CAI-2010-37

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Surface Coal Mine

Fatal Ignition or Explosion Accident
June 8, 2010

Taft Coal Sales & Associates, Inc.
Choctaw Mine
Parrish, Walker County, Alabama
ID No. 01-00347

Accident Investigators

James Brodeur
Surface Safety and Health Inspector

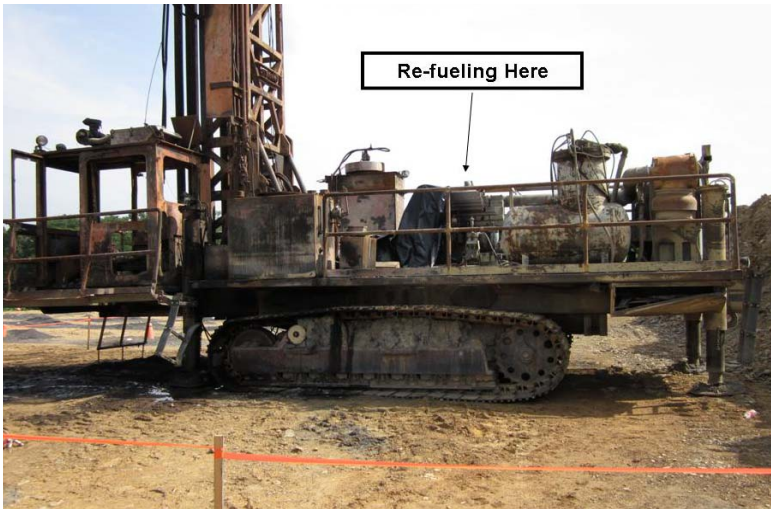
William Harbin
Surface Safety and Health Inspector

Derrick Tjernlund, PE
Senior Fire Protection Engineer
Mine Safety and Health Technical Support
Mechanical & Engineering Safety Division

Eugene D. Hennen, PE
Senior Mechanical Engineer
Mine Safety and Health Technical Support
Mechanical & Engineering Safety Division

Originating Office
Mine Safety and Health Administration
District 11
135 Gemini Circle, Suite 213
Birmingham, Alabama 35209
Richard A. Gates, District Manager

TABLE OF CONTENTS



OVERVIEW

On Tuesday, June 8, 2010, at approximately 9:25 p.m., a 38-year old service truck operator was killed while fueling a highwall rock drill. The victim notified the drill operator by CB radio that he was driving down to fuel the two drills operating on the highwall bench. The operator moved his drill into position to be fueled and idled down the drill engine. The victim backed the service truck perpendicular to the operator's side of the drill and was observed by the drill operator stepping over the back of the truck onto the drill while holding the fuel hose and nozzle. The drill operator looked away from the victim and felt what he described as a concussion/explosion. The operator exited the drill cab and observed that the drill was on fire and the victim was lying on the ground engulfed in flames. The drill operator called for help and other mine personnel responded to help extinguish the fire on the victim. The victim was transported to the mine entrance gate where medical personnel arrived shortly thereafter. The victim was transported by LifeSaver helicopter to a nearby hospital and died shortly after arrival.

The accident occurred because the work practices/procedures in use at the time of the accident were not adequate to fully protect the service truck operator. There was no provision for equipment shutoff/cool down prior to fueling, the operator was required to be in close proximity to potential ignition sources, the fueling system was susceptible to accidental discharge, and there was no provision for actions to be taken in the event of an accidental fuel discharge.

GENERAL INFORMATION

The Choctaw Mine is owned and operated by Taft Coal Sales & Associates, Inc., (a business of Walter Minerals) and is located in Parrish, Walker County, Alabama. The mine is a surface coal operation, utilizing typical drill and shoot methods to break the overburden. This operation utilizes a Bucyrus-Erie 1300 dragline, operating 24 hours-per day, Monday through Saturday, supported by bulldozers, excavators and rock trucks, which operate two, 10-hour shifts. The dragline was not being utilized in the area of the pit where the accident occurred. The typical overburden in the area was 150 feet. Once the overburden is removed, the coal seam is excavated utilizing front-end loaders, excavators and coal haulage trucks. The mine employs 85 hourly and 16 management personnel. The primary coal beds mined are the Pratt, Nickel and America seams, averaging a total of approximately 70 inches in thickness. The daily production is approximately 2,000 tons.

Excepting the dragline operation, normal production work hours for the day shift are from 6:00 a.m. to 4:00 p.m. and the evening shift from 4:00 p.m. to 2:00 a.m. The service truck operators begin their shift approximately one hour prior to the beginning of the production shift. The day shift service truck operators do not fuel the highwall drills. The two service truck operators on the evening shift fuel the drills twice; at the beginning of the evening production shift and the second fueling is started some time around 9:00 p.m.

The most recent semi-annual safety and health inspection (E01) was completed by MSHA on May 5, 2010. The non-fatal days lost (NFDL) incidence rate at the mine for 2009 was 0.00, compared to the 2009 national rate of 1.21 for coal mines of this type.

The principal officials of the mine at the time of the accident were:

Rodney Lacy……...Director of Operations
Jan Kizziah……..Vice President of Operations
Shane Gant……..Mine Superintendent
Randy Key……...Maintenance Manager
Tony Davis……..Director of Environmental, Health & Safety
John Howlett……...Evening Shift Mine Foreman
Danny Tubbs……...Evening Shift Pit Foreman
Nixon Hill……Evening Shift Pit Foreman
Jimmy Swafford……..Mobile Equipment Maintenance Supervisor

DESCRIPTION OF THE ACCIDENT

On the night of the accident, Tuesday, June 8, 2010, two service truck operators, Phillip Wade Gustafson (victim) and Adam Moon, were on duty for the evening shift. As normal, the highwall rock drills were fueled at the beginning of the shift. The rock drill involved in the accident, Reed SK45 Highwall Drill, Company No. 515, was fueled by Moon. After fueling their assigned pieces of equipment, both service truck operators performed maintenance work on other equipment. After completing the maintenance work, both service truck operators prepared to continue fueling equipment. At approximately 9:00 p.m., the victim refueled the water truck and traveled to refuel the two drills operating on the Choctaw West Pit bench.

Shortly after 9:00 p.m., Gustafson notified Jonathan Boshell, operator of the No. 515 drill, by CB radio that he was driving onto the bench to fuel the two rock drills. Boshell informed Gustafson that he would move the drill away from the recently drilled holes to a safe location on the bench. Boshell positioned the drill, idled down the engine, and then radioed Gustafson to back the service truck up to the drill. Boshell started to eat his dinner while Gustafson backed the truck up to within approximately two feet of the right hand side (drill operator cab side) of the drill (Appendix B). Boshell observed Gustafson stepping over from the back of the service truck and onto the drill while holding the fuel hose and nozzle. Boshell looked away and continued eating when he heard an explosion and felt the concussion (Boshell estimated that only seconds passed from when he observed the victim stepping onto the drill and the explosion). Boshell immediately exited the drill cab and saw the drill on fire and Gustafson engulfed in flames, rolling on the ground under the rear of the service truck. Boshell quickly went back to the cab and radioed for help. After calling for help, Boshell exited the left side of the cab, located the fire extinguisher, and began extinguishing the flames on the drill, but lost sight of Gustafson.

Wayne Perry, who was operating the other drill, heard a noise that sounded like a hydraulic hose bursting on his drill. When Perry looked out of the cab window to locate the suspected ruptured hose, he saw an orange glow coming from Boshell's drill. Realizing the drill was on fire, Perry quickly shut down his drill, secured a fire extinguisher and ran to the other drill. Perry began extinguishing the fire on the drill when he heard Gustafson. He ran around the service truck and, seeing Gustafson on the ground engulfed in flames, told him to close his eyes and mouth and then used the fire extinguisher to put the flames out. Gustafson stood up and moved away from the drill and truck. Boshell and Perry attempted to extinguish the fire on the drill with fire extinguishers without success. Other mine personnel had responded to the accident scene and were giving care to Gustafson. Gustafson was transported by pick-up truck to the mine entrance gate where he was met by arriving emergency personnel. Gustafson was air lifted to the University of Alabama at Birmingham (UAB) Hospital in Birmingham, Alabama. Gustafson's condition worsened after leaving the mine site and

he was pronounced dead shortly after arrival at the hospital. Local fire departments responded to the accident scene and extinguished the fire.

INVESTIGATION OF THE ACCIDENT

The Mine Safety and Health Administration (MSHA), was notified of the accident at approximately 9:57 p.m., on Tuesday, June 8, 2010. The Call Center notified Johnny Calhoun, Coal Mine Safety and Health Supervisor for District 11. MSHA personnel from the Bessemer Field Office were immediately dispatched and arrived at the mine at approximately 11:00 p.m. A 103(j) Order was issued verbally and modified to a 103(k) Order upon arrival at the mine, to ensure the safety of all persons during the accident investigation.

The investigation was conducted with the cooperation of MSHA's Technical Support Division, Alabama Department of Industrial Relations Mining and Reclamation Division, representatives of the mine operator and miners. Persons participating in the investigation are listed in Appendix A. Thirteen persons were interviewed during the investigation.

DISCUSSION OF THE ACCIDENT

Pre-operational Checks and Maintenance

Pre-operational checks were performed by the evening shift drill operator and the service truck operator (victim) on their respective pieces of equipment. The written record for the drill was destroyed by the fire. The drill operator stated that no hazards had been noted. The written record was retrieved from inside the service truck cab and there were no hazards recorded.

Equipment

The rock drill (Appendix C) was a Reed SK45/R45-Infinity Highwall Drill (Company No. 515, Serial No. 1Z68A64), powered by a Cummins KTA19-C turbocharged, six-cylinder, 630 hp diesel engine and used hydraulic and air actuated controls for drilling. The turbocharger was located opposite of where the victim was fueling (Appendix C).

The drill was equipped with a 320-gallon diesel fuel tank, located directly beneath the engine between the main frame rails and was fueled through a top-fill standard twist-off fuel cap with a 2-inch high filler neck. (Note: the fuel tank was estimated to have contained approximately 250 gallons of diesel fuel remaining after the fire). The hydraulic oil tank is located on the right side of the drill, directly in front of the operator cab (Appendix C) and has an approximate usable capacity of 190 gallons, based upon the external dimensions and the location of the top of the sight glass (transparent tube,

through which the level of fuel or oil can be observed). The tank was estimated to have approximately 60 gallons of SAE 10W oil remaining after the fire. Both tanks were equipped with non-pressurized fluid return lines.

The electrical system provided was 24-volts DC (direct current).

The service truck was a Mack DM690S (Company No. 764, VIN: 1M2B209CXRM014359) and was used to dispense diesel fuel and other lubricants from bulk tanks. The tanks were located on the fabricated open grate steel bed/deck of the truck, along with the associated pumps used to dispense the diesel fuel/lubricants (Appendix C).

The main hydraulic pump was driven off the truck's crank shaft and ran while the truck engine was running. The main pump received hydraulic fluid from a dedicated tank and provided the fluid pressure to the hydraulic motors, which in turn drove the individual transfer pumps. The transfer pumps move the diesel fuel and other lubricants from the bulk tanks to the equipment. A valve bank at the rear of the truck controls the transfer pumps. When the diesel fuel transfer pump was activated, it provided diesel fuel to either a hose reel equipped with a squeeze splash nozzle (similar to a standard service station nozzle), or a hose reel equipped with a Wiggins nozzle. Diesel fuel could be dispensed by either nozzle. The truck was also equipped with a Tuthill "Fill-rite" totalizing meter for measuring the quantity of fuel dispensed.

Field Testing/Observation

Testing and observation of the dispensing nozzle, the Tuthill totalizing meter, and the operating and environmental characteristics of the drill were conducted and outlined below.

The original dispensing nozzle was damaged and could not be tested. The original nozzle was removed from the dispensing hose and a new, identical nozzle was attached. A flow test was then conducted and the new nozzle dispensed diesel fuel at a rate of approximately 42-gallons per minute, at maximum flow and could discharge a stream of fuel a distance of 4 to 8-feet.

The Tuthill totalizing meter indicated a total flow of 7-gallons of fuel had been dispensed since the last reset of the meter. Field observation of the meter function indicated that once the fuel transfer pump was engaged, the reading slowly increased even if no fuel was being dispensed. The meter would increase between 1 and 2-gallons a minute at zero flow, the rate of increase being somewhat erratic. Approximately 10-seconds would be required to discharge up to 7-gallons of diesel fuel.

The drill involved in the accident had such extensive damage that its engine operating characteristics could not be tested. A similar drill was tested at idle for comparison and reference. The following information was obtained:

- Ambient air temperature at time of testing…....89° F.
- Top of turbocharger……..….775° F.
- Bottom of turbocharger……....835° F.
- Turbocharger after-cooler……..…..650° F.
- Rear exhaust manifold……..…518° F.
- Engine valve cover……,..150° F.
- Top surface of pump gearbox……..…172° F.
- Exterior of hydraulic oil tank……..….129° F.
- Hydraulic oil in tank……174° F.
- Diesel fuel in fuel tank……...95° F.
- Radiator air at rear of engine……..121° F.

There were no mechanical or electrical defects found on either piece of equipment.

Air velocity measurements taken on the drill indicated that the engine radiator fan had no effect on air movement where the victim was fueling.

Drill Hydraulic System Evaluation/Examination

To determine if a rupture in the drill's hydraulic system could have provided the initial fuel for the fire, an evaluation was conducted to determine which hydraulic circuits would have and could have been under pressure during the refueling process. Each of the circuits was examined completely. All of the circuits that would/could have been under pressure at the time of the accident are as follows: engine radiator fan hydraulic circuit, stabilizing jacks hydraulic circuits, main control valve, and drill pull-down cylinder.

An extensive examination was conducted on all of the above mentioned circuits, as well as other miscellaneous circuits. The examinations did not reveal any ruptures that could have allowed hydraulic oil to provide fuel for the initial fire.

Laboratory Testing

Source samples of fuel and hydraulic fluid, along with samples of fire debris were recovered for testing.

Source samples of hydraulic oil and diesel fuel were tested for auto-ignition temperature (AIT) and closed cup flashpoint (FP) (reported as degrees Fahrenheit (F)).

The values were in the range normally associated with these fluids:

- Hydraulic oil from drill hydraulic tank…….....AIT = 689° F and FP = 298° F.
- Clean hydraulic oil from bulk tank at depot……...AIT = 689° F and FP = 444° F.
- Diesel fuel from drill fuel tank…….....AIT = 459° F and FP = 151° F.
- Diesel fuel from bulk tank on service truck No. 764..AIT = 448° F and FP = 161° F.

Flashpoint testing of the diesel fuel and hydraulic oil samples reveals that gasoline contamination was not present. The FP of gasoline is typically in the range of a minus 45° F. If the diesel fuel or hydraulic oil was contaminated with gasoline to hazardous levels, their FP would be significantly reduced.

When evaluating the significance of the AIT measurements, the AIT for a liquid is actually the AIT of the vapors produced from the liquid, since the vapors ignite. AIT is determined under laboratory conditions with the liquid and vapors generated from the liquid being held captive inside the test apparatus. On hot surfaces in an open environment, where many of the vapors escape before being sufficiently heated, it is generally expected that surfaces in the vicinity of at least 350° F above the laboratory AIT are the most likely to cause auto-ignition.

This would indicate that the turbocharger could be more of a credible ignition source for the diesel fuel than for the hydraulic oil.

Source and fire debris samples were sent to the U. S. Coast Guard Laboratory for analysis in an attempt to identify any traces of the source samples within the fire debris. While hydraulic oil and diesel fuel (light fuel oil) were found on most of the debris samples, the quantity was not sufficient to establish a match to any of the source samples (Appendix D).

Fueling Practices, Environmental, and Human Factors

As noted earlier, the service truck has two types of nozzles that are used to dispense diesel fuel, a standard squeeze splash nozzle and a Wiggins nozzle. The squeeze splash nozzle is similar to one used at a service station and dispenses fuel at the top of the tank and is open to the atmosphere. The Wiggins refueling system is a "fast fuel" system that fills the tank from the bottom up, which reduces spillage and allows the operator to fuel from ground level. The Wiggins nozzle clamps to a special fitting on the fuel tank and is, in essence, a closed system and the design of the nozzle makes it virtually impossible to accidently "trigger" the nozzle, causing a spill. At the Choctaw Mine, the type of nozzle used to dispense fuel is dependent upon how the individual piece of equipment is set up to receive fuel. Approximately half of the equipment at this site utilizes the Wiggins system.

The drill's fuel tank was equipped with a Wiggins refueling fitting, located on the side of the drill and accessible from ground level; however, the tank was not equipped with the appropriate float tank vent needed to use this fitting. For this particular drill, the victim had to use the squeeze splash nozzle. This would have required him to climb onto the drill deck, position himself beside the idling engine, bending or kneeling over to insert the fuel nozzle into the fill neck opening, and squeezing the trigger mechanism to induce flow.

Based on interviews, the common procedure for fueling a drill with the splash nozzle follows: (This is not a written company work procedure)

- Call the drill operator on the CB radio prior to driving the truck to the drill.
- The drill moves into place to be fueled (Once in position, the drill engine is idled down, but not shut off). The drill bench and drilled holes determine the parked position of the truck when fueling. The truck may park perpendicular to the side of the drill, parallel to the side of the drill, or in front or rear of the drill. Note: In this instance, the service truck parked perpendicular to the drill.
- Set the truck parking brake.
- Put the manual transmission in neutral.
- Pull the throttle knob out to idle up the service truck engine, if an almost empty tank is going to be fueled. Use regular engine idle for most of the fueling jobs.
- Exit the truck cab and step up on the bed/deck of the truck.
- Pick up the fuel nozzle and hose and walk to the rear of the truck.
- Lay the nozzle on the drill deck/walkway with the hose going over the center hand rail.
- The fuel usage meter is usually reset to zero from the last fuel job, but recheck the meter and reset to zero if needed.
- Engage the valve bank diesel fuel lever, which will put fuel pressure to the nozzle.
- Step from the rear of the bed/deck of the truck on to the drill (over or through the drill deck handrail).
- Remove the cap from the fuel tank filler neck.
- Insert the fuel nozzle in the tank neck, squeeze the nozzle lever to start the fuel flow, and put the lever in the lock on position.
- Turn the nozzle to its side to ensure that it will not come out of the filler neck.
- Check the engine oil, hydraulic oil and air compressor oil levels.
- Wait until the nozzle automatically cuts off the flow of fuel.
- Pull up and hold the nozzle in place while continuously holding the nozzle lever in the on position to continue filling up the tank.
- Wait until the nozzle automatically cuts off again.
- Pull the nozzle out of the filler neck and lay the nozzle down.
- Replace the filler cap back on the neck.

- Climb back over onto the truck bed/deck.
- Pick up the nozzle and hose and place them on the truck bed/deck.
- Disengage the valve bank lever.
- Reset the fuel usage meter back to zero.
- Re-enter the truck cab and record the fuel gallons and levels of the fluids checked or the fluid amount added.

Gasoline was not used or transported on the service truck.

The weather conditions at the time of the accident were clear with approximately ten mile visibility, 80° F temperature, 64° F dew-point, 58% relative humidity and wind approximately 3 miles per hour, south to south east.

The victim was a smoker. Three unopened packs of cigarettes and one cigarette lighter were found in the service truck. No smoking materials were found on the drill or outside of the cab of the service truck at the scene of the accident, and there was no evidence to indicate he had used any smoking articles at the time of the accident.

Work Experience and Training

The victim had been operating a service truck at the Choctaw Mine since June 22, 2002.

He had received the initial New Miner Training at Choctaw Mine in 2002, Serviceman/Service Truck Task Training in 2002, and Annual Refresher Training each year during his employment.

Accident Scenarios

There were four possible scenarios formulated from interviews and the physical evidence.

Note: See Appendix E for additional details

(1) A hydraulic hose failure spraying hydraulic oil onto the hot surface of the engine turbocharger and igniting.

This is an unlikely scenario due to the following:

- An examination of the drill hydraulic system circuits that would have been under pressure at the time of the accident found that no hoses experienced catastrophic rupture.
- The hottest surface that could serve as an ignition source would likely be the engine turbocharger. The AIT of the hydraulic oil is too high to consider the

turbocharger a credible ignition source. The AIT for the hydraulic oil was approximately 689° F, which would require the minimum temperature of the turbocharger to be approximately 1040° F. Measurements taken did not yield turbocharger temperatures this high (turbocharger max of 835° F).

(2) Diesel fuel was ignited from a static electric spark discharged at the drill fill tank neck.

This is an unlikely scenario due to the following:

- The Flash Point of the fuel in the tank would be significantly above the expected temperature of the fuel. A large cloud of un-ignited vapors is unlikely.
- The accumulation of a large cloud of ignitable vapors would be necessary to account for the victim being engulfed in flames or the flash fire on the drill.
- A static electric spark is not a probable ignition source. High humidity (58%) along with the short fuel discharge time (less than 10-seconds) and with the short travel distance through the nozzle would make a buildup of static electricity unlikely.

(3) A diesel fuel fire from the use of smoking materials during fueling.

This is an unlikely scenario due to the following:

- The FP of the fuel in the tank would be significantly above the expected temperature of the fuel. A large cloud of un-ignited vapors is unlikely.
- The accumulation of a large cloud of ignitable vapors would be necessary to account for the victim being engulfed in flames or the flash fire on the drill.
- No smoking materials were found on the victim, the drill, or the area outside of the service truck cab and there was no evidence to indicate the victim had used any smoking articles at the time of the accident. As previously noted, three unopened packs of cigarettes and a lighter were found in the cab.

(4) Diesel fuel accidently sprayed onto the hot surfaces on and around the engine and hydraulic pump area immediately prior to fueling which vaporized and ignited.

This is the most likely scenario due to the following:

- Assuming the victim reset the fuel meter and based on the information obtained during the investigation, up to 7-gallons of diesel fuel was discharged in an approximate 10-second period.
- The surfaces of the engine and adjacent hot surfaces (hydraulic pumps and gear box) could have been at or above the FP of the diesel fuel. Any diesel fuel

splashed on these surfaces would generate a cloud of flammable vapors in the fueling area.
- There was little to no air movement at the fueling area, facilitating the accumulation of the fuel vapors.
- The AIT for the diesel fuel was approximately 450° F, which would require the minimum temperature of the turbocharger to be approximately 800° F. As noted above, the surface temperature of the turbocharger tested exceeded 800° F, making it a credible ignition source

The most likely scenario is that diesel fuel was inadvertently discharged onto the engine and adjacent hot surfaces when the victim crossed over from the service truck to the drill prior to fueling. The diesel fuel splashed onto the hot surfaces and generated a cloud of flammable vapors in the fueling area while the victim removed the fuel tank cap and inserted the fuel nozzle. The flammable vapors were present near the engine turbocharger at about the same time the nozzle was being inserted into the tank neck. The turbocharger ignited the vapors creating an explosion/flash fire, which in turn caused the victim to recoil, while still holding the nozzle in the on position, allowing additional fuel to be discharged onto the engine area and him, engulfing him in flames.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted to identify the most basic causes of the accident, which could have been corrected through reasonable management controls. During the analysis, a root cause was identified that, if eliminated, could have prevented the accident.

Root Cause: The work practices/procedures in use at the time of the accident for fueling the rock drill were not adequate to protect the service truck operator fully.

Corrective Action: The mine operator has modified the fueling procedures, which require highwall/rock drills to be shut off prior to fueling. The drill operators were trained in the new fueling procedures by their immediate supervisors and a record of the training was documented on MSHA 5000-23 Training Forms. In addition, the mine operator's approved CFR 30, Part 48 training plans are being updated to reflect the additional procedures requiring the highwall drills to be shut off prior to fueling and what actions to take in the event an accidental fuel discharge occurs. The mine operator will also further modify the fueling system or process to remove the service truck operator from close proximity to potential ignition sources and to minimize the possibility of accidental fuel discharge.

CONCLUSION

A 38-year-old service truck operator was killed when an explosion and ensuing fire occurred while he was fueling a highwall drill. The most likely cause of the accident is that as the victim was in the process of fueling the drill, diesel fuel was inadvertently discharged onto the hot engine and other surrounding hot surfaces, generating a cloud of flammable vapors which was ignited by the engine turbocharger. The ensuing explosion/flash fire caused the victim to recoil, while still holding the nozzle in the on position, allowing additional fuel to be discharged onto the engine area and him, engulfing the victim in flames.

Approved by:

Richard A. Gates
District Manager

1/3/11
Date

ENFORCEMENT ACTIONS

§103(k) Order No. 8518023

A fatal accident occurred at this mine when a combustible material was ignited and engulfed the service truck operator in flames.

This order is being issued 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 actions 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.

This order prohibits all activity in the affected area and with the affected equipment until MSHA has determined that it is safe to resume normal mining operations. The affected area begins at the entrance of the Choctaw West drill benches and extends throughout all the benches, and the affected equipment includes the Reed SK45/R45-Infinity Highwall Drill, serial No. 1Z68A64, company No. 515 and the Mack DM690S Service Truck, VIN: 1M2B209CXRM014359, company No. 764.

APPENDIX A

Persons Participating in the Investigation

CHOCTAW MINE

Dale Byram……..Director of Health & Safety
Rodney Lacy……..….Director of Operations
Jan Kizziah…….....Vice President of Operations
Randy Key……..Maintenance Manager
Shane Gant……..Mine Superintendent
Tony Davis……..Director of Environmental, Health & Safety
Steve Dickerson……..Manager of Human Resources
John Howlett……...…Evening Shift Mine Foreman
Danny Tubbs……...……...Evening Shift Pit Foreman
Nixon Hill……...Evening Shift Pit Foreman
Jimmy Swafford…….....Mobile Equipment Maintenance Supervisor
Jonathan Boshell……Evening Shift Reed Drill Operator
Wayne Perry…….…..Evening Shift Driltech Drill Operator
Ricky Webb……..…Day Shift Reed Drill Operator
Adam Moon……Evening Shift Service Truck Operator
Bobby Boshell…….Evening Shift Bulldozer Operator
Jerry Rhodes……Day Shift Service Truck Operator

REGIONAL PARAMEDICAL SERVICES, INC.

David Wade……Director

COPELAND FERRY FIRE & RESCUE

Billy Click…….Chief
Brett Dawkins……..Volunteer Fire & Rescue

STATE OF ALABAMA DEPARTMENT OF INDUSTRIAL RELATIONS MINING AND RECLAMATION DIVISION

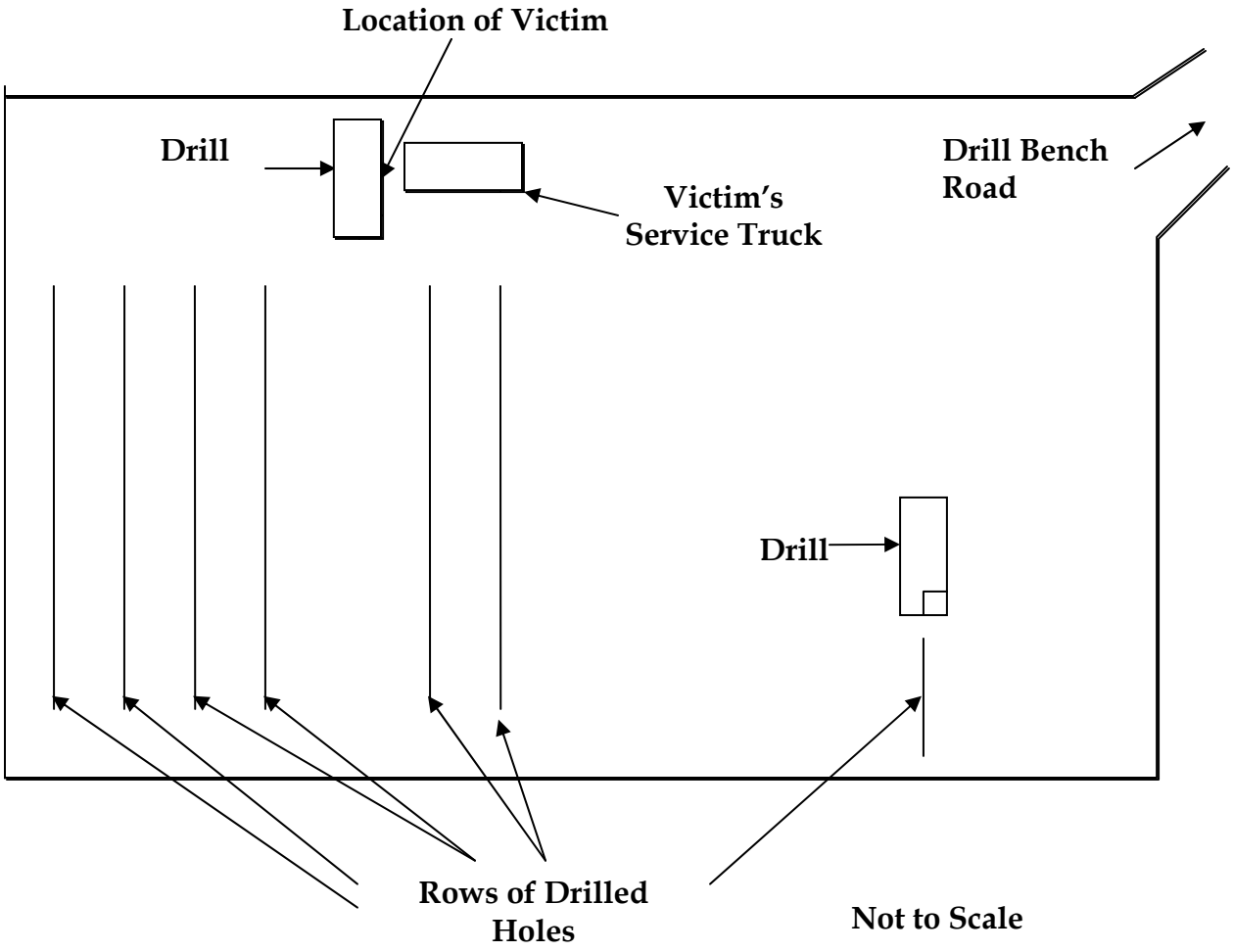
James Rivers……Mine Inspection Supervisor
Charles Whitson…….Mining Engineer, P.E.

MINE SAFETY AND HEALTH ADMINISTRATION

James Brodeur……..District 11 Coal Mine Safety and Health Inspector
William Harbin……District 11 Coal Mine Safety and Health Inspector
Derrick Tjernlund…….Senior Fire Protection Engineer, Mine Safety and Health Technical Support, Mechanical and Engineering Safety Division
Eugene Hennen…….Mechanical Engineer, Mine Safety and Health Technical Support, Mechanical and Engineering Safety Division

APPENDIX B

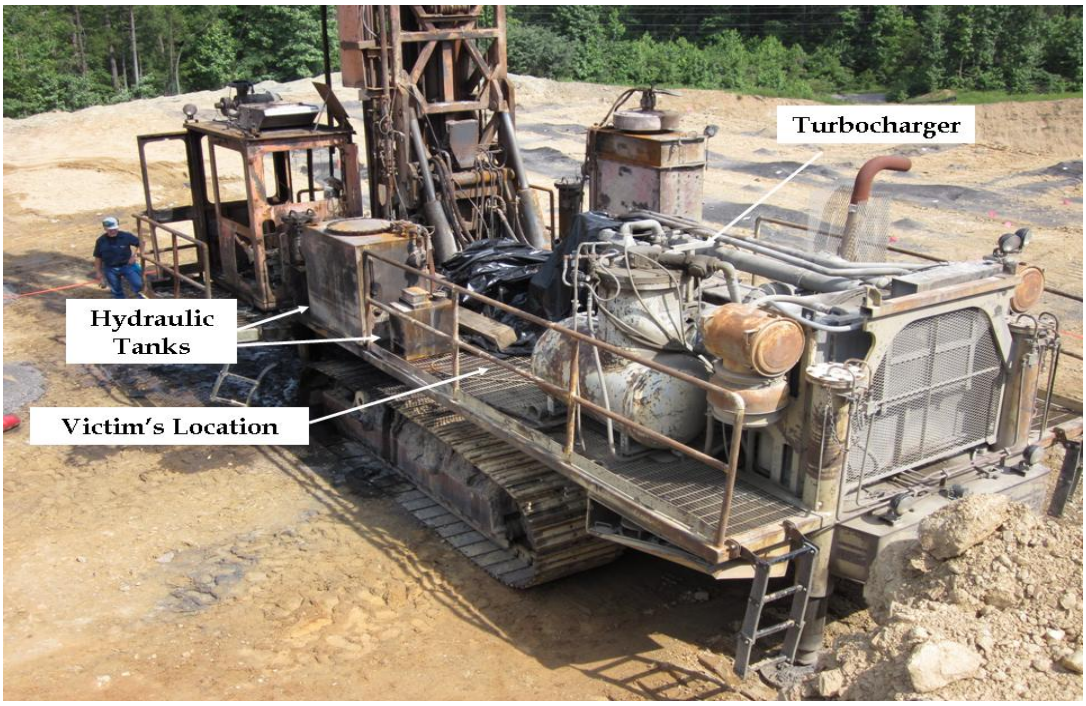
Accident Scene
Choctaw West Pit

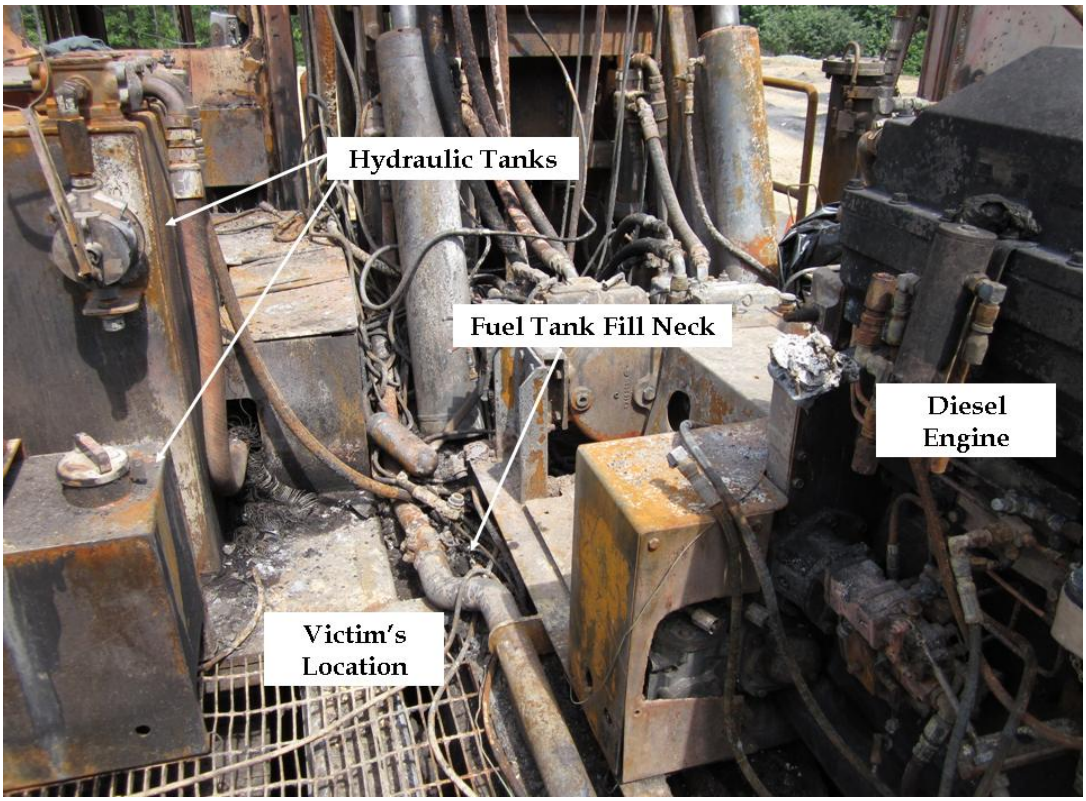


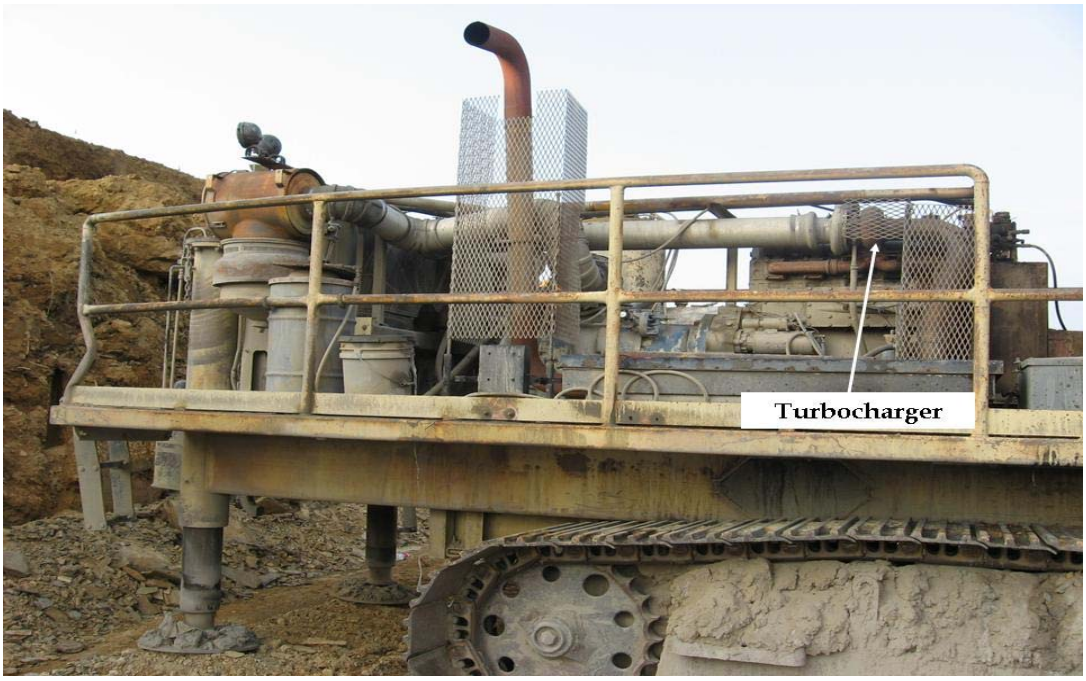
APPENDIX C

Equipment Photographs

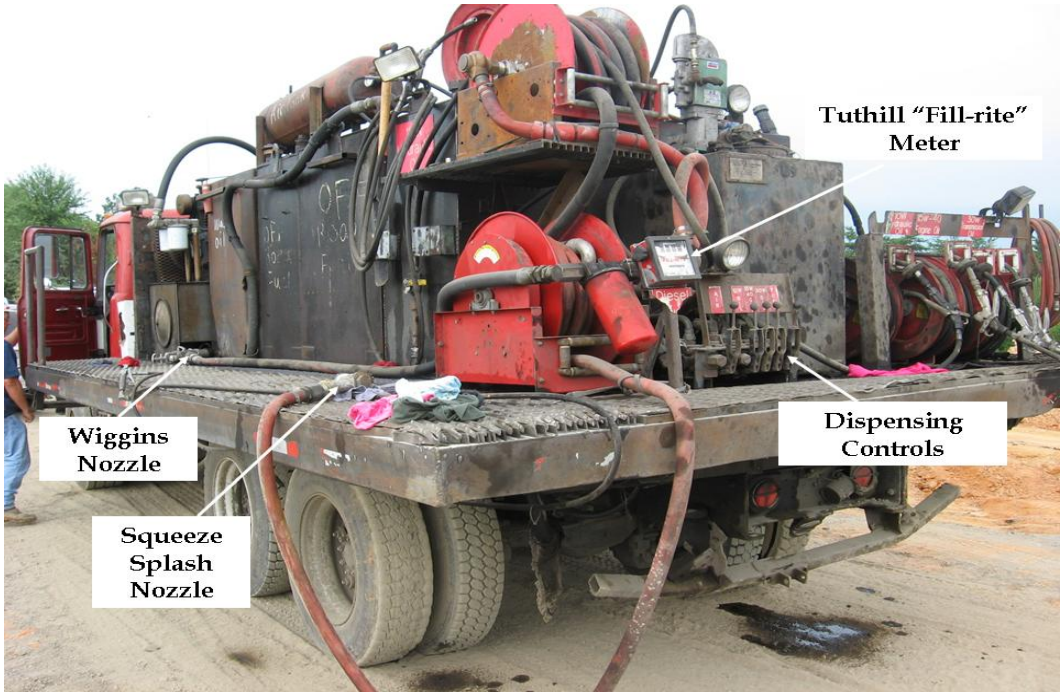
Company No. 515 Reed Highwall Drill Rig







Company No. 764 Mack Service Truck



APPENDIX D

U.S. Coast Guard Laboratory Results

Sample Description	**Hydraulic oil from drill hydraulic tank**	**Clean hydraulic oil from bulk tank at depot**	**Diesel fuel from drill fuel tank**	**Diesel fuel from bulk tank on service truck No. 764**
Remnant of clothing from accident scene	Not Found	Not Found	Contains light fuel oil but quantity not sufficient to provide correlation with source samples	Contains light fuel oil but quantity not sufficient to provide correlation with source samples
Top padding from victim's RIGHT work shoe	Contains lube oil. No correlation with source samples	Contains lube oil. No correlation with source samples	Contains light fuel oil different from source samples	Contains light fuel oil different from source samples
Top padding from victim's LEFT work shoe	Contains lube oil. No correlation with source samples	Contains lube oil. No correlation with source samples	Contains light fuel oil different from source samples	Contains light fuel oil different from source samples
Debris from drill fuel tank fill cap area	Contains lube oil with characteristics similar to source sample	Contains lube oil with characteristics similar to source sample	Contains light fuel oil different from source samples	Contains light fuel oil different from source samples
Debris from beneath airline steel pipe deck area	Contains lube oil with characteristics similar to source sample	Contains lube oil with characteristics similar to source sample	Contains light fuel oil but quantity not sufficient to provide correlation with source samples	Contains light fuel oil but quantity not sufficient to provide correlation with source samples
Debris from deck below engine on fuel pump side	Contains lube oil with characteristics similar to source sample	Contains lube oil with characteristics similar to source sample	Contains light fuel oil but quantity not sufficient to provide correlation with source samples	Contains light fuel oil but quantity not sufficient to provide correlation with source samples
Debris from side of engine at back end of drill rig (hydraulic pump)	Contains lube oil with characteristics similar to source sample	Contains lube oil with characteristics similar to source sample	Contains light fuel oil but quantity not sufficient to provide correlation with source samples	Contains light fuel oil but quantity not sufficient to provide correlation with source samples

Sample Description	**Hydraulic oil from drill hydraulic tank**	**Clean hydraulic oil from bulk tank at depot**	**Diesel fuel from drill fuel tank**	**Diesel fuel from bulk tank on service truck No. 764**
Debris from top of engine from burned vent hoses.	Contains lube oil but quantity not sufficient to provide correlation with source samples	Contains lube oil but quantity not sufficient to provide correlation with source samples	Not found	Not found
Contaminated soil sample from ground directly next to drill rig (ground just below cab area)	Contains lube oil with characteristics similar to source sample	Contains lube oil with characteristics similar to source sample	Not found	Not found
Dirt sample taken 50 feet south of drill rig	Contains lube oil but quantity not sufficient to provide correlation with source samples	Contains lube oil but quantity not sufficient to provide correlation with source samples	Not found	Not found

APPENDIX E
ACCIDENT SCENARIOS

Witness observations from event	**A hydraulic hose failure spraying hydraulic oil onto the hot surface of the engine turbocharger and igniting.**	**Diesel fuel was ignited from a static electric spark discharged at the drill fill tank neck.**	**A diesel fuel fire from the use of smoking materials during fueling**	**Diesel fuel accidently sprayed onto the** hot surfaces on and around the engine and hydraulic pump area **immediately prior to fueling which vaporized and ignited.**
Loud noise	Could account for this, but examination of the hydraulic system revealed no hoses that experienced catastrophic rupture	FP* of diesel fuel would be above expected temperature of fuel in the tank, hence a large cloud of un-ignited vapors unlikely. Also, static is not a competent ignition source since the humidity was high.	FP of fuel in tank would be above expected temperature of fuel, hence large cloud of un-ignited ignitable vapors unlikely. No smoking materials were found on the victim or in the fire area. Victim was a smoker, but smoking materials, including lighter, were found in the service truck cab	Most surfaces on the engine and hydraulic pump gear box were at or above the flashpoint of the diesel fuel. If a noticeable amount of fuel was splashed onto these areas, it could generate a large cloud of flammable vapors which could produce a loud noise when ignited.
Victim immediately engulfed in flame	Could account for this if hydraulic fluid sprayed onto victim. However, examination of the hydraulic system revealed no hoses that experienced catastrophic rupture	This scenario cannot account for victim being engulfed in flames because of the unlikely presence of a large cloud of vapors based upon FP temperature of diesel fuel versus expected temperature of that fuel	This scenario cannot account for victim being engulfed in flames because of the unlikely presence of a large cloud of vapors based upon FP temperature of diesel fuel versus expected temperature of that fuel	If the victim accidentally discharged diesel fuel from the nozzle, some of the discharge could have splashed onto the victim
Immediate large flash fire	Could account for this if hydraulic fluid sprayed in area of refueling prior to ignition. However, examination of the hydraulic system revealed no hoses that experienced catastrophic rupture	This scenario cannot account for immediate large flash fire because of the unlikely presence of a large cloud of vapors based upon FP temperature of diesel fuel versus expected temperature of that fuel	This scenario cannot account for immediate large flash fire because of the unlikely presence of a large cloud of vapors based upon FP temperature of diesel fuel versus expected temperature of that fuel	If the victim accidentally discharged diesel fuel from the nozzle, some of the discharge would have landed on surfaces at or above the flashpoint of the diesel fuel, resulting in a large, localized cloud of flammable vapor
Initial fire location	Fire appeared to start in the refueling/hydraulic equipment/engine area. Hence this scenario can account for this.	Fire appeared to start in the refueling/hydraulic equipment/engine area. Hence this scenario can account for this.	Fire appeared to start in the refueling/hydraulic equipment/engine area. Hence this scenario can account for this.	Fire appeared to start in the refueling/hydraulic equipment/engine area. Hence this scenario can account for this.

Witness observations from event	**A hydraulic hose failure spraying hydraulic oil onto the hot surface of the engine turbocharger and igniting.**	**Diesel fuel was ignited from a static electric spark discharged at the drill fill tank neck**	**A diesel fuel fire from the use of smoking materials during fueling**	**Diesel fuel accidently sprayed onto the** hot surfaces on and around the engine and hydraulic pump area **immediately prior to fueling which vaporized and ignited**
Ignition source needed	The hottest surface would likely be the turbocharger. However, the AIT of the hydraulic oil is too high to make the turbo charger a credible ignition source. The AIT for the H.O. was approximately 689 F, requiring the minimum temperature of the turbo to be approximately 1040 F. Measurements taken on a similar drill did not yield turbo temperatures this high. An ignition by an electrical fault would have required the simultaneous failure of both the electrical system and the hydraulic system, a possibility with an extremely low probability	Humidity considerations and the velocities in the hose and nozzle make static electricity an unlikely event	There is no evidence of smoking materials in the vicinity of the fire	The hottest surface would likely be the turbocharger. The AIT of the diesel fuel is within a range that makes the turbo charger a credible ignition source. The AIT for the fresh D.F. was approximately 450 F, requiring the minimum temperature of the turbo to be approximately 800 F. Measurements taken on a similar drill yielded turbo temperatures this high. At these temperatures, it is expected that a short delay would have existed between the time fuel was discharged onto the hot surfaces and occurrence of ignition. This may have been just enough of a delay for the victim to have removed the fuel cap and begin refueling.

*FP= Flashpoint AIT=Laboratory determined auto ignition temperature

APPENDIX F
Victim Information

Accident Investigation Data - Victim Information
Event Number: 4 4 0 2 5 0 6

U.S. Department of Labor
Mine Safety and Health Administration

Victim Information: 1

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:
Phillip W. Gustafson	M	36	01 Fatal

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:	6. Date and Time Started:
a. Date: 06/06/2010 b.Time: 22:45	a. Date: 06/06/2010 b.Time: 16:00

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
104 Service Truck Operator	071 Service Truck Operator	Yes X No

10. Experience	Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days
a. This Work Activity:	7	26	0	b. Regular Job Title:	7	26	0	c: This Mine:	7	26	0	d. Total Mining:	7	20	0

11. What Directly Inflicted Injury or Illness?	12. Nature of Injury or Illness:
045 Fire	120 Burn

13. Training Deficiencies
Hazard: | | New/Newly-Employed Experienced Miner: | | Annual: | | Task: | |

14. Company of Employment: (If different from production operator)
Operator
Independent Contractor ID: (If applicable)

15. On-site Emergency Medical Treatment
Not Applicable: | | First-Aid: | | CPR: | | EMT: | X | Medical Professional: | | None: | |

16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim: 9999 None (No Union Affiliation)

Victim Information:

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:	6. Date and Time Started:

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
		Yes		No	

10. Experience:	Years	Weeks	Days		Years	Weeks	Days		Years	Week	Days		Years	Weeks	Days
a. This Work Activity:				b. Regular Job Title:				c: This Mine:				d. Total Mining:			

11. What Directly Inflicted Injury or Illness?	12. Nature of Injury or Illness:

13. Training Deficiencies:
Hazard: | | New/Newly-Employed Experienced Miner: | | Annual: | | Task: | |

14. Company of Employment: (If different from production operator)
Independent Contractor ID: (If applicable)

15. On-site Emergency Medical Treatment:
Not Applicable: | | First-Aid: | | CPR: | | EMT: | | Medical Professional: | | None: | |

16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim:

Victim Information:

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:	6. Date and Time Started:

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
		Yes		No	

10. Experience:	Years	Weeks	Days		Years	Weeks	Days		Years	Week	Days		Years	Weeks	Days
a. This Work Activity:				b. Regular Job Title:				c: This Mine:				d. Total Mining:			

11. What Directly Inflicted Injury or Illness?	12. Nature of Injury or Illness:

13. Training Deficiencies:
Hazard: | | New/Newly-Employed Experienced Miner: | | Annual: | | Task: | |

14. Company of Employment: (If different from production operator)
Independent Contractor ID: (If applicable)

15. On-site Emergency Medical Treatment:
Not Applicable: | | First-Aid: | | CPR: | | EMT: | | Medical Professional: | | None: | |

16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim:

MSHA Form 7000-50b, Mar 2008 Printed 10/18/2010 11:48:37 AM