..0	personnel	Coalson	Kenneth	South Track Portal
121	574	4/4/2010 0:06	15420.3.92..0	personnel	Griffith	James	Ellis Punchout Track
122	576	4/5/2010 15:06	15420.3.92..0	personnel	Cox	Lacy	Ellis Punchout Track
123	577	4/2/2010 0:55	15420.3.99..0	personnel	Crouse	Greg	2Brks Outby Switch Ellis
124	578	3/31/2010 7:58	15420.3.47..0	personnel	Dickens	Shannon	3 Brk on North Track
125	579	3/30/2010 14:36	15420.3.92..0	personnel	Hendrickson	Wes	Ellis Punchout Track
126	580	2/28/2010 18:27	15420.3.99..0	personnel	Goss	Bobby	2Brks Outby Switch Ellis
127	581	2/22/2010 6:26	15420.3.5..0				76 Brk on Track
128	582	3/31/2010 1:21	15420.3.72..0	personnel	Farthing	Adam	3 brks inby ellis switch
129	583	4/5/2010 7:36	15420.3.87..0	personnel	Acord	Blake	South Track Portal
130	584	4/5/2010 6:33	15420.3.56..0	personnel	Price	Joel	
131	587	4/3/2010 7:22	15420.3.87..0	personnel	Slentz	Tracy	South Track Portal
132	588	4/3/2010 15:43	15420.3.92..0	personnel	Bailey	Delbert	Ellis Punchout Track

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	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
133	589	4/5/2010 13:39	15420.3.92..0	personnel	Craddock	Bill	Ellis Punchout Track
134	590	3/29/2010 16:53	15420.3.92..0	personnel	Davis	Cody	Ellis Punchout Track
135	591	4/5/2010 6:52	15420.3.92..0	personnel	Walker	Shawn	Ellis Punchout Track
136	592	4/5/2010 6:53	15420.3.92..0	personnel	Fleming	Tom	Ellis Punchout Track
137	593	4/3/2010 7:31	15420.3.92..0	personnel	Lucas	Andrew	Ellis Punchout Track
138	594	4/3/2010 23:47	15420.3.92..0	personnel	Estep	Tommy	Ellis Punchout Track
139	595	4/5/2010 6:33	15420.3.56..0	personnel	Davis	Timmy	
140	596	4/5/2010 7:25	15420.3.92..0	personnel	Adame	Jerry	Ellis Punchout Track
141	597	4/5/2010 7:05	15420.3.99..0	personnel	Ferrell	Joe	2Brks Outby Switch Ellis
142	599	4/3/2010 16:32	15420.3.92..0	personnel	Webb	Mike	Ellis Punchout Track
143	600	4/5/2010 14:08	15420.3.92..0	personnel	Cox	John	Ellis Punchout Track
144	601	4/5/2010 14:25	15420.3.87..0	personnel	Williams	Tim	South Track Portal
145	603	4/5/2010 15:07	15420.3.92..0	personnel	Farely	David	Ellis Punchout Track
146	604	3/23/2010 0:41	15420.3.87..0	personnel	Young	Thomas	South Track Portal
147	608	4/3/2010 7:30	15420.3.92..0	personnel	Anderson	Kyle	Ellis Punchout Track
148	611	4/5/2010 7:55	15420.3.87..0	personnel	Hatcher	Justin	South Track Portal
149	613	4/3/2010 16:33	15420.3.92..0	personnel	Gwinn	Randy	Ellis Punchout Track
150	614	4/5/2010 15:04	15420.3.92..0	personnel	Medley	Kevin	Ellis Punchout Track
151	618	4/4/2010 0:07	15420.3.92..0	personnel	Gray	Richard	Ellis Punchout Track
152	619	4/3/2010 6:50	15420.3.92..0	personnel	Wriston	Dwayne	Ellis Punchout Track
153	620	4/2/2010 7:23	15420.3.92..0	personnel	Waddell	Brandon	Ellis Punchout Track
154	621	4/5/2010 6:41	15420.3.56..0	personnel	Brock	Greg	
155	623	4/2/2010 0:55	15420.3.99..0	personnel	Richmond	Larry	2Brks Outby Switch Ellis
156	625	2/22/2010 16:50	15420.3.34..0	personnel	Hill	Joe	Eunice Intake
157	646	4/2/2010 7:59	15420.3.87..0	personnel	Cozart	Kelton	South Track Portal
158	648	4/5/2010 15:07	15420.3.92..0	personnel	Brown	Chad	Ellis Punchout Track
159	649	4/5/2010 13:01	15420.3.92..0	personnel	Bailey	Tad	Ellis Punchout Track
160	650	4/5/2010 15:05	15420.3.92..0	personnel	Davis	Owen	Ellis Punchout Track
161	651	4/2/2010 1:03	15420.3.92..0	personnel	Dancy	Jason	Ellis Punchout Track
162	654	4/5/2010 6:14	15420.3.1..0	personnel	Richardson	Dustin	North Track Portal
163	656	4/5/2010 9:46	15420.3.1..0	personnel	Farley	Brian	North Track Portal
164	657	4/5/2010 6:53	15420.3.92..0	personnel	Wilson	Scott	Ellis Punchout Track
165	659	4/3/2010 7:30	15420.3.92..0	personnel	Covey	Dave	Ellis Punchout Track

	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
166	661	4/5/2010 5:33	15420.3.92..0				Ellis Punchout Track
167	663	4/5/2010 6:33	15420.3.56..0	personnel	McCrosky	Nick	
168	664	3/31/2010 13:02	15420.3.92..0	personnel	Nicolau	Rick	Ellis Punchout Track
169	666	4/5/2010 15:07	15420.3.92..0	personnel	Burghduff	Jeremy	Ellis Punchout Track
170	670	4/5/2010 6:53	15420.3.92..0	personnel	Mourad	Justin	Ellis Punchout Track
171	675	4/1/2010 15:16	15420.3.92..0	personnel	Athey	Charles	Ellis Punchout Track
172	691	3/18/2010 9:07	15420.3.87..0				South Track Portal
173	698	3/18/2010 9:07	15420.3.1..0				North Track Portal
174	699	3/18/2010 9:12	15420.3.1..0				North Track Portal
175	700	3/18/2010 9:12	15420.3.1..0				North Track Portal
176	701	4/5/2010 23:43	15420.3.87..0	personnel	Bowyer	Jim	South Track Portal
177	702	4/3/2010 16:33	15420.3.92..0	personnel	Williams	Jim	Ellis Punchout Track
178	703	4/5/2010 5:26	15420.3.87..0	personnel	Peterson	Terry	South Track Portal
179	704	4/5/2010 15:11	15420.3.87..0	personnel	Massey	Joe	South Track Portal
180	705	4/5/2010 17:39	15420.3.87..0				South Track Portal
181	706	4/3/2010 7:22	15420.3.99..0	personnel	Osborne	Rodney	2Brks Outby Switch Ellis
182	707	4/5/2010 15:06	15420.3.75..0	personnel	Harrah	Steve	6 North Starter Box
183	708	4/5/2010 7:56	15420.3.87..0	personnel	Mclaine	Brian	South Track Portal
184	709	4/5/2010 14:43	15420.3.1..0	personnel	Gilbert	Mark	North Track Portal
185	710	4/5/2010 15:07	15420.3.92..0	personnel	Stanley	Jason	Ellis Punchout Track
186	711	4/5/2010 6:21	15420.3.1..0	personnel	Stover	Cliff	North Track Portal
187	712	3/25/2010 14:33	15420.3.1..0	personnel	Woods	Jeremy	North Track Portal
188	713	4/3/2010 16:02	15420.3.92..0	personnel	Ellison	Shawn	Ellis Punchout Track
189	718	4/1/2010 9:01	15420.3.1..0				North Track Portal
190	721	4/5/2010 23:57	15420.3.1..0				North Track Portal
191	723	4/5/2010 13:14	15420.3.92..0				Ellis Punchout Track
192	726	4/4/2010 0:06	15420.3.92..0	personnel	Lambert	Tracy	Ellis Punchout Track
193	728	4/2/2010 0:54	15420.3.99..0	personnel	Powers	Ryan	2Brks Outby Switch Ellis
194	729	4/5/2010 13:16	15420.3.92..0				Ellis Punchout Track
195	730	4/4/2010 0:07	15420.3.92..0	personnel	Massey	Josh	Ellis Punchout Track
196	742	3/25/2010 9:29	15420.3.1..0				North Track Portal
197	747	4/5/2010 6:36	15420.3.75..0	personnel	Griffith	Bob	6 North Starter Box
198	761	4/1/2010 10:55	15420.3.87..0	personnel	Musick	Charles	South Track Portal

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	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
199	762	4/5/2010 15:58	15420.3.1..0	personnel	Lambert	Denver	North Track Portal
200	763	3/30/2010 14:58	15420.3.1..0	personnel	Daniels	Donovan	North Track Portal
201	765	4/5/2010 7:53	15420.3.87..0	personnel	Greer	Kenny	South Track Portal
202	766	4/3/2010 16:31	15420.3.92..0	personnel	Pettry	Pacer	Ellis Punchout Track
203	768	4/5/2010 14:18	15420.3.92..0	personnel	Toney	Roger	Ellis Punchout Track
204	769	4/5/2010 6:41	15420.3.56..0	personnel	Mooney	Eddie	
205	772	4/5/2010 9:29	15420.3.1..0	personnel	Daniel	Timmy	North Track Portal
206	773	3/11/2010 7:48	15420.3.87..0	personnel	Nichols	Rick	South Track Portal
207	774	4/5/2010 6:41	15420.3.56..0	personnel	Workman	Ricky	
208	776	4/3/2010 6:28	15420.3.56..0	personnel	Scarbro	Roger	
209	777	4/5/2010 6:36	15420.3.75..0	personnel	Maynor	Romald	6 North Starter Box
210	778	4/5/2010 15:06	15420.3.92..0	personnel	Stout	Josh	Ellis Punchout Track
211	779	4/5/2010 7:05	15420.3.99..0	personnel	Smith	Chuck	2Brks Outby Switch Ellis
212	780	4/5/2010 15:07	15420.3.56..0	personnel	Elswick	Mike	
213	781	4/1/2010 5:51	15420.3.92..0	personnel	Visitor 4		Ellis Punchout Track
214	782	4/2/2010 0:50	15420.3.87..0	personnel	Daniel	Steven	South Track Portal
215	783	3/26/2010 4:55	15420.3.5..0	personnel	Visitor 3		76 Brk on Track
216	785	4/3/2010 16:32	15420.3.92..0	personnel	Nelson	Travis	Ellis Punchout Track
217	786	4/5/2010 17:01	15420.3.87..0	personnel	Hodge	Josh	South Track Portal
218	788	4/5/2010 8:04	15420.3.87..0	personnel	Cooper	Harold	South Track Portal
219	789	4/5/2010 16:05	15420.3.87..0	personnel	Williams	Josh	South Track Portal
220	790	4/3/2010 16:32	15420.3.92..0	personnel	Ford	Luke	Ellis Punchout Track
221	791	4/1/2010 15:17	15420.3.87..0	personnel	Lewis	Omar	South Track Portal
222	792	3/26/2010 8:18	15420.3.87..0	personnel	Martin	Eric	South Track Portal
223	793	4/5/2010 15:07	15420.3.5..0	personnel	Atkins	Jason	76 Brk on Track
224	794	4/1/2010 15:15	15420.3.47..0	personnel	Jacquez	Mike	3 Brk on North Track
225	795	4/5/2010 18:00	15420.3.87..0	personnel	Irvin	Jeremy	South Track Portal
226	796	3/26/2010 22:24	15420.3.87..0	personnel	Sorrells	Eric	South Track Portal
227	797	4/5/2010 9:38	15420.3.87..0	personnel	Griffith	Jason	South Track Portal
228	798	4/5/2010 8:01	15420.3.87..0	personnel	Snow	Kieth	South Track Portal
229	799	4/2/2010 1:03	15420.3.92..0	personnel	Patrick	Hilbert	Ellis Punchout Track
230	801	4/1/2010 7:40	15420.3.92..0	personnel	Stanley	Darrell	Ellis Punchout Track
231	802	4/5/2010 9:43	15420.3.87..0	personnel	Clemmons	John	South Track Portal

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	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
232	804	3/26/2010 14:26	15420.3.5..0	personnel	Pompie	David	76 Brk on Track
233	805	4/5/2010 15:07	15420.3.75..0	personnel	Scott	Deward	6 North Starter Box
234	806	4/5/2010 6:33	15420.3.56..0	personnel	Mullins	Rex	
235	807	4/5/2010 15:07	15420.3.75..0	personnel	Acord	Carl	6 North Starter Box
236	809	4/1/2010 15:16	15420.3.87..0	personnel	Basham	Henry	South Track Portal
237	811	4/1/2010 15:16	15420.3.87..0				South Track Portal
238	812	4/5/2010 7:48	15420.3.87..0	personnel	Todd	Nick	South Track Portal
239	813	3/10/2010 23:29	15420.3.87..0				South Track Portal
240	814	4/5/2010 16:56	15420.3.1..0	personnel	Williams	Mitch	North Track Portal
241	815	4/5/2010 15:07	15420.3.5..0	personnel	Willingham	Benny	76 Brk on Track
242	816	4/4/2010 22:17	15420.3.87..0	personnel	Maynor	Buddy	South Track Portal
243	817	4/5/2010 11:02	15420.3.99..0	personnel	Sullivan	Bill	2Brks Outby Switch Ellis
244	818	4/5/2010 15:07	15420.3.75..0	personnel	Clark	Robert	6 North Starter Box
245	819	4/5/2010 13:40	15420.3.87..0	personnel	Justice	Will	South Track Portal
246	820	3/29/2010 6:34	15420.3.87..0	personnel	JENKINS	ADAM	South Track Portal
247	832	3/19/2010 6:35	15420.3.5..0				76 Brk on Track
248	861	2/11/2010 10:25	15420.3.1..0				North Track Portal
249	976	4/5/2010 6:41	15420.3.56..0	personnel	Jones	Dean	
250	991	3/26/2010 14:25	15420.3.5..0	personnel	Pettry	James	76 Brk on Track
251	999	4/5/2010 7:59	15420.3.87..0	personnel	Morris	John	South Track Portal

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	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
1	703	4/5/2010 5:26	15420.3.87..0	personnel	Peterson	Terry	South Track Portal
2	303	4/5/2010 5:32	15420.3.92..0	personnel	Bickford	John	Ellis Punchout Track
3	661	4/5/2010 5:33	15420.3.92..0				Ellis Punchout Track
4	513	4/5/2010 5:38	15420.3.92..0	personnel	Neely	John	Ellis Punchout Track
5	287	4/5/2010 6:04	15420.3.1..0	personnel	Brackett	Bruce	North Track Portal
6	654	4/5/2010 6:14	15420.3.1..0	personnel	Richardson	Dustin	North Track Portal
7	711	4/5/2010 6:21	15420.3.1..0	personnel	Stover	Cliff	North Track Portal
8	564	4/5/2010 6:32	15420.3.56..0	personnel	Lane	Rick	
9	595	4/5/2010 6:33	15420.3.56..0	personnel	Davis	Timmy	
10	663	4/5/2010 6:33	15420.3.56..0	personnel	McCrosky	Nick	
11	570	4/5/2010 6:33	15420.3.56..0	personnel	Bell	Chris	
12	806	4/5/2010 6:33	15420.3.56..0	personnel	Mullins	Rex	
13	305	4/5/2010 6:33	15420.3.56..0	personnel	Napper	Josh	
14	540	4/5/2010 6:33	15420.3.56..0	personnel	Persinger	Dewey	
15	584	4/5/2010 6:33	15420.3.56..0	personnel	Price	Joel	
16	300	4/5/2010 6:33	15420.3.56..0	personnel	Morgan	Adam	
17	547	4/5/2010 6:33	15420.3.56..0	personnel	Quarles	Gary	
18	502	4/5/2010 6:34	15420.3.5..0	personnel	Marcum	Joe	76 Brk on Track
19	747	4/5/2010 6:36	15420.3.75..0	personnel	Griffith	Bob	6 North Starter Box
20	777	4/5/2010 6:36	15420.3.75..0	personnel	Maynor	Romald	6 North Starter Box
21	769	4/5/2010 6:41	15420.3.56..0	personnel	Mooney	Eddie	
22	976	4/5/2010 6:41	15420.3.56..0	personnel	Jones	Dean	
23	526	4/5/2010 6:41	15420.3.56..0	personnel	Chapman	Kenny	
24	501	4/5/2010 6:41	15420.3.56..0	personnel	Payne	Boone	
25	774	4/5/2010 6:41	15420.3.56..0	personnel	Workman	Ricky	
26	621	4/5/2010 6:41	15420.3.56..0	personnel	Brock	Greg	
27	591	4/5/2010 6:52	15420.3.92..0	personnel	Walker	Shawn	Ellis Punchout Track
28	670	4/5/2010 6:53	15420.3.92..0	personnel	Mourad	Justin	Ellis Punchout Track
29	537	4/5/2010 6:53	15420.3.92..0	personnel	Tilley	Joe	Ellis Punchout Track
30	592	4/5/2010 6:53	15420.3.92..0	personnel	Fleming	Tom	Ellis Punchout Track
31	657	4/5/2010 6:53	15420.3.92..0	personnel	Wilson	Scott	Ellis Punchout Track
32	176	4/5/2010 6:55	15420.3.1..0				North Track Portal
33	779	4/5/2010 7:05	15420.3.99..0	personnel	Smith	Chuck	2Brks Outby Switch Ellis

	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
34	597	4/5/2010 7:05	15420.3.99..0	personnel	Ferrell	Joe	2Brks Outby Switch Ellis
35	596	4/5/2010 7:25	15420.3.92..0	personnel	Adame	Jerry	Ellis Punchout Track
36	107	4/5/2010 7:29	15420.3.92..0	personnel	Mills	Nate	Ellis Punchout Track
37	583	4/5/2010 7:36	15420.3.87..0	personnel	Acord	Blake	South Track Portal
38	567	4/5/2010 7:42	15420.3.87..0	personnel	Jerry	Martin	South Track Portal
39	560	4/5/2010 7:42	15420.3.87..0	personnel	Stanley	Jeff	South Track Portal
40	812	4/5/2010 7:48	15420.3.87..0	personnel	Todd	Nick	South Track Portal
41	329	4/5/2010 7:51	15420.3.87..0	personnel	Sciculuna	Cliff	South Track Portal
42	765	4/5/2010 7:53	15420.3.87..0	personnel	Greer	Kenny	South Track Portal
43	331	4/5/2010 7:55	15420.3.87..0	personnel	McAlpine	Kevin	South Track Portal
44	611	4/5/2010 7:55	15420.3.87..0	personnel	Hatcher	Justin	South Track Portal
45	708	4/5/2010 7:56	15420.3.87..0	personnel	Mclaine	Brian	South Track Portal
46	999	4/5/2010 7:59	15420.3.87..0	personnel	Morris	John	South Track Portal
47	798	4/5/2010 8:01	15420.3.87..0	personnel	Snow	Kieth	South Track Portal
48	788	4/5/2010 8:04	15420.3.87..0	personnel	Cooper	Harold	South Track Portal
49	519	4/5/2010 8:18	15420.3.92..0	personnel	Dicken	Mike	Ellis Punchout Track
50	110	4/5/2010 8:18	15420.3.92..0				Ellis Punchout Track
51	530	4/5/2010 8:18	15420.3.92..0	personnel	Nutter	Kevin	Ellis Punchout Track
52	772	4/5/2010 9:29	15420.3.1..0	personnel	Daniel	Timmy	North Track Portal
53	226	4/5/2010 9:29	15420.3.1..0	personnel	Daniel	Roger	North Track Portal
54	797	4/5/2010 9:38	15420.3.87..0	personnel	Griffith	Jason	South Track Portal
55	802	4/5/2010 9:43	15420.3.87..0	personnel	Clemmons	John	South Track Portal
56	656	4/5/2010 9:46	15420.3.1..0	personnel	Farley	Brian	North Track Portal
57	817	4/5/2010 11:02	15420.3.99..0	personnel	Sullivan	Bill	2Brks Outby Switch Ellis
58	231	4/5/2010 12:27	15420.3.1..0	personnel	Semenske	Charles	North Track Portal
59	511	4/5/2010 12:55	15420.3.92..0				Ellis Punchout Track
60	649	4/5/2010 13:01	15420.3.92..0	personnel	Bailey	Tad	Ellis Punchout Track
61	723	4/5/2010 13:14	15420.3.92..0				Ellis Punchout Track
62	729	4/5/2010 13:16	15420.3.92..0				Ellis Punchout Track
63	589	4/5/2010 13:39	15420.3.92..0	personnel	Craddock	Bill	Ellis Punchout Track
64	819	4/5/2010 13:40	15420.3.87..0	personnel	Justice	Will	South Track Portal
65	230	4/5/2010 13:50	15420.3.92..0	personnel	Weeks	Jerry	Ellis Punchout Track
66	600	4/5/2010 14:08	15420.3.92..0	personnel	Cox	John	Ellis Punchout Track

List of 118 Tags in Database

	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
67	768	4/5/2010 14:18	15420.3.92..0	personnel	Toney	Roger	Ellis Punchout Track
68	601	4/5/2010 14:25	15420.3.87..0	personnel	Williams	Tim	South Track Portal
69	122	4/5/2010 14:30	15420.3.92..0	personnel	Hagar	Everett	Ellis Punchout Track
70	121	4/5/2010 14:35	15420.3.92..0	personnel	Halstead	Scott	Ellis Punchout Track
71	709	4/5/2010 14:43	15420.3.1..0	personnel	Gilbert	Mark	North Track Portal
72	614	4/5/2010 15:04	15420.3.92..0	personnel	Medley	Kevin	Ellis Punchout Track
73	650	4/5/2010 15:05	15420.3.92..0	personnel	Davis	Owen	Ellis Punchout Track
74	128	4/5/2010 15:05	15420.3.92..0	personnel	Plumley	Ralph	Ellis Punchout Track
75	707	4/5/2010 15:06	15420.3.75..0	personnel	Harrah	Steve	6 North Starter Box
76	778	4/5/2010 15:06	15420.3.92..0	personnel	Stout	Josh	Ellis Punchout Track
77	130	4/5/2010 15:06	15420.3.92..0	personnel	Jackson	Eric	Ellis Punchout Track
78	576	4/5/2010 15:06	15420.3.92..0	personnel	Cox	Lacy	Ellis Punchout Track
79	805	4/5/2010 15:07	15420.3.75..0	personnel	Scott	Deward	6 North Starter Box
80	603	4/5/2010 15:07	15420.3.92..0	personnel	Farely	David	Ellis Punchout Track
81	145	4/5/2010 15:07	15420.3.75..0	personnel	Woods	James	6 North Starter Box
82	780	4/5/2010 15:07	15420.3.56..0	personnel	Elswick	Mike	
83	648	4/5/2010 15:07	15420.3.92..0	personnel	Brown	Chad	Ellis Punchout Track
84	666	4/5/2010 15:07	15420.3.92..0	personnel	Burghduff	Jeremy	Ellis Punchout Track
85	807	4/5/2010 15:07	15420.3.75..0	personnel	Acord	Carl	6 North Starter Box
86	793	4/5/2010 15:07	15420.3.5..0	personnel	Atkins	Jason	76 Brk on Track
87	569	4/5/2010 15:07	15420.3.92..0	personnel	Shears	Dave	Ellis Punchout Track
88	710	4/5/2010 15:07	15420.3.92..0	personnel	Stanley	Jason	Ellis Punchout Track
89	818	4/5/2010 15:07	15420.3.75..0	personnel	Clark	Robert	6 North Starter Box
90	815	4/5/2010 15:07	15420.3.5..0	personnel	Willingham	Benny	76 Brk on Track
91	704	4/5/2010 15:11	15420.3.87..0	personnel	Massey	Joe	South Track Portal
92	319	4/5/2010 15:12	15420.3.87..0	personnel	Gray	Charles	South Track Portal
93	316	4/5/2010 15:40	15420.3.87..0	personnel	Brown	Ricky	South Track Portal
94	310	4/5/2010 15:43	15420.3.87..0	personnel	Foster	Eddie	South Track Portal
95	306	4/5/2010 15:44	15420.3.87..0	personnel	Rife	Jeremy	South Track Portal
96	323	4/5/2010 15:44	15420.3.87..0	personnel	Holdren	Travis	South Track Portal
97	324	4/5/2010 15:44	15420.3.87..0	personnel	Curry	Wes	South Track Portal
98	330	4/5/2010 15:45	15420.3.87..0	personnel	Cadle	Chris	South Track Portal
99	504	4/5/2010 15:46	15420.3.87..0	personnel	Lynch	Melvin	South Track Portal

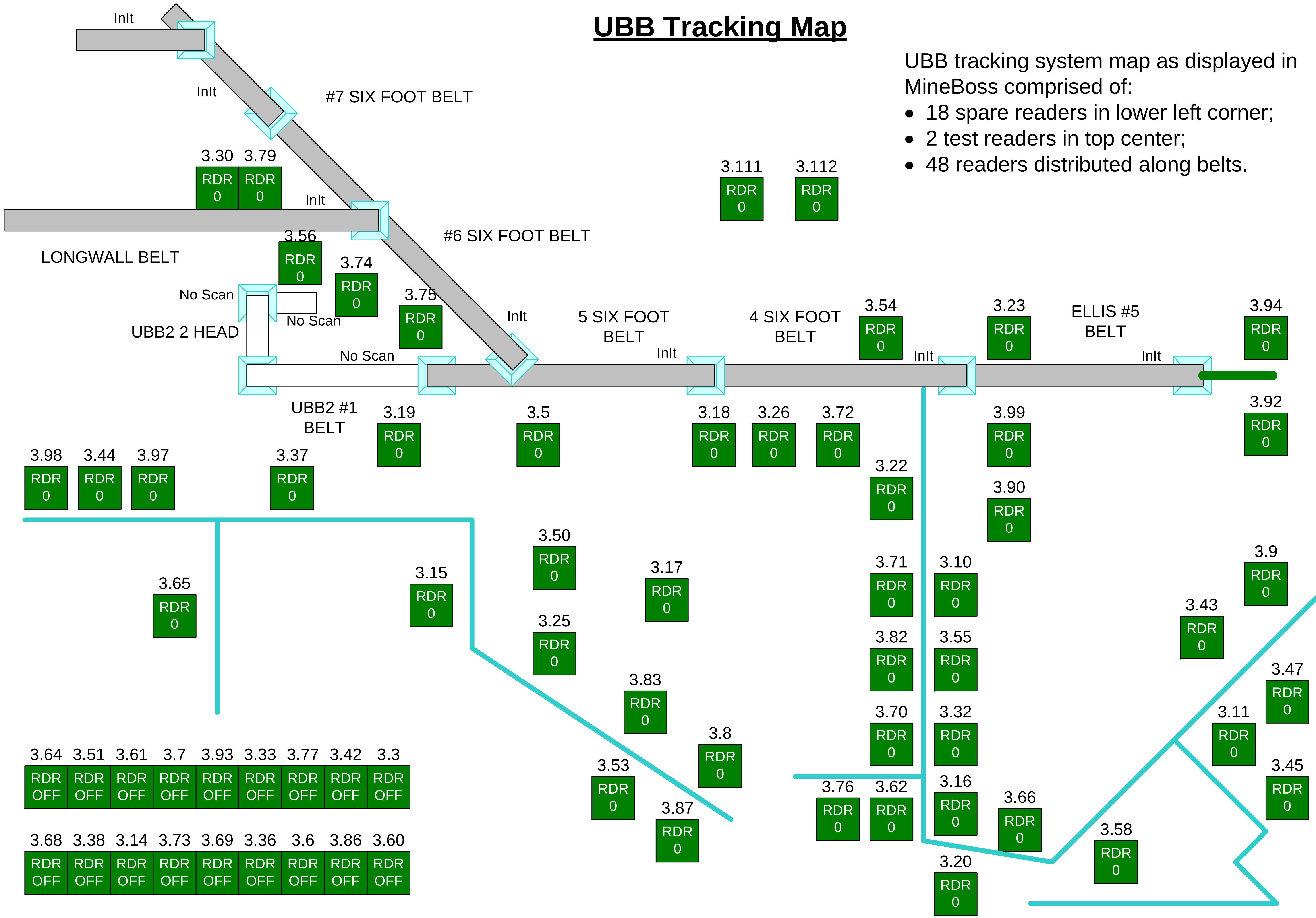
List of 118 Tags in Database

	tag_id	time	reader_address	resource_type	last_name	first_name	reader_label
100	313	4/5/2010 15:50	15420.3.87..0	personnel	Williams	Danny	South Track Portal
101	327	4/5/2010 15:58	15420.3.87..0	personnel	Lucas	James	South Track Portal
102	762	4/5/2010 15:58	15420.3.1..0	personnel	Lambert	Denver	North Track Portal
103	789	4/5/2010 16:05	15420.3.87..0	personnel	Williams	Josh	South Track Portal
104	108	4/5/2010 16:08	15420.3.87..0	personnel	Reed	Jeremy	South Track Portal
105	103	4/5/2010 16:22	15420.3.87..0	personnel	Earls	Clifton	South Track Portal
106	118	4/5/2010 16:25	15420.3.87..0	personnel	Bishop	Bobby	South Track Portal
107	304	4/5/2010 16:32	15420.3.87..0	personnel	Lambert	Kevin	South Track Portal
108	814	4/5/2010 16:56	15420.3.1..0	personnel	Williams	Mitch	North Track Portal
109	573	4/5/2010 16:57	15420.3.87..0	personnel	Coalson	Kenneth	South Track Portal
110	545	4/5/2010 17:00	15420.3.87..0	personnel	Smith	Mike	South Track Portal
111	786	4/5/2010 17:01	15420.3.87..0	personnel	Hodge	Josh	South Track Portal
112	705	4/5/2010 17:39	15420.3.87..0				South Track Portal
113	795	4/5/2010 18:00	15420.3.87..0	personnel	Irvin	Jeremy	South Track Portal
114	105	4/5/2010 20:05	15420.3.1..0	personnel	Baker	Bobby	North Track Portal
115	283	4/5/2010 21:08	15420.3.87..0				South Track Portal
116	559	4/5/2010 21:47	15420.3.87..0	personnel	Stewart	Lacy	South Track Portal
117	701	4/5/2010 23:43	15420.3.87..0	personnel	Bowyer	Jim	South Track Portal
118	721	4/5/2010 23:57	15420.3.1..0				North Track Portal

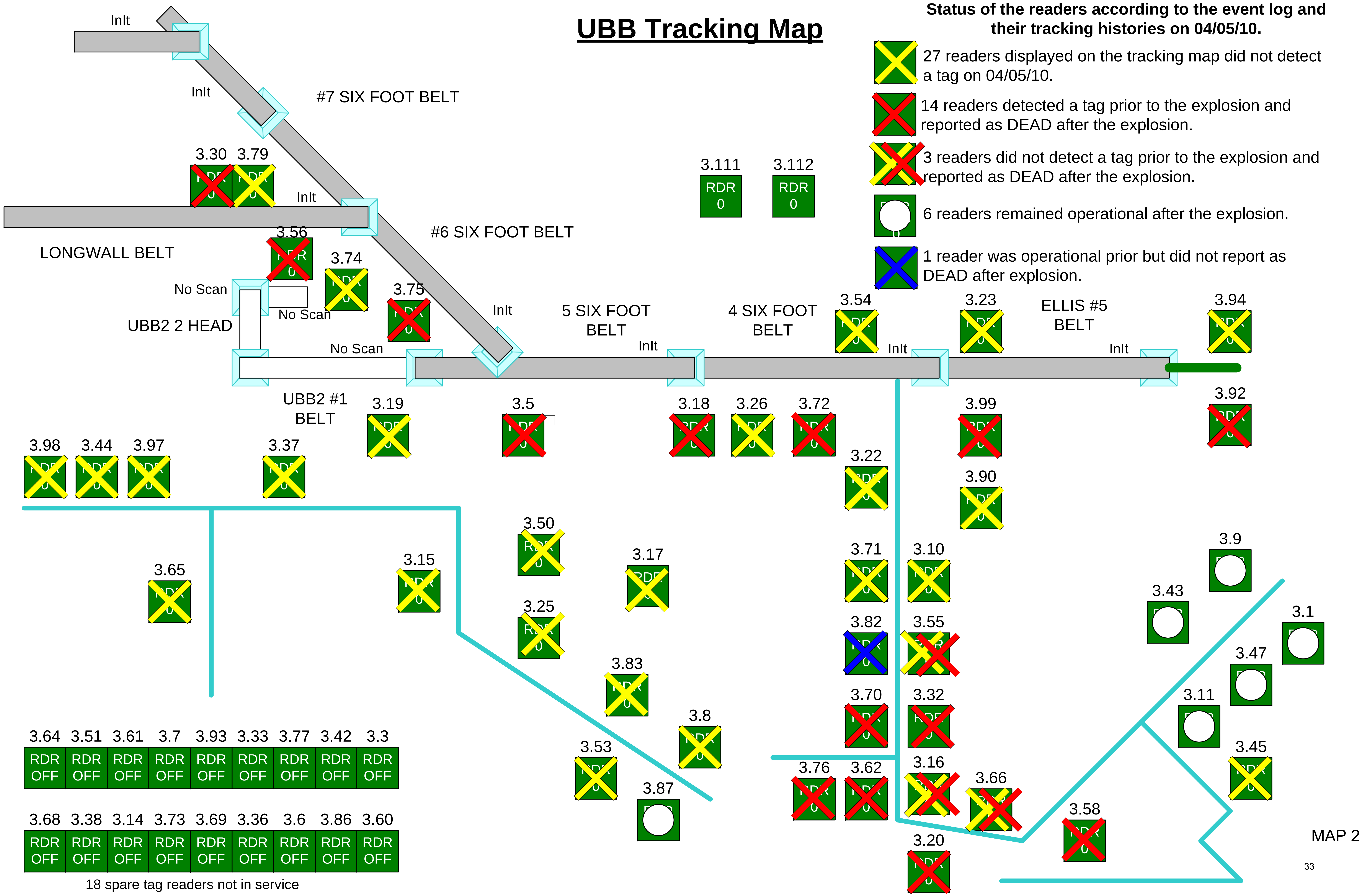
UBB Tracking Map

UBB tracking system map as displayed in MineBoss comprised of:

- 18 spare readers in lower left corner;
- 2 test readers in top center;
- 48 readers distributed along belts.

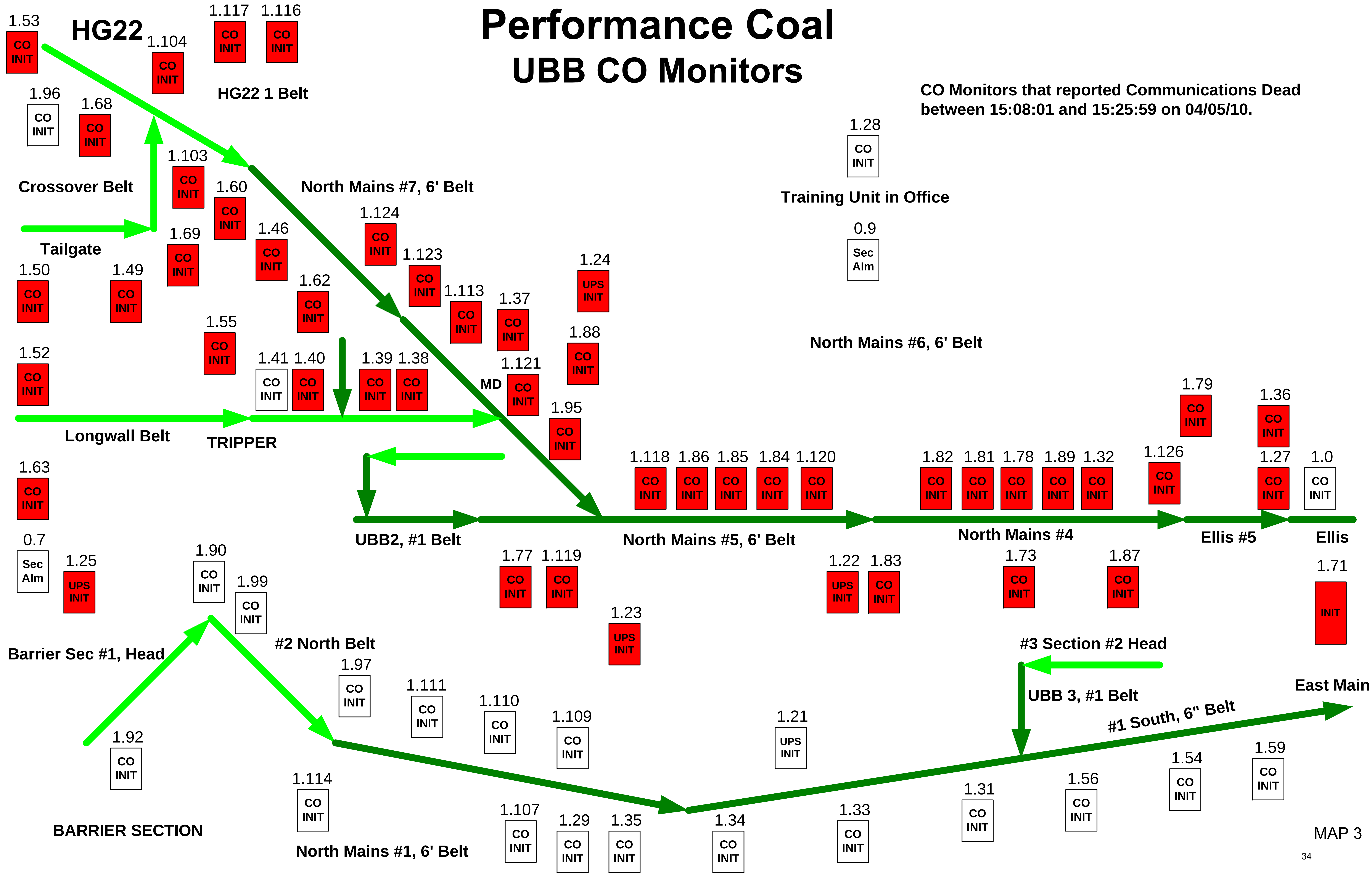


MAP 1


UBB Tracking Map
Status of the readers according to the event log and their tracking histories on 04/05/10.
27 readers displayed on the tracking map did not detect a tag on 04/05/10.
14 readers detected a tag prior to the explosion and reported as DEAD after the explosion.
3 readers did not detect a tag prior to the explosion and reported as DEAD after the explosion.
6 readers remained operational after the explosion.
1 reader was operational prior but did not report as DEAD after explosion.
#7 SIX FOOT BELT
#6 SIX FOOT BELT
LONGWALL BELT
UBB2 2 HEAD
UBB2 #1 BELT
5 SIX FOOT BELT
4 SIX FOOT BELT
ELLIS #5 BELT
InIt
No Scan
3.111
RDR 0
3.112
RDR 0
3.30
3.79
3.56
3.74
3.75
3.54
3.23
3.94
3.19
3.5
3.18
3.26
3.72
3.99
3.92
3.98
3.44
3.97
3.37
3.22
3.90
3.50
3.17
3.71
3.10
3.9
3.65
3.15
3.25
3.82
3.55
3.43
3.1
3.47
3.83
3.70
3.32
3.11
3.8
3.53
3.76
3.62
3.16
3.66
3.45
3.87
3.58
3.20
3.64
3.51
3.61
3.7
3.93
3.33
3.77
3.42
3.3
RDR OFF
3.68
3.38
3.14
3.73
3.69
3.36
3.6
3.86
3.60
18 spare tag readers not in service
MAP 2

Performance Coal
UBB CO Monitors

CO Monitors that reported Communications Dead between 15:08:01 and 15:25:59 on 04/05/10.



MAP 3

APPENDIX B – MSHA PERSONNEL INVOLVED IN THE INVESTIGATION

Mine Safety and Health Administration

Juliette Hill
Kevin Hedrick
Matthew Heightland
Stephen Dubina

APPENDIX AK

MINE EMERGENCY EVACUATION AND FIREFIGHTING PLAN

APPENDIX AK

MINE EMERGENCY EVACUATION AND FIREFIGHTING PLAN

Appendix AK

Mine Emergency Evacuation and Firefighting Program of Instruction

The plan is designed to instruct miners on all shifts in the procedures for mine emergencies that present an imminent danger to miners from fire, explosions, and inundations, and to evacuate all miners not required for a mine emergency response. The minimum contents stipulated by 30 CFR, § 75.1502 and § 75.1504 in an operator's program requires quarterly drills to be performed. There are four emergencies that have been determined to be imminent dangers to persons underground; training drills dealing with emergencies such as fires, water inundation, gas inundation, and explosions must be performed on a quarterly basis. The records for the five quarters preceding the explosion on April 5, 2010, show that no explosion drill training was conducted. Several miners commented during interviews that the drills they had participated in dealt with mine fires. No interviewees mentioned any other scenarios being covered. Employees are required to know the responsible person designated by the mine operator to take charge in a mine emergency. Also, they must be trained to use fire fighting equipment, locate emergency supplies, know the location of all mine communication devices, travel the escapeway routes, know how to use rescue alternatives or barricade, perform donning procedures of self-contained self-rescuers (SCSR), and understand their typical job assignments during an emergency.

A review of the operator's approved plans, records, and testimony was performed by the accident investigation team, which identified deficiencies in the operator's program. Emergency drill records provided by PCC for the five quarters preceding the explosion were reviewed, revealing that the operator had not only failed to develop a systematic means to insure that all miners received proper training during emergency drills, but had also failed to ensure that drills were being conducted. The records indicated that members of management conducting drills failed to cover the required topics in the Mine Emergency Evacuation and Firefighting Program of Instruction, approved on January 25, 2010. The program requires miners to receive training in the proper deployment of rescue chambers in every drill, but only three records provided by the operator, from the first quarter of 2009, indicated that the deployment of rescue chamber training occurred during the drills. The records provided no indication that any subsequent quarterly drills covered the subject. Several witnesses testified they were provided rescue chamber training during annual refresher training and did not mention any training received during quarterly drills. One employee was interviewed and testified:

> Q. Okay. And how about the refuge chamber, have you had any training on that?
>
> A. Yeah. Yeah, a couple times a year. (miner testimony)

The drill records have deficiencies that indicated a disregard by mine management for miners' safety. The operator is required to certify by signature and date that the training or drill was held in accordance with regulations. Mine management failed to ensure all miners were involved in the proper drills, and trained according to the approved programs. Miners were also not alternating travel between the primary and alternate escapeways from quarter to quarter. Examples of interviews with miners show a lack of proper training:

Q. So you're saying the last time you'd walked the primary escapeway is back before the longwall started?
A. Yeah, it was in '09.

Q. Have you participated in the quarterly evacuation drills from your assigned work area?
A. Uh-huh (yes).
Q. When was the last time?
A. Goodness gracious. It seems like it was like November maybe we walked out…

Q. When was the last time you traveled the primary escapeway? How many times did you travel?
A. Primary escapeway at UBB?
Q. Uh-huh (yes).
A. I couldn't even tell you

Q. I think at 78 Crosscut down here on the --- where you come to those four sets of doors right there?
A. Right.
Q. Okay. Did anyone or any people on a section ever talk about what would happen if those doors had left, been left open and a fire or something happened outby? Where would you all go since that was your intake escapeway?
A. No.

Q. And when was the last --- I know I'm jumping around here, but when was the last time that you traveled your primary escapeway?
A. I don't think I ever did that up there.
Q. Ever since you've been there you never --- didn't know your travelway, primary?
A. Well, just they showed us on the map. That was about it.

Q. Okay. Were there any drills or anything that they made you guys do, walking the intake escapeway coming out of the mine?
A. Yeah. There was one time that we had to do that. We had to leave the section early and walk the intake out.

Q. Do you remember approximately when that was?
A. No, I don't. I really don't

Q. Did you ever travel the intake escapeway?
A. Only thing I ever done relating intake is when I worked over Thanksgiving vacation, I helped put the leaky feeder system in, in the intake. But that was going down the main line.

Q. When was the last time you done an escapeway drill on the beltline?
A. That I recall, I don't know if we ever walked the beltline. I really don't recall.
Q. When was the last time you was down the beltline?
A. The farthest I ever went on the beltline was maybe walked the length of the monorail.

Since the explosion, the mine operator has been cited for failure to comply with the approved Mine Emergency Evacuation and Fire Fighting Program, failure to remove miners to safe areas when two consecutive carbon monoxide sensors indicated alerts, and for the failure to conduct drills according to 75.1504.

APPENDIX AL

SUMMARY OF EXAMINATION OF THREE REFUGE ALTERNATIVES

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

November 22, 2011

MEMORANDUM FOR NORMAN G. PAGE
Accident Investigation Team Leader

FROM: JOHN P. FAINI [signature] for
Chief, Approval and Certification Center

SUBJECT: Summary of Examination of Three Refuge Alternatives Located at Performance Coal Company's Upper Big Branch Mine–South

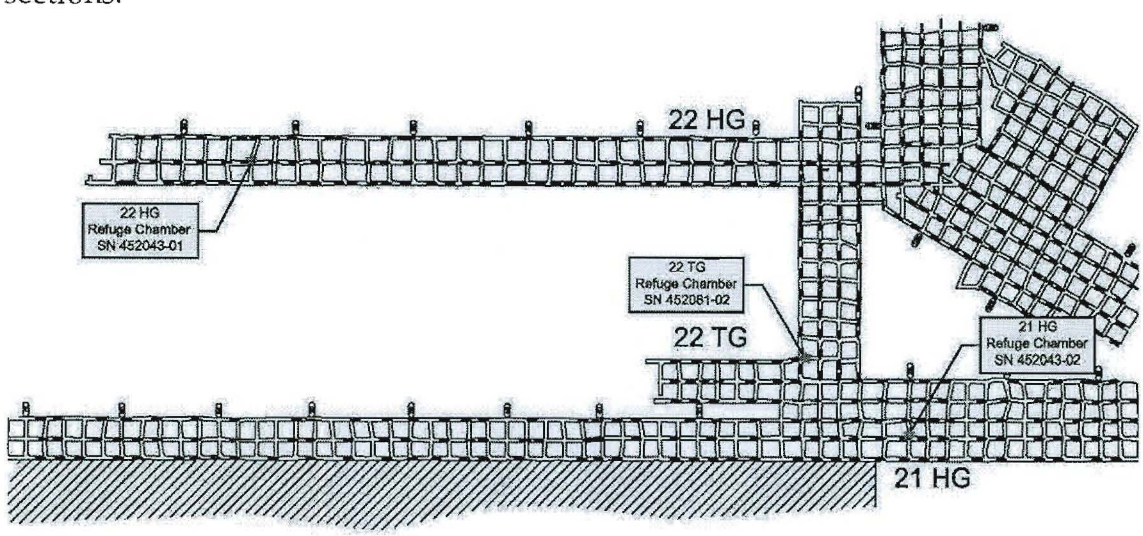
The Approval and Certification Center (A&CC), as requested by Upper Big Branch Mine Accident Investigation Team Leader, Norman Page, conducted an investigation of three Strata Portable Fresh Air Bay refuge alternatives placed into service prior to a fatal mine explosion on April 5, 2010 at the Upper Big Branch Mine-South. Although not part of the actual accident investigation, the purpose of these examinations was for fact finding and to determine the functionality of the refuge alternative, post event. On March 31, 2011, the examination of the three Strata Portable Fresh Air Bay refuge alternatives that are located at the Upper Big Branch Mine was conducted.

Background:
A refuge alternative is intended to provide a life-sustaining environment for persons trapped underground when escape is impossible. Refuge alternatives also can be used to facilitate escape by sustaining trapped miners until they receive communications regarding escape options or until rescuers arrive. MSHA considers refuge alternatives as a last resort to protect persons who are unable to escape from an underground coal mine in the event of an emergency.

The four "components" of a refuge alternative are 1) Structural, 2) Breathable Air, 3) Atmosphere Monitoring, and 4) Harmful Gas Removal. The *Structural Component* creates an isolated atmosphere and contains the other integrated components. Each refuge must be designed and made to withstand 15 pounds per square inch (psi) overpressure for 0.2 seconds and exposure to a flash fire for 3 seconds prior to deployment. The *Breathable Air Component* provides the breathable air to sustain each person for 96 hours. Breathable air shall be supplied by compressed air cylinders, compressed breathable-oxygen cylinders, or boreholes with fans installed on the surface or compressors installed on the surface. Only uncontaminated breathable air shall be supplied to the refuge alternative. The *Atmosphere Monitoring Component* provides persons inside the refuge alternative with the ability to determine the concentrations of carbon dioxide, carbon monoxide, oxygen, and methane, inside and outside the structure, including the airlock. The *Harmful Gas Removal Component* removes toxic gases from explosions and fires through purge air and also removes carbon dioxide produced by the occupants. The Strata Portable Fresh Air Bay utilizes an air motor powered by the compressed air and compressed oxygen to entrain airflow through soda lime cartridges, which removes the miners' exhaled carbon dioxide from the interior atmosphere.

Examination:
The Structural, Breathable Air, and Harmful Gas Removal Components of the Strata Fresh Air Bay refuge alternatives were examined for their ability to function after an emergency event. None of the units were deployed on April 5, 2010, the date of the explosion, and remained in the pre-event condition. The Atmosphere Monitoring Component was not expected to function during these examinations since battery life on the hand-held Solaris™ gas detectors would have expired, and the detectors had remained in place and not charged since the explosion.

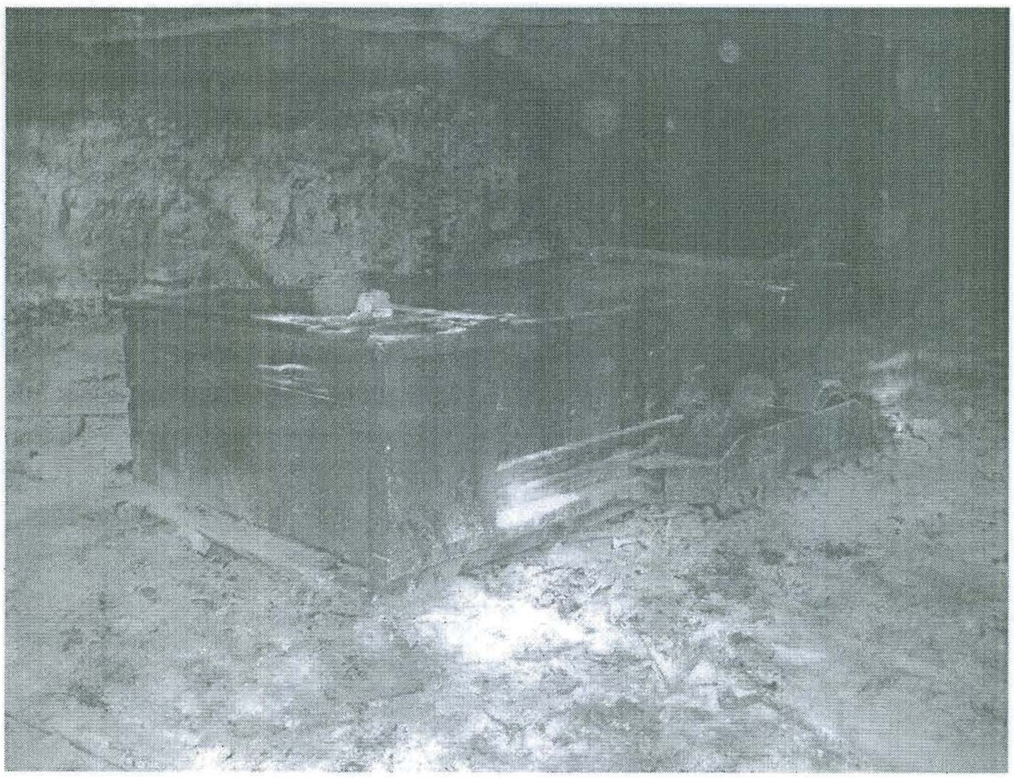
A team of 16 individuals from Strata Safety Products, MSHA, the State of West Virginia, the UMWA, and Massey travelled to each of the three refuge chamber locations to examine and deploy the chambers. The intent was to check the functionality of the chambers following the event of April 5, 2010. The units examined by the team were located in Headgate 21, Headgate 22, and Tailgate 22 sections.



Each refuge was first examined for physical damage to the exterior and representatives from Strata Safety Products conducted an inspection of the compressed gas systems which was observed by the team. After these inspections, Strata then performed a step by step procedure to deploy each unit which was observed by the team. The deployment included inflating the tent, activating the purge air system in the airlock, and activating the Breathable Air and Harmful Gas Removal components. The team then entered through the airlock into the tent. The air driven fan motor to the scrubber was turned on and adjusted without the chemical scrubbing agents being opened and used. The supply and provision caches which included chemical scrubbing cartridges, water, food, and spare parts were verified and checked for any damage.

Summary of the Examination / Deployment:

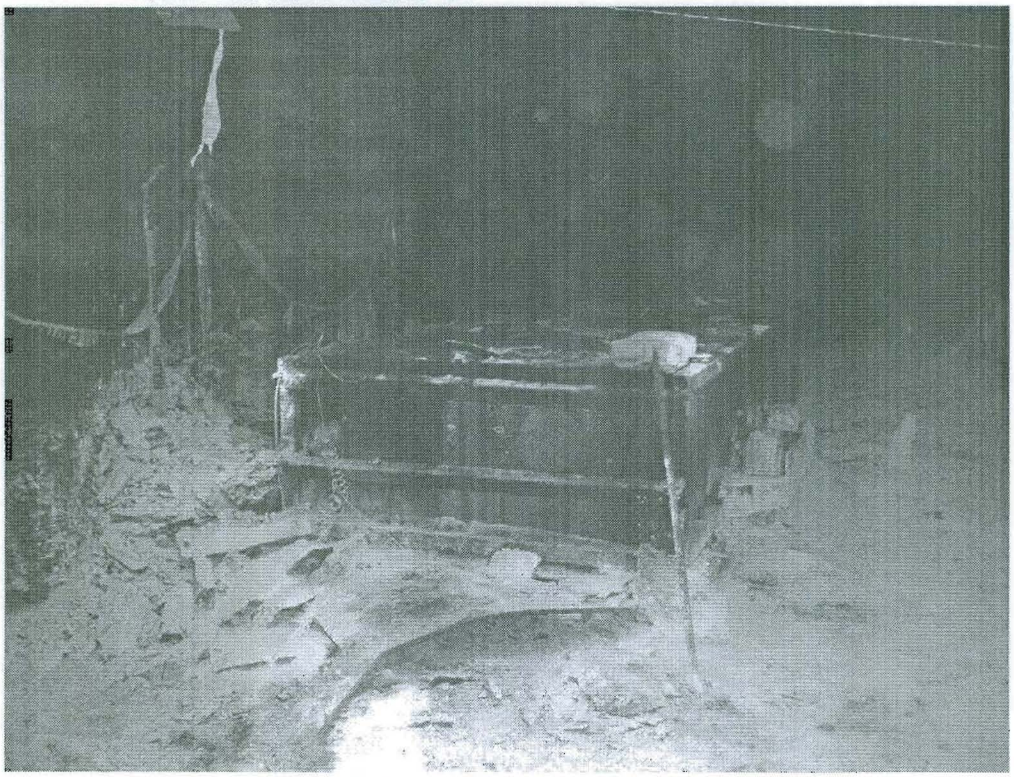
Location: **Headgate 21**
Strata Fresh Air Bay Model M2624-3.5
Serial Number 452043-02



- Side access door showed no visible damage.
- Solaris™ gas detector was located inside this side access door.
- Compressed gas cylinder pressures were within the manufacturer's specifications (4400-4600 psi).
- No corrosion or moisture in cylinder storage compartment.
- The tent inflated (approximately 4 minutes).
- Purge air system was functional.

- The CO2 scrubber fan motor started and ran. No scrubbing chemicals were used.
- The oxygen system functioned.
- The supplies were intact.

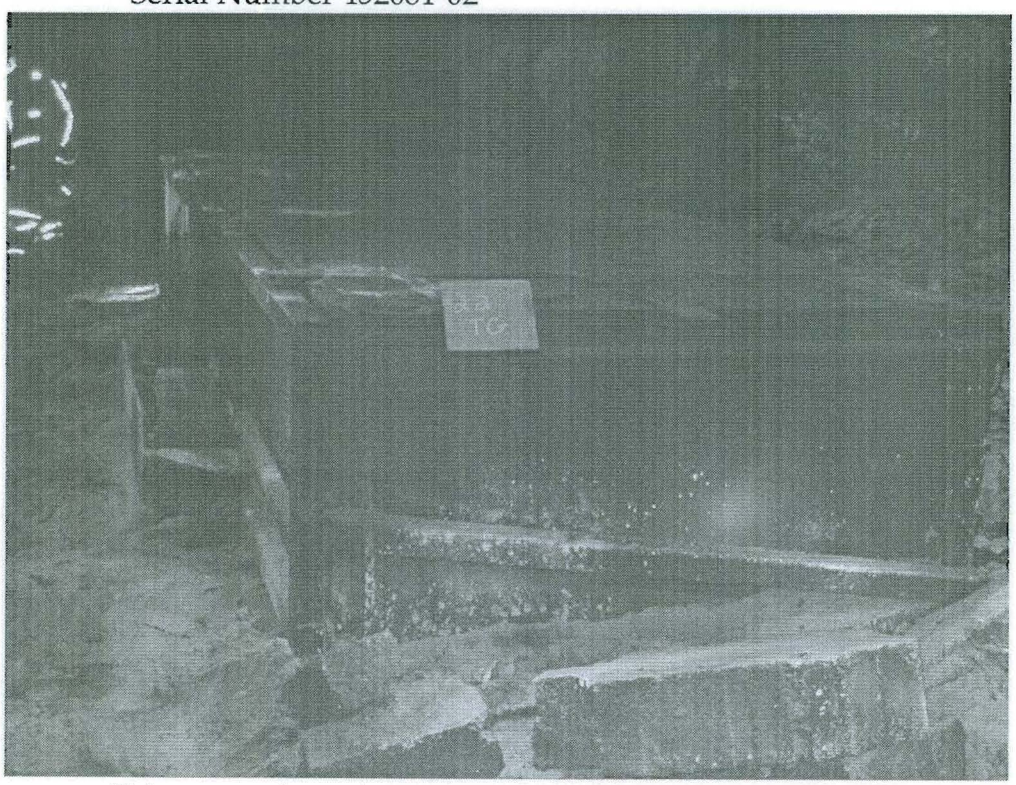
Location: **Headgate 22**
Strata Fresh Air Bay Model M2624-3.5
Serial Number 452043-01



- The unit appeared to have been under up to 20 inches of water. The water reportedly built up following the explosion and while the mine's pumps were not operated. The water was eventually pumped and the area was dry during the inspection.
- Side access door showed no visible damage and there was no evidence of moisture.
- There was evidence of heating on a plastic bag containing the hand-held gas detector stored in this compartment.
- Solaris™ gas detector was located in this compartment. It could not be determined if the detector would operate from the affects of the flash fire and heating due to the battery status. The detector had remained in place and had not been charged since the explosion. There was no visible evidence of damage or heat effects to the detector.

- A test was conducted at A&CC that exposed a similar Solaris™ gas detector stored in a plastic bag to 300° F for three seconds. The results of the test indicated that the plastic bag would deform, but the gas detector functioned as designed.
- Compressed gas cylinder pressures were within the manufacturer's specifications (4400-4600 psi) as read on gauges on the manifold.
- No corrosion or moisture was evident in cylinder storage location.
- A slate bar was required to assist in opening the tent deployment door because of debris on and around the unit, It was not determined as to when the material may have fallen from the adjacent rib either before or after the explosion.
- There was evidence of heating on the top corners of the tent storage compartment door. The seal showed no sign of heat damage.
- The tent inflated (approximately 4 minutes).
- Purge air functioned.
- The CO2 scrubber fan motor started and ran.
- The oxygen system functioned.
- The supplies were intact.

Location: **Tailgate 22**
Strata Fresh Air Bay Model M2624-3.5
Serial Number 452081-02



- Side access door showed no visible damage.

- No Solaris™ or other gas detector was located on this unit.
- Compressed gas cylinder pressures were within the manufacturer's specifications (4400-4600 psi).
- No corrosion or moisture was evident in cylinder storage location.
- The tent inflated. (approximately 4 minutes).
- Purge air system functioned.
- The CO2 scrubber fan motor started and ran..
- The oxygen system functioned.
- The supplies were intact.
- The tent deployment door would not open fully due to a rib roll. The tent was able to inflate and deploy around the door with no compromise.

Conclusion:
The three Strata Safety Products Portable Fresh Air Bays deployed as expected during the tests conducted on March 31, 2011. No tests were conducted beyond approximately 10 minutes of deployment and operation of the scrubber system without the chemicals being used. The systems were shut off and the tents were deflated following the examinations. The ability of the Strata refuge alternatives at the Upper Big Branch Mine to function as designed for 96 hours when occupied by the 20 miner maximum occupancy (as per the ERP) was not determined during these examinations.

APPENDIX AM

EXAMINATION AND TESTING OF SELF-CONTAINED SELF-RESCUERS (SCSRs)

Examination and Testing of Self-Contained Self-Rescuers (SCSRs) Recovered from the Upper Big Branch Mine Disaster

MSHA/NIOSH Report

November 18, 2011

Executive Summary

On April 5, 2010 an underground explosion at Performance Coal Company's Upper Big Branch (UBB) mine located in Raleigh County, West Virginia, did massive damage throughout large portions of the mine and created high concentrations of carbon monoxide (CO) in much of the mine atmosphere. Miners working in the UBB mine at the time of the explosion were equipped with the CSE SR-100, a NIOSH/MSHA-approved one-hour self-contained self-rescuer (SCSR) per Title 42, *Code of Federal Regulations*, Part 84, (42 CFR, Part 84) bearing approval TC-13F-0239. On April 12, 2011, the Mine Safety and Health Administration (MSHA) requested the assistance of the National Institute for Occupational Safety and Health (NIOSH) to investigate SR-100s recovered from the UBB mine after the explosion. This report summarizes the SCSR evaluations performed as part of the resulting investigative effort.

The forty-one units recovered from inside or outside the mine by MSHA mine-site investigators were viewed to fall into one of two categories. They were classified either as opened, or unopened. The unopened units are also referred to as intact. Eighteen SCSRs were classified as unopened and 23 SCSRs were classified as opened. Units recovered outside the mine included both unopened and opened SCSRs.

Three of four intact units tested on a Breathing and Metabolic Simulator (BMS) provided at least 60 minutes of respiratory support when consumed at a standard rate. The fourth unit lost its starter oxygen due to a manufacturing flaw and the test was terminated at approximately four minutes.

A combination of different recovery times, different storage conditions, and time elapsed since all the units had been recovered, hindered observations on the opened units, and greatly increased the difficulty of analysis. These factors essentially limited the conclusions that could be drawn for these units. Three of the opened units' conditions were consistent with use at a light to moderate rate of consumption and six of them exhibited characteristics consistent with use at a higher rate of consumption. The remainder of the opened units appeared to exhibit conditions more consistent with only being exposed to ambient atmosphere.

Background

MSHA's mine-site investigators collected the SR-100, SCSRs from the UBB mine. According to the MSHA mine-site investigators the SCSRs presented to NIOSH for evaluation came from a variety of locations. Most units were recovered from within the mine; however, a group of units that included unopened as well as opened units was recovered from a mantrip vehicle that had been brought out of the mine within 24 hours of the explosion. The units recovered from within the mine were not recovered until more than 60 days had elapsed from the time of the incident due to the need to follow standard mine rescue and recovery protocols in the aftermath of the explosion. At the time of collection, the MSHA mine-site investigators stored the recovered units in one of three ways. Some units were individually bagged in plastic, some were individually bagged in paper, and others were bagged collectively in large plastic bags. All bagged units were placed into large plastic storage boxes and held with other evidence in trailers.

MSHA maintained the chain of custody of all the SCSRs during all phases of this investigation. These apparatus are considered by MSHA and the other investigators as evidence in the UBB mine investigation. Prior to beginning the evaluations of the SCSRs, interested parties were invited to observe all evaluation activities. The only outside interested parties present to observe testing and examination were the United Mine Workers of America (UMWA) and CSE Corporation (hereafter referred to as CSE). Representatives of the UMWA and CSE were present for all of the testing and examination activities. No other interested parties attended at any time. The time frame for evaluating and testing was governed by circumstances and findings. The SCSRs were delivered to MSHA's facilities in Bruceton, Pennsylvania, on or about June 15, 2011. Laboratory evaluations began July 18, 2011, and were completed by August 9, 2011.

Objectives

1.) Inspect and catalog the condition of SR-100 units, as recovered during the MSHA investigation
2.) Evaluate the life support performance of SR-100 units in the as-received condition according to the established protocol (Attachment 1)

Methods

The evaluation of the recovered SR-100s was conducted at the NIOSH, National Personal Protective Technology Laboratory (NPPTL) facilities in Bruceton, Pennsylvania. The evaluation was conducted by NIOSH and MSHA personnel in accordance with a protocol established for this investigation (Attachment 1).

Inspection

Past experience with accident investigations has revealed that one of the most important products of the evaluation is an accurate visual record of the evidence. To this end, NIOSH and MSHA cataloged and created a visual record using digital photographs. Photographs were made of all SCSRs, as received, and the inspection of the SR-100s was documented with pictures as well. During this inspection, examiners assessed the condition of both external and internal system components. To the greatest extent possible, examiners inspected each SCSR according to the manufacturer's approved visual inspection criteria. (See Attachment 2) It was not possible to follow the manufacturer's inspection procedure completely on opened units. When the units are opened, the lids become separated from the SCSRs along with the closure straps which contain the serial number and manufacturing date. With the assistance of CSE, serial numbers of these units were determined according to the serial number of the oxygen starter assembly which is recorded on the body of the chemical canister portion of the unit. The closure or security strap also retains the heat indicator which falls away and is almost always lost when the unit is opened. All observable aspects of the manufacturer's visual inspection were noted where possible.

The opened SR-100s were subjected to a methodical disassembly, culminating with a visual assessment of the chemical bed. Due to the varying conditions of storage, collection and the amount of time that had elapsed since the units were collected, this assessment could only be used for gross determination of status. As the chemical bed is reacted and consumed, its appearance changes gradually. If the unit is disassembled within a short time of use, it is possible to compare the appearance of the chemical bed within the SCSRs under examination with those of SCSRs similarly evaluated under known conditions of use. Since the UBB units had been exposed to ambient atmosphere for an extended amount of time after being opened, or opened and used, any kind of graduated assessment due to additional reaction of the chemical from this exposure was obscured. However, because exposure to atmosphere only, as opposed to being exposed to use, followed by exposure to atmosphere, creates a different pattern of reaction within the chemical bed, it was possible to distinguish between units that had been breathed through before exposure to the atmosphere, and units that had been exposed only to the atmosphere after being opened. Additionally, among the units deemed to have been breathed through, it was possible to determine which units had likely been consumed rapidly, and which units had likely been consumed at a slower rate. Photos were used to document all visual assessments.

Only two of the 18 unopened SCSRs clearly passed all inspection criteria. These two SCSRs were found in a storage box which apparently protected them from the immediate effects of the explosion. Either through the effects of the explosion or from damage incurred prior to the explosion, the remaining 16 intact units failed visual inspection. It is not possible to determine if all of the negative indications observed were due to the explosion or existed prior to it.

The life-support capacity of the unopened SR-100s was assessed by means of a performance test using a Breathing and Metabolic Simulator (BMS). The BMS testing used on the unopened SR-100s can not be regarded as a direct substitute for human subject testing specified at 42 CFR, Part 84, but performance can be compared to other units tested using the BMS. For this test the BMS was set to extract 1.35 lpm oxygen, and inject 1.15 lpm carbon dioxide at a ventilation rate of 30 lpm. Units failing inspection are not expected to perform well, so for this reason, only two of the 16 unopened units failing inspection were performance tested along with the two passing all inspection criteria. Three of these units performed adequately when tested on the BMS. The fourth unit, one of the two which passed all inspection criteria lost its charge of starter oxygen due to a metal shaving which was interfering with an O-ring seal in the starter mechanism. This unit could only have been used in manual- or cold-start mode.

For the intact SCSRs evaluated on the BMS, the full manufacturer's inspection could be conducted including the ASMD (Acoustic Solids Movement Detector) test. (See Attachment 3) The ASMD test analyzes the noise induced in the unit by moving it. The noise produced by the SCSR when shaken is used as an indicator of shock and vibration damage incurred by the chemical bed within the SCSR. In the field, this assessment is made using a hand-held instrument provided by CSE. In the laboratory it is made using a more sophisticated set of instrumentation which includes a small anechoic chamber. Neither of these assessment techniques could be conducted on the opened SCSRs, but the laboratory ASMD method was applied to each of the unopened SR-100, SCSRs which were performance tested. Excessive noise as evaluated by either of the test instruments is an indication of chemical-bed damage that may adversely affect the performance of the SCSR. SCSRs which fail the ASMD test, also fail inspection. The two units found in the storage container exhibited ASMD values of 18dB, and the two which failed visual inspection exhibited ASMD values of 53dB and 41dB. All of these were within the 60dB cutoff to pass the ASMD test.

Findings

Exceptional or notable findings are as follows:

Unopened-units:

1.) Sixteen of the eighteen unopened units failed visual inspection for various reasons.

2.) When tested on the BMS, one of the unopened SCSRs lost its startup oxygen as a result of a metal shaving interfering with an O-ring seal on the starter mechanism. This unit could only have been used in manual- (or cold-start) mode. It is not possible to manually start the SCSR in strict accordance with the CSE Users' Instructions (Attachment 2, page 14) when testing on the BMS. Therefore, the test was discontinued as soon as the unit failed to provide enough volume for the simulator to inhale, which occurred about four minutes into the test.[1]

3.) The other three tested units performed adequately.

Detailed findings are documented in Table 1, and each of the examined units is illustrated in Attachment 4.

Findings regarding the opened units must be tempered by the knowledge that all of the units had been exposed to ambient atmosphere for over a year by the time they were presented to NIOSH for investigation and the subsequent evaluations. The chemicals

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[1] In light of information gathered during an extensive investigation of the SR-100 oxygen starter mechanism, this defect was seen to be an anomaly. This finding represents the sole observation.

contained in the units are designed for one-time use which is meant to occur immediately after the unit is unsealed. Once unsealed, chemical reactions will proceed regardless of whether the unit is donned by a user or not. However, the pattern of reaction will be different between a unit that is unsealed and donned and one that has simply been unsealed. That difference will be more obvious the sooner the evaluation occurs relative to the time the unit was first unsealed or opened. After a long enough time has passed, any differences between the two conditions will become completely obscured by the continued reaction of the chemicals. Certain assumptions have been made in an effort to most effectively conduct the unit inspections and subsequent life-support assessments. These assumptions can be characterized as follows:

1.) Circumstances of collection were therefore assumed to provide guidance for evaluation.
    a. Given that units were collected under, in broad terms, three different sets of circumstances: outside the mine, inside the mine in various locations, inside the mine in isolated pairs, it is assured that they were exposed to differing environments. However, it is assumed that any two units collected under a similar set of circumstances were exposed to essentially the same post-explosion environments. For example, two units which remained underground during the early phases of mine recovery both laid at random spots on the mine floor. The working assumption is that neither of them was lying in a puddle of water for any portion of that time.
    b. Given that units were collected at different times, and packaged for retention in different ways (i.e. plastic, paper, bulk), the assumption is that the units were all stored in the same area, and exposed to the same temperature and humidity environment between the time they were collected by MSHA and evaluated under this investigation.
2.) In the case of the most degraded units, it was assumed that similar external appearance could be relied upon as a good indicator of internal appearance. This was most important, and the prevailing assumption, for units thought to have been used quite heavily according to their external appearance. Because they were so heavily contaminated with an extremely caustic effluent of reaction (consistent with high use), only one of them was dismantled to affirm the observation of heavy use.

Under these assumptions, the units were evaluated in groups focused on similar collection circumstances. The notable or exceptional observations and associated findings regarding the opened units are as follows:

1.) All twenty-three units were not received in standard deployed configuration; all units were either used, opened for use, or broken open by the forces of the explosion. Consequently, it is not possible to make a pass/fail judgment with regard to the required inspection criteria.
2.) The oxygen closures of twenty opened SCSRs had punctured which indicates that the units had been activated prior to being received for inspection. This

determination was made by examining the start-up closure, a frangible disc, of each compressed oxygen container. Despite this finding, there is no method to verify that oxygen flowed into the units from the start-up containers.
4.) Six of the open units are in a condition that one would expect of units that had been consumed rather vigorously and rather completely.
5.) Three of the open units are in a condition more consistent with units that had been consumed rather slowly, but also rather completely.
6.) The remaining 14 units are in a condition more consistent with units that had been opened, but remained unused (i.e. not breathed through).
7.) Two of the 14 units mentioned in 6.) were judged to have been forced open by the explosion and showed no signs of attempted use. These units served as a rather useful reference point.

Table 2 is the complete listing of findings regarding the opened units.

Exhibit #	Recovery Location	SN	MFR Date	Visual Inspection	ASMD	Notes	Life Support Duration
PE-0039-a	Inside	224160	Oct-08	Pass	Pass	Found in a storage container	Lost starter oxygen due to a burr on the starter plunger. Test stopped at 4 minutes.
PE-0039-b	Inside	228283	Nov-08	Pass	Pass	Found in a storage container	66 Minutes
A-02-A	Outside	227015	Oct-08	Fail	Pass	Heat indicator red	66 Minutes
PE-0088	Inside	133640	Jun-06	Fail	Pass	Shows signs of heat/soot	63 Minutes

Table 1 - Index of performance-tested units

Exhibit #	Location	Serial Number	MFR Date	Oxygen Activated	Notes	Overall Condition Consistent with use? Yes/No	Spent KO_2	Oxygen consumption rate
PE-0101	Inside	228539		Yes	Bagged in a paper bag - Caustic leakage evident S/N 228539 (from CSE)	Yes	Complete	High
PE-0198	Inside	139549		No observation	Bagged in a paper bag - Caustic leakage evident S/N 139549 (from CSE)	Yes	External observation only	No observation
PE-0197	Inside	139529		No observation	Bagged in a paper bag - Caustic leakage evident S/N 139529 (from CSE)	Yes	External observation only	No observation

PE-0108	Inside	139590		No observation	Bagged in a paper bag - Caustic leakage evident S/N 139590 (from CSE)	Yes	External observation only	No observation
PE-0110	Inside	139494		No observation	Bagged in a paper bag - Caustic leakage evident S/N 139494 (from CSE)	Yes	External observation only	No observation
PE-0111	Inside	228242		No observation	Bagged in a paper bag - Caustic leakage evident S/N 228242 (from CSE)	Yes	External observation only	No observation
PE-0130	Inside	238802	Feb-09	No	Bagged in plastic - No caustic leaking evident	No	Partial	NA
PE-0037	Inside	136909		Yes	Bagged in plastic - No caustic leaking evident, Bottle no. 48043	No	Partial	NA
PE-0027	Inside	228246		Yes	Bagged in plastic - No caustic leaking evident S/N 228246 (from CSE)	No	Partial	NA
PE-0053	Inside	137539		Yes	Bagged in plastic - Caustic leakage evident S/N 137539 (from CSE)	Yes	Complete	Low
PE-0046	Inside	179857		Yes	Bagged in plastic - No caustic leaking evident, Bottle no. A95255	No	Partial	NA
PE-0055	Inside	194266		Yes	Bagged in plastic - No caustic leaking evident S/N 194266 (from CSE)	No	Partial	NA
PE-0025	Inside	179758		Yes	Bagged in plastic - No caustic leaking evident S/N 179758 (from CSE)	No	Partial	NA
PE-0131	Inside	228439	Nov-08	No	Bagged in plastic - No caustic leaking evident	No	Partial	NA
A-02-B	Outside	201117		No	Bottle #A120126 Bagged collectively -No caustic leaking evident S/N 201117 (from CSE)	No	Partial	NA
A-02-C	Outside	228295		Yes	Bottle #A148070 Bagged collectively - No caustic leaking evident S/N 228295 (from CSE)	No	Partial	NA
A-02-D	Outside	179813		Yes	Bottle #A95080 Bagged collectively - No caustic leaking evident S/N 179813 (from CSE)	Yes	Complete	Low
A-02-E	Outside	228270		Yes	Bottle #A148553 Bagged collectively - No caustic leaking evident S/N 228270 (from CSE)	No	Partial	NA
A-02-F	Outside	228299		Yes	Bottle #A149998 Bagged collectively - Caustic leakage evident S/N 228299 (from CSE)	Yes	Complete	Low
A-02-G	Outside	179728		Yes	Bottle #A91663 Bagged collectively - No caustic leaking evident S/N 179728 (from CSE)	No	Partial	NA
A-02-H	Outside	180099		Yes	Bottle #A95444 Bagged collectively - No caustic leaking evident S/N 180099 (from CSE)	No	Partial	NA

A-02-I	Outside	179804		Yes	Bottle #A93445 Bagged collectively -No caustic leaking evident S/N 179804 (from CSE)	No	Partial	NA
A-02-J	Outside	179843		Yes	Bottle #A97114 Bagged collectively - No caustic leaking evident S/N 179843 (from CSE)	No	Partial	NA

Unit determined to have been opened by force of explosion
Unit identifiers beginning with "A" were assigned by NIOSH during the investigation at Bruceton

Table 2 - Index of opened units

This inspection and testing of respirators from Upper Big Branch was done at the request of MSHA as part of its investigation of the mine disaster. NIOSH and MSHA were not able to conduct an evaluation of respirators recovered from the Upper Big Branch mine accident site for more than a year after the accident. Those examining the units were limited in their ability to fully evaluate the respirators by the impact of the explosion on the units and the length of time following the explosion before the respirators could be examined and tested. Given these limitations, those examining the units exercised their best professional judgment and experience in presenting the findings in this report; but these findings should only be relied on and considered only within the constraints which limited their analyses.

Attachment 1
Evaluation Protocol

Investigation Protocol for Self-Contained Self-Rescuers (SCSRs) Recovered from the UBB Mine Explosion
May 20, 2011

1.0 Background

1.1 The CSE SR-100 is an MSHA NIOSH approved 1-hr SCSR.

1.2 The SR-100 was deployed at the Massey UBB mine.

1.3 On April 5, 2010 an explosion occurred at the Massey UBB underground mine.

1.4 Selected SCSRs collected during the MSHA investigation will be visually inspected and tested.

1.5 These apparatus are considered by MSHA as evidence in their investigation.

2.0 General Considerations

2.1 MSHA will maintain the chain of custody while the units are undergoing investigation.

2.2 Parties to the testing of the apparatus are MSHA, and NIOSH. These Parties may permit others to observe this inspection and testing. The Parties will control the inspections and tests and the test conditions. The Parties will notify observers of the time and place of the inspections and tests, but may limit the number of observers who can be present.

2.3 Units will be opened and inspected in the presence of all Parties, and observers subject to the conditions specified in 2.2.

2.4 The role of the observers is simply to observe. They may not control the inspection and testing, or test scenarios. If at any time during inspection and testing observers are deemed to be interfering with, or influencing inspection and testing, they will be asked to leave.

2.5 No human subject tests will be conducted. Performance assessments will be conducted using a breathing and metabolic simulator (BMS). This testing is not to be regarded as a direct substitute for human subject testing specified in Title 42, Code of Federal Regulations, Part 84.

2.6 The time frame for inspection and testing will be governed by findings and the availability of supplies. Under the current understanding of the situation, inspection and testing could span several weeks. The Parties must be in agreement on the acceptability of any components or supplies needed for inspection and testing.

2.7 NIOSH and MSHA facility safety personnel will be informed of the intent to inspection and test, and may be asked to consult on the overall safety of the activity, and to observe the inspection and test procedures to assure facility and personnel safety.

2.8 In order to assure the safety of laboratory personnel, all reasonable efforts will be made to determine if any toxic substances are involved relative to the SCSRs. If such substances may be on the SCSRs, they will be sanitized. This is a standard precaution.

3.0 <u>Objective</u>

3.1 MSHA and NIOSH will conduct a joint investigation of the SCSR's used in the Massey UBB mine explosion.

3.2 The objectives are:

3.2.1 To inspect and catalog the condition of the apparatus, as delivered to NIOSH by MSHA.

3.2.2 To evaluate the life support performance of the apparatus (if possible).

4.0 <u>Method</u>

4.1 The investigation will be conducted at NIOSH, Bruceton Research Center, in NPPTL facilities.

4.2 Procedure

4.2.1 Catalog and create a visual record (digital photographs) of all SCSR's, as received.

4.2.2 <u>Inspection</u>

4.2.2.1 Sanitize any SCSRs that require such a procedure, and conduct a visual inspection according to manufacturer's instructions

4.2.2.2 Assess condition of breathing hose and bag, as well as other system components

4.2.2.3 Digital photographs will be used for visual record.

4.2.3 <u>Life Support</u>

4.2.3.1 Unopened units: Performance test on Breathing and Metabolic Simulator (BMS)

4.2.3.2 Opened units: Perform a visual inspection and assess condition of the chemical bed. NOTE: Assessment of the chemical bed condition should not be construed as an indication of the condition at the time of recovery from the mine due to the length of elapsed time from recovery until evaluation at NIOSH, NPPTL.

4.2.3.3 Document life support assessments with digital photographs as appropriate.

5.0 <u>Report</u>

5.1 Prepare and submit a report on the results of the investigation to the MSHA investigation team.

Attachment 2
CSE Users' Instructions
Donning Manual

CSE CORPORATION

Safety
Works

Corporate Headquarters
600 Seco Road
Monroeville, PA 15146
Phone: 412-856-9200
Fax: 412-856-9203
Email: customerservice@csecorporation.com
Website: www.csecorporation.com

SR-100 NIOSH/MSHA 03/03 Rev 2
SRX-206-H

March 18, 2003

CSE CORPORATION

SR-100

60 Minutes Self Contained Self Rescuer

Donning Procedures
for
Person-Wearable
Self Contained Self Rescuer

CSE CORPORATION

600 SECO ROAD, MONROEVILLE, PA. 15146, USA

(412) 856-9200

MODEL SR-100 SCSR

CLOSED-CIRCUIT, ESCAPE ONLY, SELF-CONTAINED BREATHING APPARATUS

THESE RESPIRATORS ARE APPROVED ONLY IN THE FOLLOWING CONFIGURATIONS:

RESPIRATOR COMPONENTS						
TC-	PROTECTION[1]	RESPIRATOR	ALTERNATE POUCHES			CAUTIONS AND LIMITATIONS[2]
		Q15-20-0000-6	Q15-20-9002-6	Q15-20-9069-6	Q15-20-9042-6	
13F-239	60 min/SC/ESC	X	X	X	X	JMNOS

1. PROTECTION

SC - Self-Contained
ESC - Escape

2. CAUTIONS AND LIMITATIONS

J - Failure to properly use and maintain this product could result in injury or death.

M - All approved respirators shall be selected, fitted, used, and maintained in accordance with MSHA, OSHA and other applicable regulations.

N - Never substitute, modify, add, or omit parts. Use only exact replacement parts in the configuration as specified by the manufacturer.

O - Refer to User's Instructions, and/or maintenance manuals for information on use and maintenance of these respirators.

S - Special or critical User's Instructions and/or specific use limitations apply. Refer to User's Instructions before donning.

Special User Instructions

(In accordance with Section "S" of the NIOSH cautions and limitations)

CSE CORPORATION Safety Works

SR-100 SCSR

Warranty Policy

CSE Corporation warrants to the original end-user purchaser this product to be free from defects in material and workmanship for 1 year from the date of purchase. During this period, CSE will repair or replace defective parts on an exchange basis. F.O.B. the factory at Monroeville, Pennsylvania. Freight charges to and from the CSE factory will be paid by the end-user purchaser. The decision to repair or replace defective parts shall be determined by CSE.

Validation: To validate this warranty, the registration card must be detached, completed and returned to CSE's offices within 30 days of purchase.

Conditions and Exclusions: To maintain this warranty, the purchaser must perform maintenance and inspection as prescribed in the owners manual and such other necessary care as may be required according to the use of the equipment in the reasonable judgment of CSE. Normal wear and tear, parts damaged by abuse, misuse, negligence, or accidents are excluded from this warranty. Purchaser acknowledges that, notwithstanding any contrary term or provision in the purchaser's purchase order or otherwise, the only warranty extended by CSE is the express warranty contained herein. PURCHASER FURTHER ACKNOWLEDGES THAT THERE ARE NO OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATIONS, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE; THAT THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF; THAT NO ORAL WARRANTIES, REPRESENTATIONS, OR GUARANTEES OF ANY KIND HAVE BEEN MADE BY CSE, ITS DISTRIBUTORS OR THE AGENTS OF EITHER OF THEM, THAT IN ANY WAY ALTER THE TERMS OF THIS WARRANTY; THAT CSE AND ITS DISTRIBUTORS SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING BUT NOT LIMITED TO INJURY TO THE PERSON OR PROPERTY OF THE PURCHASER OR OTHERS, AND FROM OTHER LOSSES OR EXPENSES INCURRED BY THE PURCHASER ARISING FROM THE USE, OPERATION, STORAGE, OR MAINTENANCE OF THE PRODUCT COVERED BY THE WARRANTY; THAT CSE'S LIABILITY UNDER THIS WARRANTY IS RESTRICTED TO REPAIR OR REPLACEMENT OF DEFECTIVE PARTS AT CSE'S SOLE DISCRETION. The warranty shall be void if the date and/or serial numbers affixed to the products by CSE are removed, obliterated, or defaced.

CSE Corporation, 600 Seco Rd. , Monroeville, PA. 15146 (412) 856-9200 or 1-800-245-2224

Part Number ________________ Serial Number______________________

SR-100 Warranty Statement 8/5/01

CSE CORPORATION

Safety
Works

SR-100
Warranty Registration

Date of Purchase ____________ Serial Number________________

Name________________________________Phone_______________

Company____

Address____

____

Mail or Fax SR-100 Warranty Card (412-856-9203)

Warranty is void unless registration card is completed and returned to CSE within 30 days of receipt of product.

SR-100 SAFETY GUIDELINES:

THIS MANUAL MUST BE READ COMPLETELY BY ALL INDIVIDUALS USING, INSPECTING OR PROVIDING TRAINING FOR THE CSE SR-100. The CSE SR-100 will perform as designed only if it is maintained and used in accordance with the manufacturer's instructions and regulatory standards. FAILURE TO FOLLOW THESE INSTRUCTIONS AND REGULATIONS COULD RESULT IN SERIOUS INJURY OR DEATH.

SAFETY GUIDELINES – DEFINITIONS

SAFETY TERMINOLOGY. The following symbols are utilized throughout this manual to help you recognize safety related to the SR-100.

WARNING – Indicates a potential hazardous situation which, if not avoided, **could** result in **death or serious injury**.

CAUTION – Indicates a potential hazardous situation which, if not avoided, **may** result in **minor or moderate injury**.

Warning: The CSE SR-100 has been designed by CSE and approved as an Escape Self Contained Breathing Apparatus (ESCBA) and should only be used to escape from atmospheres Immediately Dangerous to Life and Health (IDLH).

Warning: The CSE SR-100 is not approved for use as a Self Contained Breathing Apparatus (SCBA) and should not be used for rescue, fire-fighting or underwater breathing.

Warning: Before donning SR-100 remove any foreign matter from your mouth such as chewing tobacco or gum.

Warning: Breathing through the SR-100 differs from breathing ambient air; temperature and resistance will be slightly higher. This is normal during use and never warrants removal of the mouthpiece.

Warning: The user should be familiar with operational primary escape ways, secondary escape ways and SR-100 cache locations.

Warning; Never remove the mouthpiece unless you have reached fresh air or you are replacing the unit you are wearing with a reserve unit.

Warning: Do not attempt to talk while wearing SR-100, maintain a tight seal on mouthpiece and nose clip. Try to communicate via hand signals or writing.

SR-100 SAFETY GUIDELINES: Continued

Warning: Remove the SR-100 from service if any of the following conditions exist: top or bottom moisture indicator is not blue, the security seal is broken, the unit was exposed to temperatures above 130^{0}F as indicated by the temperature indicator being red, or shows indications of physical abuse(Crushed, burnt, visible puncture holes, substantial cracks dents, or any other visible signs of trauma.)

Warning: The unit must temporarily be removed from service if the internal temperature of the unit drops below 32^{0}F. Once the internal temperature rises above 32^{0}F the unit may be returned to service.

Warning: Never attempt to use a damaged SR-100, unit already removed from service or that does not meet inspection criteria.

Warning: The SR-100 is intended as a one time use only product, once the unit is opened it is considered spent and should be disposed of properly.

Warning: Avoid direct contact between the breathing bag and open flames or chemicals during use.

Warning: The SR-100 and carrying pouch should be kept clean. Do not submerge the SR-100 in water or use petroleum solvents to clean.

Warning: The SR-100 is approved with the SR-100 carrying pouch, any modification or substitution of this pouch should be removed immediately and replaced with an approved SR-100 pouch.

Warning: The user should perform the daily inspection of the CSE SR-100 prior to carrying the unit.

Warning: Only a trained and qualified individual may perform the 90 day inspection of the CSE SR-100.

Warning: Do not introduce petroleum based liquids or flammable liquids into the unit. The chemical (potassium super oxide) in this unit is not combustible but it can ignite flammable liquids when they come in contact.

NOTES:

APPENDIX III: ACCESSORIES

Part Number	Description
Q152000006	SR-100 SELF CONTAINED SELF RESCUER
Q152090026	SR-100 POUCH
X151590058	SUSPENDERS
X151590098	BELT, ULTRA SMALL 28" - 34"
X151590108	BELT, SMALL 30" - 37"
X151590118	BELT, MEDIUM 36" - 43"
X151590128	BELT, LARGE 39" - 45"
X151590138	BELT, X-LARGE 45" - 51"
X151590148	BELT,XX-LARGE 51" - 57"
X151590158	BELT, XXX-LARGE 56" - 62"
X151590398	TRAINING VIDEO
2170611001	ACOUSTICS SOLIDS MOVEMENT DETECTOR
2170612001	ASMD SPOT CHECKER
21706KIT01	ACOUSTICS SOLIDS MOVEMENT DETECTOR KIT

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SR-100

NIOSH/MSHA Approved

TC-13F-239

APPENDIX II:GLOSSARY

ASMD - Acoustic Solids Movement Detector

CO_2 - Carbon Dioxide

EGRESS - to go or come out

EPA - Environmental Protection Agency

ESCBA - Escape Self Contained Breathing Apparatus

IDLH - Immediately Dangerous to Life and Health

KO_2 - Potassium Super Oxide

LiOH - Lithium Hydroxide

MSHA– Mine Safety and Health Administration

NIOSH - National Institute of Occupational Safety and Health

O_2 - Oxygen

PWSCSR - Pearson Wearable Self Contained Self Rescuer

SCSR - Self Contained Self Rescuer

APPENDIX I: SR100 SPECIFICATIONS

	SR100
Weight: Carried	5.7 lbs./2.6kg
Weight: In Use	4.9lbs/2.2kg
Dimensions	7.75” x 4” x 5.5”
Deliverable Oxygen	3.5 ft.^{3}/100 Liters
Rated Duration (minimum)	60 Minutes
Method of Operation	Chemical based re-breather KO2/LiOH
Oxygen supply rate (liters per minute)	On Demand
Bag Volume (liters)	9+/-0.5
Storage Temperatures	32° — 130° F 0°— 54° C
Maximum Service Life	10 Years
Warranty	1 Year
Approvals	MSHA/NIOSH TC-13F-239

SR-100 INFORMATION

GENERAL DESCRIPTION

The CSE SR-100 provides the highest level of respiratory protection for workers who must perform duties in conditions classified as having the potential to be Immediately Dangerous to Life and Health (IDLH). The light weight, compact design of the CSE SR-100 make it ideal to be carried on an individual’s belt so that it can be donned in a matter of seconds in the event that the atmosphere changes to IDLH.

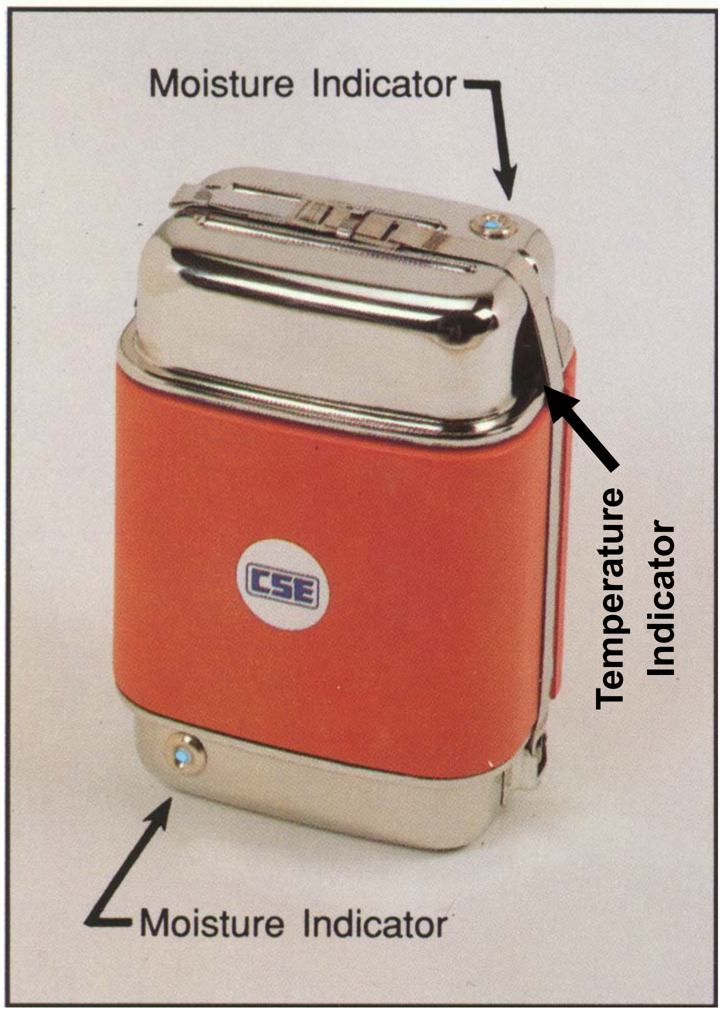
Approved as an Escape Self Contained Breathing Apparatus (ESCBA) the CSE SR-100 may also be referred to as Person Wearable Self Contained Self Rescuer (PWSCSR), rebreather or closed circuit breathing apparatus. The SR-100 recycles the user’s exhaled breath, chemically removing carbon dioxide and replenishing the oxygen based on the user’s demand or work rate. The unit uses a bi-directional chemical canister system in which the users exhaled breath makes two passes through the carbon dioxide absorption/oxygen generation canister before the gas returns to the user. This innovative technology provides the highest level of protection for potentially IDLH applications found in mining, tunneling, chemical plants, pulp/paper plants, water treatment plants, and confined space entry.

The CSE SR-100 provides 100 liters of useable oxygen in the event the user must escape from a potential IDLH atmosphere.

SR-100 FEATURES

Sealed Configuration
The SR-100 is enclosed in a rugged stainless steel case.

Moisture and Temperature Indicators



MAINTENANCE

Keep the SR-100 clean, especially around the moisture indicators and the Temperature indicator. Use a damp cloth to wipe clean. Do not clean SR-100 with petroleum based solvents. Avoid dirt build-up between the carrying pouch and the canister.

The Carrying Pouch should be cleaned periodically using mild laundry detergent in cold water and air dried.

DISPOSAL INSTRUCTIONS

Contact CSE Corporation, CSE Distributor or Licensed Hazardous Material Handler for disposal of SR-100.

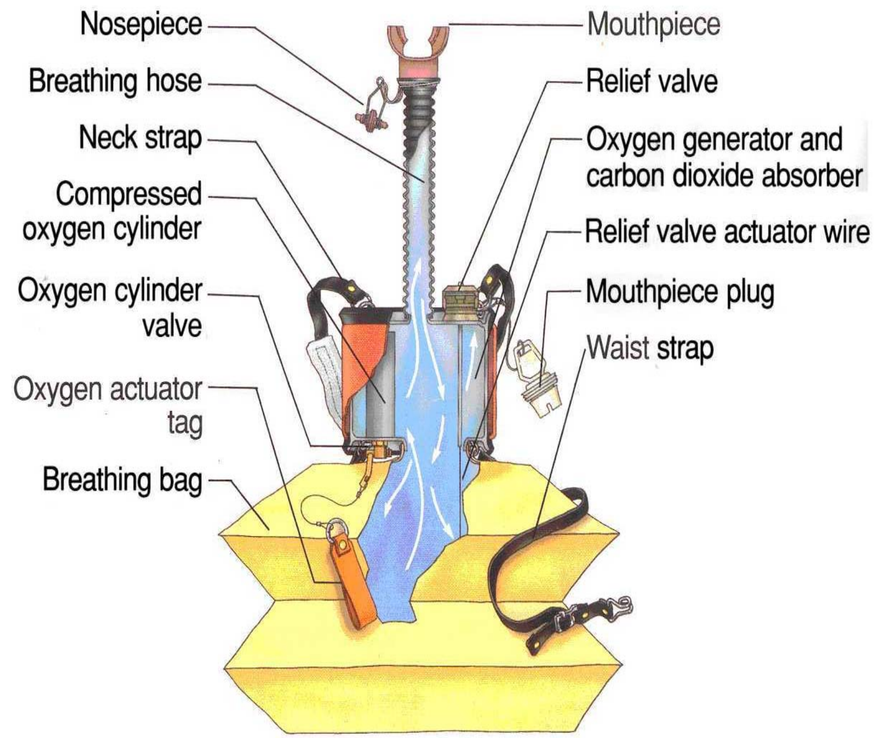
The EPA Hazardous Waste Classifications are:

D001, RQ, Potassium Superoxide, corrosive, 8, UN2466, PGI

D002, RQ, Potassium Superoxide, 5.1, N2466, PGI

Applicable state waste codes, codes that apply to conditions of the products use or specific Hazardous Waste Handler codes should be identified in accordance with federal, state and local regulations.

SR-100 Internal Components



SR-100 OPERATION

Donning from Kneeling Position

Remove SR-100 from carrying pouch and place it on the ground in front of you.

If equipped with a hard hat and lamp place it on the ground in front of you so that the light shines on the SR-100.

Unfasten the pull tab of the security band located at the top of the unit and place your pointer finger through the loop while placing your opposite hand on the top of the unit.

Now pull the tab toward you while pressing with the other hand against the top of the unit. As the security band is released the top and bottom covers can be removed.

Loop the neck strap over your head. Do not adjust the strap until you have completed the donning procedure.

Donning from Standing Position

Remove SR-100 from carry pouch and cradle the unit in one hand.

With the free hand unfasten the pull tab of the security band located at the top of the unit and place your pointer finger through the loop.

While firmly cradling the unit in your opposite hand pull the tab toward you. As the security band is released the top and bottom covers can be removed. Hold on to the goggles.

Loop the neck strap over your head. Do not adjust the strap until you have completed the donning procedure.

SHIPPING PROCEDURES: Continued

When preparing SR-100 packages for transportation by Cargo Aircraft the packages must be plainly marked with the above information and the following statement:

THIS PACKAGE IS NOT AUTHORIZED FOR TRANSPORTATION ABOARD AIRCRAFT IF IT HAS BEEN OPENED.

If you have any question regarding shipping procedures please call CSE Corporation Customer Service at 1-412-856-9200.

SHIPPING PROCEDURES

The CSE SR-100 is a Chemical Oxygen Generator, therefore it is classified as Hazardous Material by the U.S. Department of Transportation and United Nations Dangerous Goods. All SR-100 shipments should be prepared by an individual trained in hazardous materials shipping regulations and shipped in approved packaging with appropriate markings, labeling, shipping documentation, placard and carrier specific requirements:

Proper Shipping Name................Chemical Oxygen Generator.
Approval ....CA 9912010
Hazard Class...5.1
Subsidiary Risk...N/A
UN Number..3356
Packing Group...II
SR-100 Net quantity of hazardous materials per ..……0.6 kg

When preparing SR-100 packages for transportation by Motor Vehicle, Rail Freight, and Cargo Vessel the packages must be plainly marked with the above information and the following statement:

THIS PACKAGE IS NOT AUTHORIZED FOR TRANSPORTATION ABOARD AIRCRAFT.

SR-100 OPERATION: Continued

Removing a difficult top or bottom cover

Normally the top and bottom covers are easily removed once the security band has been released. In the unlikely event that the covers do stick, they can be removed by following the procedures listed below.

The top cover can be removed by twisting it just as you would twist off the lid of a jar.

The bottom cover can be removed by standing on the security band after it has been released and pulling on the body of the unit.

Holding the unit firmly in both hands, tap the top or bottom cover against a solid surface to knock the cover off.

A screw driver or tool can be used to pry difficult covers off, take care not to puncture or rip the breathing bag and hose when using a tool.

3+3 DONNING PROCEDURES

The 3+3 DONNING PROCEDURES provide an efficient method for donning the SR-100. The first 3 Primary Steps are designed to quickly isolate the individuals respiratory system from potentially IDLH atmosphere. Properly trained the user should be able carry out the Primary Steps in approximately 10 seconds. The next 3 Secondary Steps are designed to make the necessary adjustments to the unit while the user is safely under oxygen.

The user must be proficient in the 3+3 DONNING PROCEDURE before entering the work place.

3 Primary Steps

1. Activate Oxygen
2. Insert Mouthpiece
3. Put on Nosepiece

3 Secondary Steps

4. Put on Goggles
5. Adjust Straps
6. Replace Hard Hat and Move Out

CSE SR-100 INSPECTION CRITERIA: Continued

Moisture Indicator

*PASS

*FAIL

* Actual color shade may differ slightly

Temperature Indicator

*PASS

*FAIL

* Actual color shade may differ slightly. Fail indicates unit has been subjected to temperatures exceeding 130°F.

CSE SR-100 INSPECTION CRITERIA: Continued

Check the Temperature indicator located on the security band, right side of top cover. The Temperature indicator is a dull white to dull pink under normal conditions.
Remove the unit from service if the Temperature Indicator turns to a bright red.

New SR-100 without carrying pouch and with approved carrying pouch.

The carrying pouch should be loose fitting so that the unit may be easily removed when needed in an emergency. See Maintenance for carrying pouch cleaning.

1. Oxygen

Pull the large fluorescent orange **oxygen actuator tag down** to activate the oxygen.

2. Mouthpiece

Remove the mouthpiece plug and immediately insert the **Mouthpiece** into your mouth, exhale into the unit first then start to **breathe normally.**

CSE SR-100
INSPECTION CRITERIA

DAILY VISUAL INSPECTION:

Readiness of the SR-100 is confirmed visually, at any time, by quickly checking the indicators and general condition of the unit prior to entering the workplace.

Check for the following items:

PASS **Remain in Service**	**FAIL** **Remove from Service**
Date of Manufacture, less than 10 years	Date of Manufacture, if date exceeds 10 years.
Security band is secure.	Security band has been become slack, unattached, or unfastened.
Top and bottom moisture indicators are blue. Temperature indicator, located on the side of the unit should be pink or white.	If the top and bottom moisture indicators of either indicator is white or pink or damaged do not attempt to use. If the temperature indicator, located on the side of the unit is red, do not attempt to use.
Top and bottom covers are properly aligned.	Top and bottom covers are jarred or misaligned.
Top and bottom cover seals are properly aligned.	Top and bottom cover seals are cut, split or displaced.
No signs of significant trauma	Signs of significant trauma (beyond normal wear and tear) such as substantial dents in the top and bottom covers or substantial dents, breaks or punctures in the orange plastic outer cover. If the unit has been crushed, burnt, or suffered any damage that cause the security strap to become slack , unattached, or unfastened.

DURATION:Continued

The degree of training and familiarity can affect the duration. The more training and experience the subject has with an SCSR, the more their breathing will be calm and controlled. If a subject is familiar with a particular escape way, it may improve the mechanics of their escape. The greater the training and familiarity, the greater the duration.

Talking can increase breathing resistance by allowing saliva to enter the breathing hose and possibly enter the canister. Minimizing talking and swallowing one's own saliva, the greater the duration.

Removing all non-essential carrying weight, the greater the duration.

All SCSR(s) place some limited stress on the user due to increased breathing resistance and an increase in the temperature of the inhaled breath. For this reason, it is always advisable to limit the level of physical exertion, if possible, while wearing any SCSR.

3. Nosepiece

Grip each tab of nosepiece and squeeze gently while pulling the two nose pads apart just enough to slip the **nosepiece** on to nose so that both nostrils are completely closed.

4. Put On Goggles

Put on safety **goggles**. Corrective lens may be worn over top of goggles by looping temples of glasses under goggle straps.

DURATION

The SR-100 is tested and approved by several approval/ certification laboratories. These approvals will carry different duration ratings based on the testing criteria of the particular testing laboratory. Each of these units provide a certain range of protection based on the factors listed below. The duration of ALL SCSR(s) will vary, depending on the user's oxygen consumption rate. In most circumstances, your SR-100 will provide approximately 1 hour of protection. However, there are a number of factors that can affect the user's oxygen consumption and duration. These are:

The amount of work required to escape affects the duration. Running, walking bent over, crawling or climbing a ladder for example will increase the work required to escape. Less work results in greater duration.

The physical condition or fitness of the user affects the duration. A high heart rate, age and percent of body fat suggest inferior levels of fitness. The more fit the user, the more efficient utilization of oxygen, permitting higher work rates or longer durations.

The user's fitness, weight, response to inspired carbon dioxide and tolerance to breathing resistance all affect the amount of oxygen required by the user. The more fit and the less weight, the greater the duration.

The user's breathing rate affects the duration. The rate can be increased by excitement and fear. The lower the breathing rate, the greater the duration.

MANUAL START PROCEDURES

The user can easily confirm that the oxygen starter system has released oxygen into the breathing bag by two observations.

Once the Oxygen Actuator has been pulled the user will hear a faint hiss of the oxygen being released from the bottle into the unit for a few seconds.

Second and more noticeable indication, the user will see the breathing bag fill as long as the mouthpiece plug is still inserted into the mouthpiece.

In the event the compressed oxygen starter does not activate or the oxygen vents through the mouthpiece because the plug is left out of the mouthpiece during activation, the user should manually start the unit.

1. Remove the Mouthpiece from your mouth. The nose piece should remain attached to the nose.

2. Inhale ambient air through the mouth.

3. Exhale into the mouthpiece to begin inflating the breathing bag.

4. Repeat this process 3 to 6 times until the breathing bag is full.

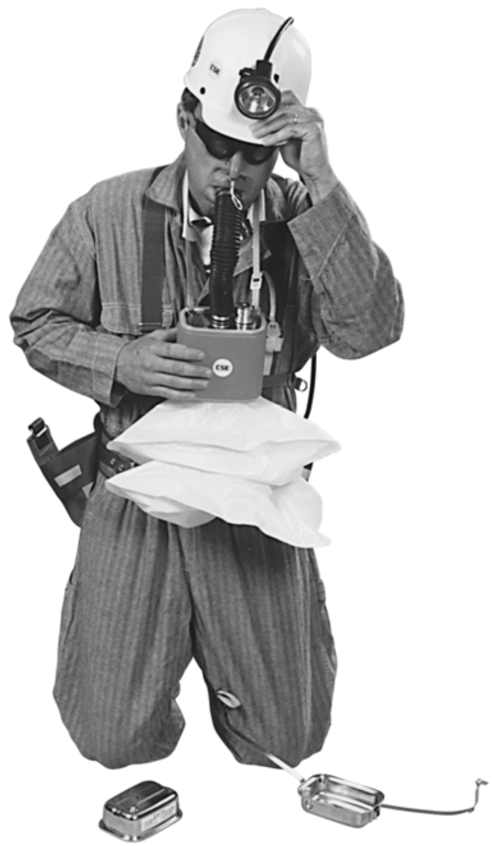
5. Continue with the 3+3 Donning Procedure.

6. Begin the egress by moving at a moderate work rate, allowing the breathing bag to inflate with the excess oxygen. Once the bag is full, you can then increase your egress to a more normal rate.

5.Adjust Strap

Neck Strap Adjustment. Proper adjustment can be checked by raising your head to look up. If you feel a pull on the mouthpiece, the unit is too low on your chest. Wrap the **waist strap,** which hangs from the bottom of the canister, around your waist and fasten it to the clip on the opposite side of the canister.

6. Replace Hat and Move out



Replace **hard hat** and **move out**.

* After donning your SR-100, discard any non-essential equipment, and/or gear, to minimize your carrying weight.

SECOND UNIT TRANSITION DONNING PROCEDURES

In most circumstances, your SR-100 will provide approximately 1 hour of protection enabling you to safely exit an IDLH atmosphere. However, there are a number of factors that can affect the user's oxygen consumption and duration (See pages 15 - 16 for **Duration**). While donning a second unit is procedurally the same as donning the first unit it is important for the user to be prepared to carry out this change over.

The user should be trained on **Second Unit Transition Donning Procedures.**

1. Access a second unit from cache at the earliest possible time during the egress.

2. Monitor time on first unit, the volume of the breathing bag and breathing resistance. Near the end of use, the breathing bag volume will become noticeably lower and/or the breathing resistance will become almost intolerable. At the end of use the user will be unable to draw any more oxygen from the system.

3. Change over to second unit following donning procedures while there is still volume to the breathing bag and resistance is still tolerable.

Attachment 3
CSE Users' Instructions
Daily and 90-Day Inspetions Manual

Safety
Works

Corporate Headquarters
600 Seco Road
Monroeville, PA 15146
Phone: 412-856-9200
Fax: 412-856-9203
Email: customerservice@csecorporation.com
Website: www.csecorporation.com

SR-100 ASMD 10/02 Rev 1
SRX-206-H

October 16, 2002

SR-100 SCSR

Daily Visual and 90 Day Inspection Criteria

ASMD
Instruction Manual

SR-100

NIOSH/MSHA Approved

TC-13F-239

CSE CORPORATION

Safety Works

ASMD

Warranty Policy

CSE Corporation warrants to the original end-user purchaser this product to be free from defects in material and workmanship for 1 year from the date of purchase. During this period, CSE will repair or replace defective parts on an exchange basis. F.O.B. the factory at Monroeville, Pennsylvania. Freight charges to and from the CSE factory will be paid by the end-user purchaser. The decision to repair or replace defective parts shall be determined by CSE.

Validation: To validate this warranty, the registration card must be detached, completed and returned to CSE's offices within 30 days of purchase.

Conditions and Exclusions: To maintain this warranty, the purchaser must perform maintenance and inspection as prescribed in the owners manual and such other necessary care as may be required according to the use of the equipment in the reasonable judgment of CSE. Normal wear and tear, parts damaged by abuse, misuse, negligence, or accidents are excluded from this warranty. Purchaser acknowledges that, notwithstanding any contrary term or provision in the purchaser's purchase order or otherwise, the only warranty extended by CSE is the express warranty contained herein. PURCHASER FURTHER ACKNOWLEDGES THAT THERE ARE NO OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATIONS, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE; THAT THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF; THAT NO ORAL WARRANTIES, REPRESENTATIONS, OR GUARANTEES OF ANY KIND HAVE BEEN MADE BY CSE, ITS DISTRIBUTORS OR THE AGENTS OF EITHER OF THEM, THAT IN ANY WAY ALTER THE TERMS OF THIS WARRANTY; THAT CSE AND ITS DISTRIBUTORS SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING BUT NOT LIMITED TO INJURY TO THE PERSON OR PROPERTY OF THE PURCHASER OR OTHERS, AND FROM OTHER LOSSES OR EXPENSES INCURRED BY THE PURCHASER ARISING FROM THE USE, OPERATION, STORAGE, OR MAINTENANCE OF THE PRODUCT COVERED BY THE WARRANTY; THAT CSE'S LIABILITY UNDER THIS WARRANTY IS RESTRICTED TO REPAIR OR REPLACEMENT OF DEFECTIVE PARTS AT CSE'S SOLE DISCRETION. The warranty shall be void if the date and/or serial numbers affixed to the products by CSE are removed, obliterated, or defaced.

CSE Corporation, 600 Seco Rd. , Monroeville, PA. 15146 (412) 856-9200 or

1-800-245-2224

Part Number _________________ Serial Number________________________

ASMD Warranty Statement August 5, 2001

Safety Works

ASMD
Warranty Registration

Date of Purchase ____________ Serial Number________________

Name________________________________Phone_______________

Company____

Address____

____

Mail or Fax ASMD Warranty Card (412-856-9203)

Warranty is void unless registration card is completed and returned to CSE within 30 days of receipt of product.

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SR-100 SAFETY GUIDELINES

THIS MANUAL MUST BE READ COMPLETELY BY ALL INDIVIDUALS USING, INSPECTING OR PROVIDING TRAINING FOR THE CSE SR-100. The CSE SR-100 will perform as designed only if it is maintained and used in accordance with the manufacturer's instructions and regulatory standards. FAILURE TO FOLLOW THESE INSTRUCTIONS AND REGULATIONS COULD RESULT IN SERIOUS INJURY OR DEATH.

SAFETY GUIDELINES – DEFINITIONS

SAFETY TERMINOLOGY. The following symbols are utilized throughout this manual to help you recognize safety related to the SR-100.

WARNING – Indicates a potential hazardous situation which, if not avoided, **could** result in **death or serious injury.**

CAUTION – Indicates a potential hazardous situation which, if not avoided, **may** result in **minor or moderate injury**.

Warning: The CSE SR-100 has been designed by CSE and approved as an Escape Self Contained Breathing Apparatus (ESCBA) and should only be used to escape from atmospheres Immediately Dangerous to Life and Health (IDLH).

Warning: The CSE SR-100 is not approved for use as a Self Contained Breathing Apparatus (SCBA) and should not be used for rescue, fire-fighting or underwater breathing.

Warning: Before donning SR-100 remove any foreign matter from your mouth such as chewing tobacco or gum.

Warning: Breathing through the SR-100 differs from breathing ambient air; temperature and resistance will be slightly higher. This is normal during use and never warrants removal of the mouthpiece.

Warning: The user should be familiar with operational primary escape ways, secondary escape ways and SR-100 cache locations.

Notes:

SR-100 SAFETY GUIDELINES: Continued

Warning; Never remove the mouthpiece unless you have reached fresh air or you are replacing the unit you are wearing with a changeover unit.

Warning: Do not attempt to talk while wearing SR-100, maintain a tight seal on mouthpiece and nose clip. Try to communicate via hand signals or writing.

Warning: Remove the SR-100 from service if any of the following conditions exist: top or bottom moisture indicator is not blue, the security seal is broken, the unit was exposed to temperatures above 130°F and the temperature indicator is red, or show indications of physical abuse (crushed, burnt, visible puncture holes, substantial cracks dents, or any other visible signs of trauma.)

Warning: The unit must temporarily be removed from service if the internal temperature of the unit drops below 32^0F. Once the internal temperature rises above 32^0F the unit may be returned to service.

Warning: Never attempt to use a damaged SR-100, unit already removed from service or that does not meet inspection criteria.

Warning: The SR-100 is intended as a one time use only product, once the unit is opened it is considered spent and should be disposed of properly.

Warning: Avoid direct contact between the breathing bag and open flames or chemicals during use.

Warning: The SR-100 and carrying pouch should be kept clean. Do not submerge the SR-100 in water or use petroleum solvents to clean.

SR-100 SAFETY GUIDELINES: Continued

Warning: The user should perform the daily inspection of the CSE SR-100 prior to carrying the unit.

Warning: Only a trained and qualified individual may perform the 90 day ASMD inspection of the CSE SR-100.

Warning: Do not introduce petroleum based liquids or flammable liquids into the unit. The chemical (potassium super oxide) in this unit is not combustible but it can ignite flammable liquids when they come in contact.

INSPECTION DATA LOG BOOK

		Indicators				
Serial No.	**Date**	**Top**	**Bottom**	**Tempera-ture**	**90-Day ASMD**	**Inspector's Name**
		Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	

INSPECTION DATA LOG BOOK

		Indicators				
Serial No.	Date	Top	Bottom	Tempera-ture	90-Day ASMD	Inspector's Name
		Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	

ACOUSTIC SOLIDS MOVEMENT DETECTOR (ASMD)

GENERAL DESCRIPTION

Designed to be used by SR-100 operators, the Acoustic Solids Movement Detector (ASMD) was created as a non-destructive method to detect changes in the chemical bed of the SR-100, either through misuse or normal wear and tear. Although, in most cases the trauma can be seen, there are times when the SR-100 does not show significant damage, therefore this manual is to be used as a reference guide for the proper usage and care of the SR-100.

By attaching the ASMD to the front center of the SR-100, a simple shake test can be performed by shaking the unit in an up and down motion, several times. A LED indicator on the ASMD will inform the user as to whether the unit passes the criteria to remain in service. Any unit which does not meet the criteria must be removed form service.

This Test is to be repeated on each SR-100 at least every 90-Days.

CSE SR-100 DAILY INSPECTIONS CRITERIA:

The carrying pouch should be loose fitting so that the unit may be easily removed when needed in an emergency.

New SR-100 without carrying pouch and with approved carrying pouch.

INSPECTION DATA LOG BOOK

		Indicators				
Serial No.	Date	Top	Bottom	Tempera-ture	90-Day ASMD	Inspector's Name
		Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	

INSPECTION DATA LOG BOOK

		Indicators				
Serial No.	**Date**	**Top**	**Bottom**	**Tempera-ture**	**90-Day ASMD**	**Inspector's Name**
		Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	

CSE SR-100 DAILY INSPECTION CRITERIA

DAILY VISUAL INSPECTION:

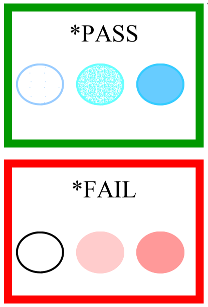
Readiness of the SR-100 is confirmed visually, at any time, by quickly checking the indicators and general condition of the unit prior to entering the workplace.

Check for the following items:

PASS **Remain in Service**	**FAIL** **Remove from Service**
Date of Manufacture, less than 10 years	Date of Manufacture, if date exceeds 10 years.
Security band is secure.	Security band has been become slack, unattached, or unfastened.
Top and bottom moisture indicators are blue. Temperature indicator, located on the side of the unit should be pink or white.	If the top and bottom moisture indicators of either indicator is white, pink or damaged do not attempt to use. If the temperature indicator, located on the side of the unit is red, do not attempt to use.
Top and bottom covers are properly aligned.	Top and bottom covers are jarred or misaligned.
Top and bottom cover seals are properly aligned.	Top and bottom cover seals are cut, split or displaced.
No signs of significant trauma. (Beyond normal wear and tear.)	Signs of significant trauma (beyond normal wear and tear) such as substantial dents in the top and bottom covers or substantial dents, breaks or punctures in the orange plastic outer cover. If the unit has been crushed, burnt, or suffered any damage that cause the security strap to become slack , unattached, or unfastened

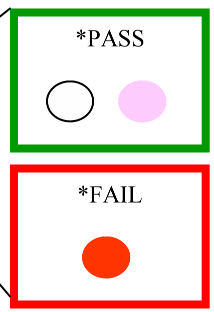
CSE SR-100 DAILY INSPECTIONS CRITERIA: Continued

Moisture Indicator



* Actual color shade may differ slightly

Temperature Indicator



* Actual color shade may differ slightly. Fail indicates unit has been subjected to temperatures exceeding 130°F.

INSPECTION DATA LOG BOOK

Where required by law or regulation, a responsible person should inspect the unit and record the findings in a log or data book. At minimum, the serial number, inspection date, indicator colors, and the inspector's name should be noted.

		Indicators				
Serial No.	**Date**	**Top**	**Bottom**	**Tempera-ture**	**90-Day ASMD**	**Inspector's Name**
		Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail	

APPENDIX II:GLOSSARY

ASMD - Acoustic Solids Movement Detector

CO_2 - Carbon Dioxide

EGRESS - to go or come out

EPA - Environmental Protection Agency

ESCBA - Escape Self Contained Breathing Apparatus

IDLH - Immediately Dangerous to Life and Health

KO_2 - Potassium Super Oxide

LiOH - Lithium Hydroxide

MSHA– Mine Safety and Health Administration

NIOSH - National Institute of Occupational Safety and Health

O_2 - Oxygen

PWSCSR - Pearson Wearable Self Contained Self Rescuer

SCSR - Self Contained Self Rescuer

CSE SR-100 DAILY INSPECTIONS:

Criteria for Units to Remain to Service

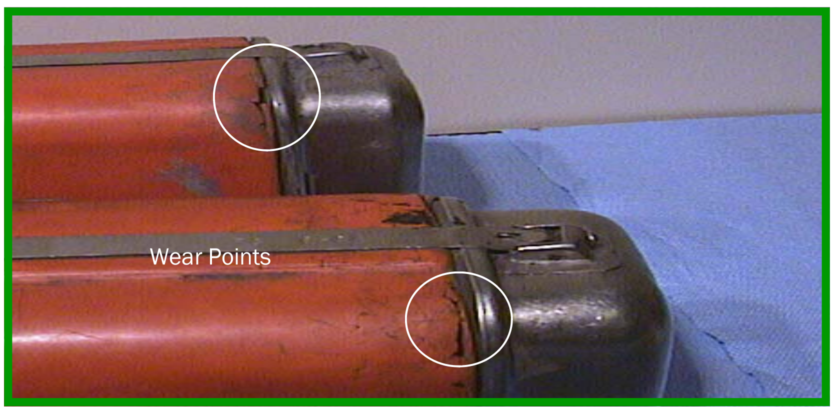
These three units have been in service for approximately six years and show the typical signs of normal wear and tear. The plastic dust covers are abraded on the corners and along the edges. There are also some dents in the top and bottom stainless steel covers.

However, the security bands are in place and the color indicators are blue, indicating no ingress of moisture. The two seals between the top and bottom covers and the chemical canister appear to be securely in place. These units pass the daily and 90-day visual inspection criteria.

CSE SR-100 DAILY INSPECTIONS:

Criteria for Units to Remain in Service

This unit's condition shows normal wear and tear. The abraded corner on the plastic cover and minor dent in the stainless steel top cover do not cause the unit to fail visual inspection. The unit may remain in service if it passes the remainder of the inspection.



These wear points are the result of abrasion and minor impacts that do not adversely affect the SR-100 performance. These units may remain in service if they pass the remainder of inspection criteria.

CSE SR-100 INSPECTION CRITERIA CONTINUED:

5. If the RED LED is visible only once or twice on the first or second shake or not at all the SR-100 may be returned to service. If the RED LED lights up consistently while shaking, the SR-100 must be taken out of service. Please remember to test the SR-100 in a smooth up and down motion rather than violently shaking the unit which could cause unrelated noises and give a false reading.

6. The ASMD is powered with a 9V, field replaceable, battery. If for some reason the power does not come on, replace the battery. To replace the battery, remove the battery compartment cover from the ASMD case, lift pad and remove the battery from the compartment and separate the snap connector from the battery. Connect a fresh 9V battery to the snap connector and wrap it within the foam cushion. Holding the foam tightly against the battery, replace the battery compartment cover. If the power still does not come on, return the ASMD to CSE for repair.

CSE SR-100 INSPECTION CRITERIA CONTINUED:

4. Hold the SR-100 firmly, placing one hand on the top and one hand on the bottom of the unit. Move the unit in a swinging up and down motion from shoulder to waist. This should be repeated four times in a smooth motion.

(look for the RED LED to flash on and off).

(2)Pictures showing the position of the hands/arms during the shake test.

CSE SR-100 DAILY INSPECTION:

Damaged Units, Remove from Service

Examples of damaged units.

All units displayed must be removed from service

Warning: Never attempt to us a damaged SR-100 or unit already removed from service.

CSE SR-100 DAILY INSPECTION:

Damaged Units, Remove from Service

Seals are protruding and security band out of alignment. Such conditions result from forceful impacts.

These units must be removed form service.

This unit has received a severe impact to its top cover. As a result, the top cover has a significant dent and the seal ring has been displaced.

This unit must be removed from service.

CSE SR-100 90 DAY INSPECTION CRITERIA CONTINUED:

90 DAY VISUAL AND ASMD INSPECTIONS CONTINUED:

3. Now your SR-100 is ready to be checked using the Acoustic Solids Movement Detector (ASMD). Check the readiness of the ASMD unit by first turning the ASMD unit on and tapping the case with your finger. This makes a noise causing the red failure indicator to flash on and off. This will confirm the ASMD power switch is on..

Picture showing location of Switch on the ASMD.

CSE SR-100 90 DAY INSPECTION CRITERIA CONTINUED:

90 DAY VISUAL AND ASMD INSPECTIONS:
This is the ASMD Test as detailed:

1. Remove your SR-100 from its carrying pouch.

If difficulty is experienced in getting the SR-100 into or out of its carrying pouch, it can be cleaned with clean, cool water and air-dried. Do not use harsh chemicals or detergents on the pouch or the SR-100 unit. If a pouch wears out and is no longer serviceable, it must be replaced.

2. Slide the harness of the ASMD over the top metal lid and down the orange casing until the straps fit around the lid and case of the SR-100 (Covering the round CSE sticker). Now pull the two Velcro straps firmly through the buckle to tighten the ASMD against the SR-100. Continue to tighten the two straps until the foam of the rubberized sound sensor is slightly compressed, then secure the straps by attaching the Velcro Sections.

Acoustic Solids Movement Detector Mounted on a SR-100

CSE SR-100 DAILY INSPECTION:

Damaged Units, Remove from Service

This unit fails the visual inspection because its seal has been displaced and is protruding from under the stainless steel cover.

This unit must be removed from service.

CSE SR-100 90 DAY INSPECTION CRITERIA:

ASMD SPOT CHECKER: Operating Instructions

The ASMD Spot Checker is used to check the calibration level of the Acoustic Solids Movement Detector (ASMD) making sure the ASMD's red LED comes on at the designated noise level.

Picture of the ASMD Spot Checker

1. To activate the ASMD Spot Checker, plug its power adapter into a 120V outlet, insert the cord from the power adapter into the bottom of the ASMD spot checker and turn on the switch located next to the plug at the bottom of the unit. A green LED will light up to show the power is on.

CSE SR-100 90 DAY INSPECTION CRITERIA CONTINUED:

ASMD SPOT CHECKER: Operating Instructions

2. With the power on you will hear an audible sound emitting from the ASMD Spot Checker. If the audible noise is not heard, return the ASMD Spot Checker to CSE Corporation for repair.

3. The ASMD Spot Checker should be returned to CSE every **six months** for calibration.

Checking ASMD with ASMD Spot Checker

1. Turn on the power switches of both the ASMD and the ASMD Spot Checker. Join the units at their rubber cones, squeeze the cones together so as to compress the foam pad attached to the ASMD rubber cone. At this time the red LED should be visible in the ASMD top panel. If the red LED is visible you are ready to begin using the ASMD. This check of the ASMD should be performed once each day you are going to evaluate SR-100's for noise.

2. If the red LED is not visible when tested with the ASMD Spot Checker, the ASMD must be removed from service and returned to CSE for repair.

Attachment 4
Illustrations

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Figure 22 - Unit PE-00130, as Received and Remaining Chemical 37
Figure 23 - Unit PE-0131, as Received 38
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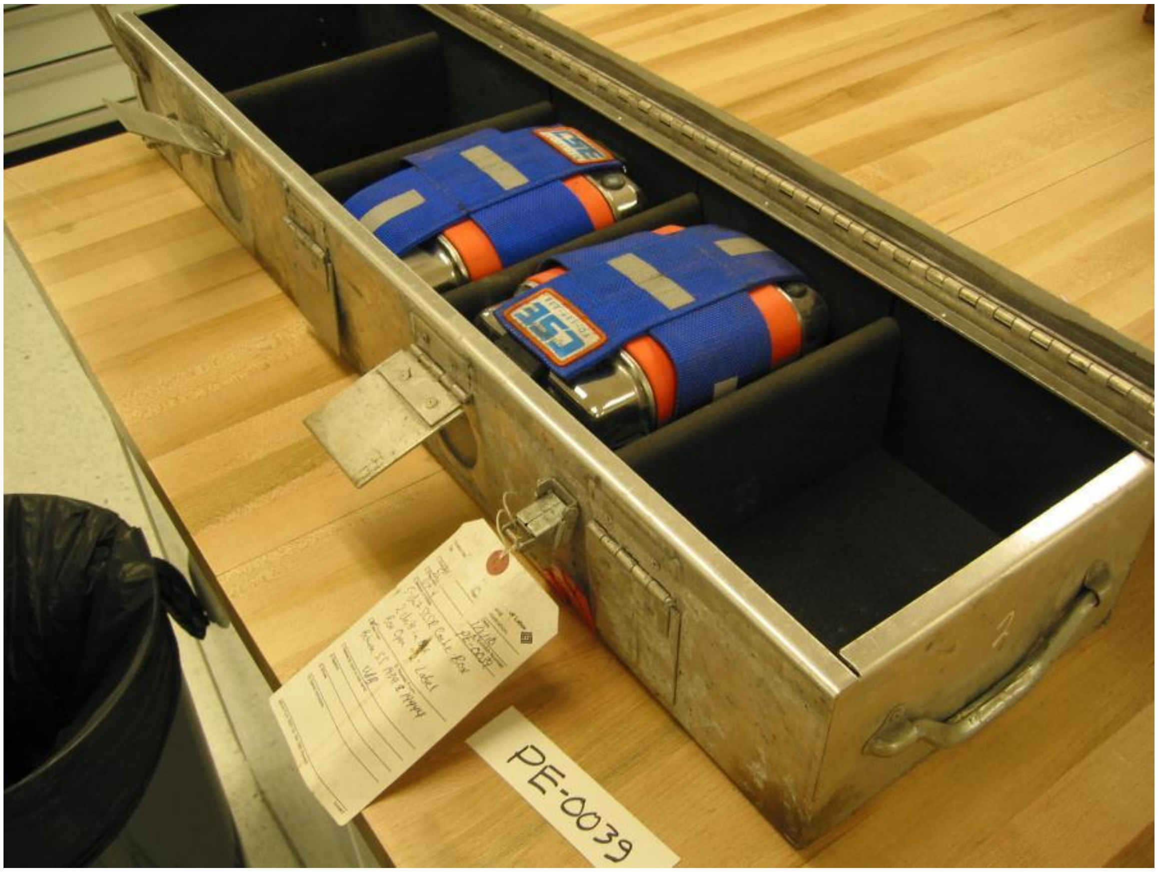

Figure 1 - PE-0039, Units -A and -B in Storage Box

Figure 2 - Unit PE-0039-A

Figure 3 - Unit A-02-A, as Received

Figure 4 - Unit PE-0088, as Received

Figure 5 - Units PE-0101, PE-0108, PE-0110, PE-0111, PE-0197, and PE-0198, as Received

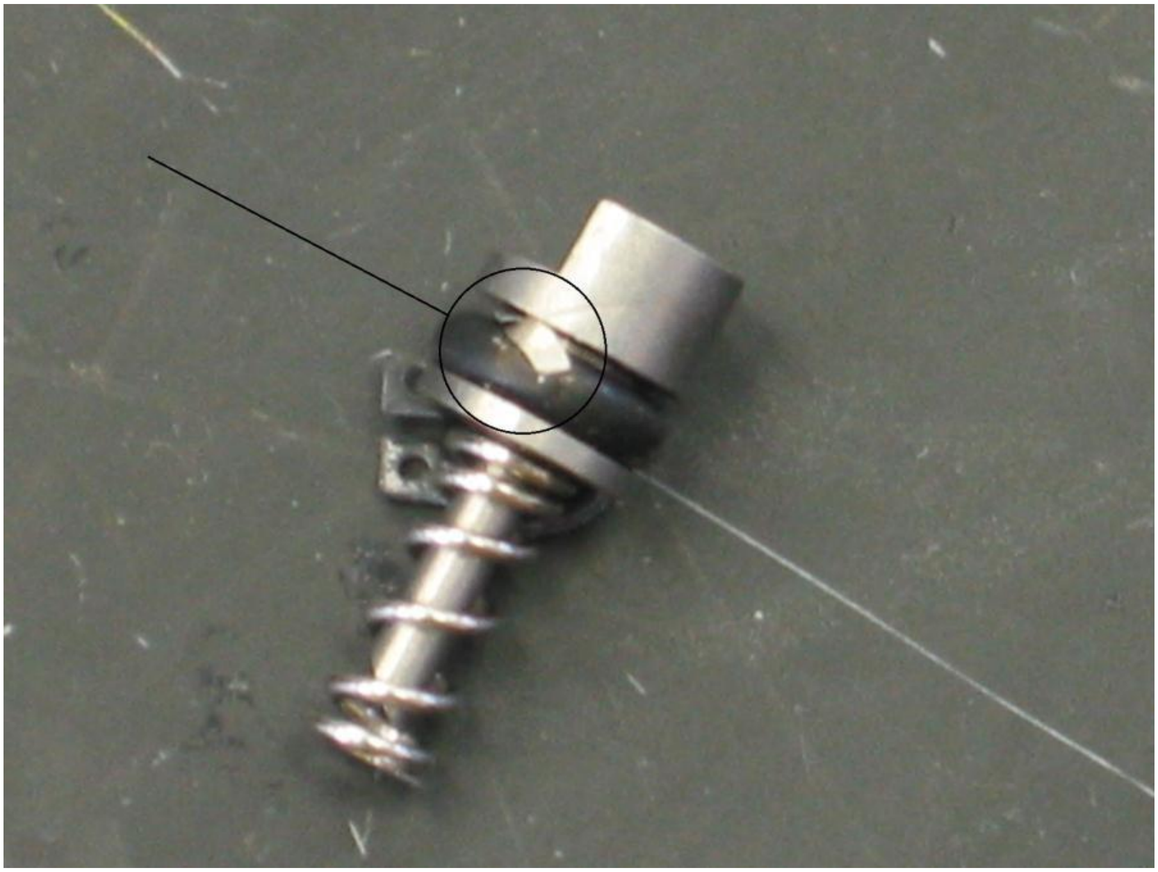

Figure 6 - Starter Plunger from Unit PE-0139-a , Showing Metal Shaving

Figure 7 - Unit A-02-B, as Received (Unactivated)

Figure 8 - Unit A-02-C, as Received and Remaining Chemical

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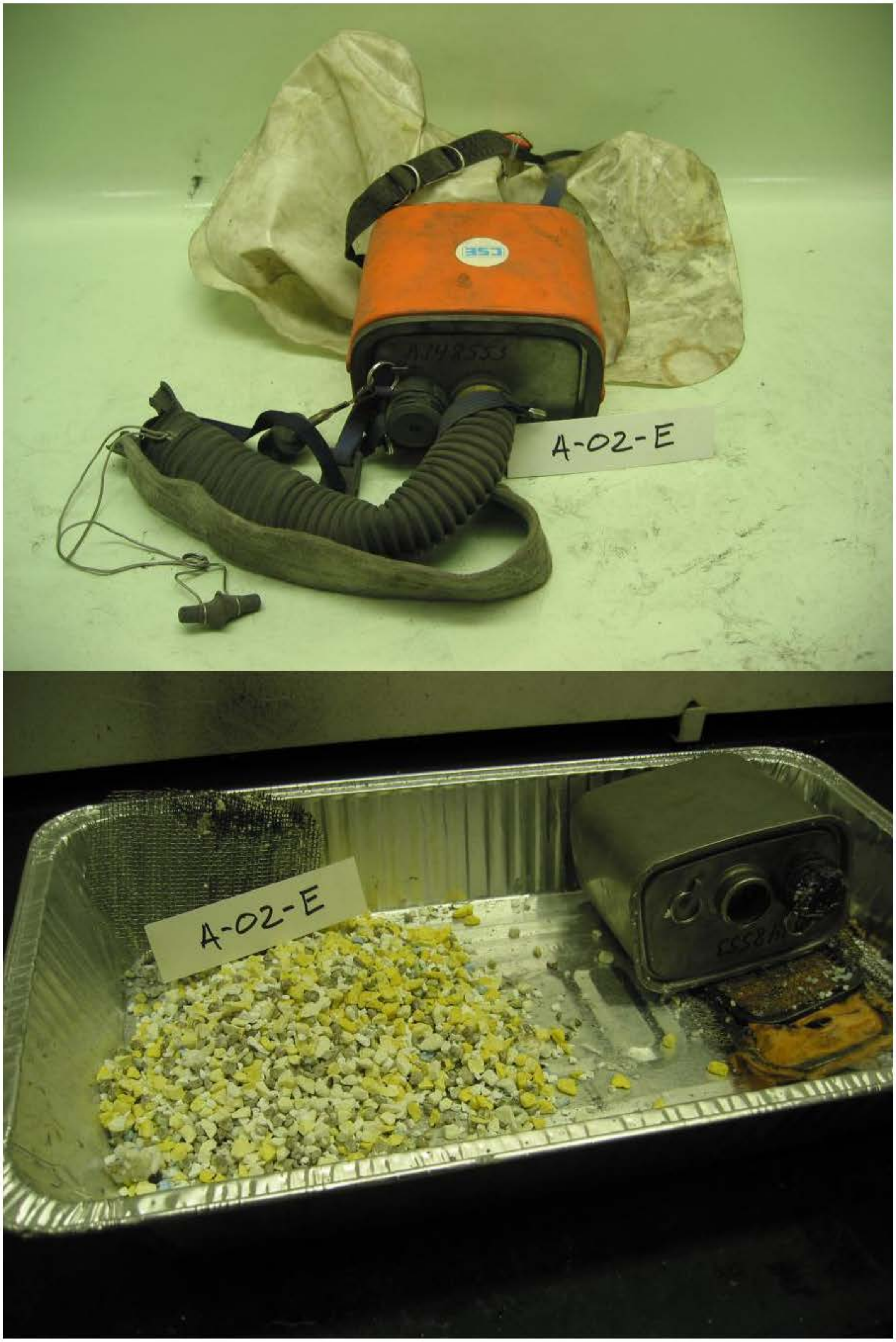

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Figure 11 - Unit A-02-F, as Received and Remaining Chemical

Figure 12 - Unit A-02-G, as Received and Remaining Chemical

Figure 13 - Unit A-02-H, as Received and Remaining Chemical

Figure 14 - Unit A-02-I, as Received and Remaining Chemical

Figure 15 - Unit A-02-J, as Received and Remaining Chemical

Figure 16 - Unit PE-0037, as Received and Remaining Chemical

Figure 17 - Unit PE-0027, as Received and Remaining Chemical

Figure 18 - Unit PE-0053, as Received and Remaining Chemical

Figure 19 - Unit PE-0046, as Received and Remaining Chemical

Figure 20 - Unit PE-0055, as Received and Remaining Chemical

Figure 21 - Unit PE-0025, as Received and Remaining Chemical

Figure 22 - Unit PE-00130, as Received and Remaining Chemical

Figure 23 - Unit PE-0131, as Received

Figure 24 - Unit PE-0101, as Received and Remaining Chemical

APPENDIX AN

LIST OF PERSONNEL ASSISTING IN THE INVESTIGATION

Appendix AN

List of Personnel Assisting in the Investigation

Mine Safety and Health Administration Personnel

(Assisted in Conducting E01 Inspection and Accident Investigation Team Activities)

District 1

Michael Dudash	Mine Safety and Health Inspector

District 6

James Adams	Mine Safety and Health Inspector
Silas Adkins	Supervisory Mine Safety and Health Inspector
Saul Akers	Mine Safety and Health Specialist (Roof Control)
Joeseph A. Armstrong	Mine Safety and Health Inspector
Robert Bates	Supervisory Electrical Engineer
Quentin D. Blair	Mine Safety and Health Inspector (Electrical)
Brian Dotson	Supervisory Mine Safety and Health Specialist (Ventilation)
Kenneth Fleming	Mine Safety and Health Inspector
Arnold Fletcher	Mine Safety and Health Inspector (Electrical)
Kenneth Fletcher	Mine Safety and Health Specialist (Ventilation)
David Hardin	Mine Safety and Health Inspector
Leland Hess	Mine Safety and Health Inspector (Electrical)
David Ison	Supervisory Mine Safety and Health Inspector
Barry Johnson	Mine Safety and Health Specialist (Ventilation)
Terry M. Jude	Mine Safety and Health Specialist (Ventilation)
Anthony Lucas	Mine Safety and Health Inspector
George Mann	Mine Safety and Health Specialist (Roof Control)
James Keith McElroy	Mine Safety and Health Inspector (Electrical)
Gerald W. McMasters	Supervisory Mine Safety and Health Specialist (SI)
Jeffrey Miles	Mine Safety and Health Specialist (Health)
James Newman	Mine Safety and Health Inspector
Randy Newsome	Mine Safety and Health Specialist (Ventilation)
Danny Pack	Mine Safety and Health Specialist (Health)
Craig Plumley	Supervisory Mine Safety and Health Specialist (Ventilation)
Lester Keith Preece	Mine Safety and Health Inspector
Ricky Runyon	Mine Safety and Health Specialist (Roof Control)
Jimmy Soard	Mine Safety and Health Specialist
Vernus Sturgill	Supervisory Mine Safety and Health Inspector
Robert Wise	Mine Safety and Health Inspector
Larry Wolford	Mine Safety and Health Inspector
Roger Workman	Mine Safety and Health Inspector

Donny Young	Mine Safety and Health Specialist (Roof Control)

District 7

Randall Lewis	Mine Safety and Health Inspector (Electrical)
Patrick A. Stanfield	Mine Safety and Health Inspector (Electrical)

District 8

Adron Wilson	Supervisory Coal Mine Safety and Health Specialist (SI)

MSHA Mine Emergency Unit Personnel

(Assisted in Collecting Mine Dust Samples and Conducting Examinations)

District 2

Thomas Bochna	Mine Safety and Health Inspector
Jeffrey Hennessey	Mine Safety and Health Inspector (Ventilation)
David Leverknight	Mine Safety and Health Inspector
Jeremy Williams	Mine Safety and Health Inspector

District 3

Josh Brady	Mine Safety and Health Specialist (Roof Control)
Ryan Carman	Mine Safety and Health Specialist (Ventilation)
Jeff Maxwell	Mine Safety and Health Inspector (Electrical)

District 5

James Duckworth	Mine Safety and Health Specialist (Ventilation)
John Hughes	Mine Safety and Health Inspector
Clayton E. Sparks	Staff Assistant
Paul Sutherland	Mine Safety and Health Specialist (Health)

District 6

Anthony Benton	Mine Safety and Health Inspector
Nathan Mounts	Mine Safety and Health Inspector (Health)
David Stepp	Mine Safety and Health Inspector

District 7

Charles L. Barton	Supervisory Mine Safety and Health Inspector
Dale Jackson	Mine Safety and Health Specialist (Ventilation/Roof Control)
Rick Suffridge	Mine Safety and Health Inspector

District 8

Shawn Batty	Mine Safety and Health Inspector

District 9

Russ Bloomer	Mine Safety and Health Inspector
Randy Gunderson	Mine Safety and Health Inspector

District 10

Rodney Adamson	Mine Safety and Health Inspector (Electrical)

District 11

Rodney Williams	Mine Safety and Health Inspector

Educational Policy and Development

Fred Martin	Mine Safety and Health Specialist (Training)

Pittsburgh Safety and Health Technology Center

(Assisted in Underground Evaluations and Testing)

Edward Arnold	Industrial Hygienist
George Aul	Geologist
Dennis Beiter	Mining Engineer
Virgil Brown	Mine Safety and Health Specialist
David Chirdon	Program Manager Intrinsic Safety New Technology Development
Kim Diederich	Mining Engineer
Steven Dubina	Electronics Engineer
Dustin Hinchman	Mining Equipment Compliance Specialist
William Kelly	Mining Equipment Compliance Specialist
Robert Penigar	Engineering Technician
Mark Pompei	Mining Engineer
Jason Reichart	General Engineer
Mark Schroeder	Supervisory Mining Engineer
Christina Stalnaker	Industrial Hygienist
John Urosek	Mine Emergency Response Coordinator
Matthew Wharry	General Engineer

Approval and Certification Center

(Assisted with Testing)

Kenneth Darby	Electrical Engineer
Michael Hockenberry	Fire Protection Engineer
Robert Holubeck	Electrical Engineer
Frank J. Prebeg	Electrical Engineer
Derrick Tjernland	Senior Fire Protection Engineer

National Mine Health and Safety Academy

(Assisted with Photography and Audio/Visual Productions)

Jon Braenovich	Training Instructor (Roof Control)
Jason Brown	Information Technology Specialist
Diane L. Carr	Audio/Visual Production Specialist
Theodore Farrish	Training Specialist
Glen Poe	Training Instructor (Roof Control)
Donald Starr	Manager, Department of Instructional Materials
William E. Walker	Audio/Visual Production Specialist

West Virginia Office of Mine Health Safety and Training

William A. Tucker	Administrator
Monte R. Hieb	Chief Engineer
Barry L. Koerber	Assistant Attorney General
Barry C. Fletcher	District Inspector
Kendall R. Smith	Chief Electrical Inspector
John P. Scott	Electrical Inspector
McKennis P. Browning	Inspector-at-Large
Johnny L. Kinder	Inspector-at-Large
Danny L. Jarrell	Assistant Inspector-at-Large
John T. O'Brien	Assistant Inspector-at-Large
H. Dwight McClure	District Inspector
Russell E. Manning	District Inspector
Charles D. Hill	Electrical Inspector
Steven G. Stanley	Electrical Inspector
Raymond M. Cox	Electrical Inspector
Ralph E. Tanner	District Inspector
James H. Hodges	Safety Instructor
John W. Cruse	Technical Analyst
Terry L. Farley	Administrator
Philip W. Adkins	Safety Instructor

Governor's Independent Investigation Panel (GIIP)

J. Davitt McAteer, Esq.	GIIP, Team Leader Vice President, Wheeling Jesuit University
Katherine Beall, Esq.	Certified Public Accountant
James A. Beck, Jr.	Project Manager Wheeling Jesuit University
Patrick C. McGinley, Jr., Esq.	Professor Wheeling Jesuit University
Celeste Monforton, DrPH, MPH	Professional Lecturer George Washington University
Debbie Roberts	Paralegal, Program Assistant Wheeling Jesuit University
Beth Spence	Coalfield Specialist American Friends Service Committee
Suzanne M. Weise, Esq.	Lecturer in Law Supervising Attorney, West Virginia University