**CAI-2012-01**

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

**COAL MINE SAFETY AND HEALTH**

# REPORT OF INVESTIGATION

**Underground Coal Mine**
**Fatal Exploding Vessel under Pressure Accident**
**January 11, 2012**

**Buchanan Mine #1**
**Consolidation Coal Company**
**Mavisdale, Buchanan County, Virginia**
**ID No. 44-04856**


**Accident Investigators**

**Jason D. Hess**
**Coal Mine Inspector**

**Michael A. Hockenberry**
**Fire Protection Engineer**

**Originating Office**
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## OVERVIEW

At approximately 7:40 p.m. on Wednesday, January 11, 2012, Joe E. Saunders (victim), a 44-year old Utility/Diesel Locomotive Operator, with one year and eight months mining experience, was involved in a serious accident, resulting in traumatic injury to his face and head. Saunders and two other miners were working to reinstall a 1½-inch fire hose outlet to the 6-inch fresh water supply pipe. As the miners were working to reinstall the outlet, water pressure built up in the 6-inch fresh water pipe due to the inby 6-inch valve not closing properly. The increase in pressure caused a previously damaged 1½-inch valve on the outlet to fail catastrophically, propelling the steel water outlet into the victim's face and head. The victim was hospitalized for seven days in an intensive care unit before he died as a result of his injuries.

## GENERAL INFORMATION

Consolidation Coal Company's Buchanan Mine #1 is an underground coal mine located two miles south of Route 460, adjacent to State Route 632, at Mavisdale, Buchanan County, Virginia. Consol Energy Incorporated located in Pittsburgh, Pennsylvania, is the parent company of Consolidation Coal Company. The principal officers for the mine at the time of the accident were:

Jack Richardson ..... V.P. Central Appalachia Operations
Brett Holbrook ..... General Superintendent
Danny Atwell .....…. Assistant Superintendent
Craig Dickerson ..... Assistant Superintendent
Eric Smith ..... General Mine Foreman

The mine has 13 shaft openings into the Pocahontas No. 3 Seam. The seam averages 72 inches in height. Five mine fans exhausting 2.6 million cubic feet of air per minute provide ventilation. Laboratory analysis of return air samples shows a methane liberation rate of 10.7 million cubic feet per day through the mine fans. The development units are ventilated using a double split system with exhausting line curtains or auxiliary fan and ventilation tubing.

Employment is provided for 694 underground and 65 surface miners working on three production shifts per day, seven days per week. No shifts are designated as maintenance shifts. The mine produces an average of 15,000 tons of raw material daily from 10 continuous mining machine units (five "super" sections), and one longwall unit. Coal is transported from the faces by shuttle cars, battery-powered ram cars and a longwall face conveyor. The coal is then transported to the production shaft bottom by belt conveyors, stored in bunkers, and hoisted to the surface by skip hoist cars. Employees and materials are

transported in and out of the mine via hoists and underground travel is facilitated by a diesel-powered track haulage system.

The mine is developed with 10 active continuous mining machine sections supporting longwall mining. Longwall panels are developed 750 feet wide, by 11,500 feet long. At the time of the accident, mining was ongoing on all 10 active continuous mining machine sections and the longwall. In addition, development had been completed on the #18 right panel off 3 East Mains, and work was being conducted to set up for longwall retreat mining.

Methane within this mine is removed by degasification of the seam with vertical holes drilled and fractured in the virgin areas of the seam (frac holes) prior to mining, and horizontal degasification holes drilled on the tailgate side of the longwall during development. The frac holes later become vertical degasification boreholes (gob holes) as the longwall retreats and caving causes atmospheric communication between the gob and the vertical holes.

MSHA completed the last regular health and safety inspection (E01) of the mine on December 22, 2011. A regular safety and health inspection was commenced on January 03, 2012, and was ongoing at the time of the accident. The Non-Fatal Days Lost (NFDL) injury incidence rate for the mine in 2011 was 0.78, compared to a National NFDL rate of 3.73.

## DESCRIPTION OF THE ACCIDENT

On January 11, 2012, Joe E. Saunders received traumatic head and face injuries when a pressurized water delivery manifold separated, striking him in the head. The accident occurred at approximately 7:40 p.m., while Saunders and fellow co-worker David Green were transporting a shuttle car along the track haulageway. Green operated the lead diesel locomotive with Saunders operating the tail diesel locomotive. A Freedom shuttle car was positioned on a rail-mounted lowboy hauler connected to the rear of the lead locomotive and to the front of the tail locomotive, forming a "haulage trip." Greg Addington, First Class Mine Foreman, was riding in the passenger seat of the tail locomotive and had been assigned to supervise these miners during the shift.

The day shift had brought the lowboy and shuttle car (haulage trip) from the Page Portal and parked it at the 8 left side track off the 4 north mains, allowing the shift change mantrip traffic to clear. Green, Saunders, and Addington met at the haulage trip lowboy and made preparations to continue transporting the shuttle car via the haulage trip to the 21st right panel off 3 East Mains. The miners drove the haulage trip approximately 10,300 feet along the 4 North Mains and the 3 East Mains track, arriving at crosscut #61.

As the haulage trip proceeded through crosscut #61 intersection, the shuttle car struck the tip of the manifold, dislodging a component of the 1½-inch valve from the valve body. The electrical panel board of the shuttle car protruded 38 inches from the left track rail, because of insufficient clearance for safe transport through the area. When the water valve was dislodged, water was sprayed into the air, wetting Saunders and Addington.

Green and Saunders drove the haulage trip through this area and stopped the trip just inby the broken water outlet. Green traveled on foot approximately five crosscuts inby to crosscut #66, where he closed a cut-off valve in the 6-inch water supply line to stop the flow of water. Saunders exited his locomotive and traveled on foot outby to crosscut #58¾, where he also closed a cut-off valve to stop the flow of water in the 6-inch water line. Saunders then traveled on foot back to crosscut #62, where he turned the cut-off lever of the 6-inch crossover pipe toward the "off" position. He believed he was stopping the flow of water from the 10-inch water line located in the adjacent #4 entry (see Appendix A). According to interview statements, Addington was wet and traveled on foot into the right crosscut, between the #5 and #6 entries in crosscut #61, to stay out of the air current.

Green and Saunders met at the cutoff valve located at crosscut #62. During the interview process, Green stated he observed Saunders cutting off the crosscut #62 valve. Green stated he observed Saunders reach down, push it over and tap it with his hammer to where it should have been closed. After the crosscut #62 crossover valve was turned by Saunders, Green and Saunders traveled outby to the crosscut #61 to investigate the broken water outlet and repair it. Both Green and Saunders examined the water outlet and found that the first quarter turn ball valve, which was connected to the 1½-inch nipple on the supply line, had separated into two pieces. The separation occurred when the brass tailpiece of the ball valve was pulled out of the brass valve body. The tailpiece is provided with male fine threads and is threaded into the female fine-threaded body of the ball valve. The tailpiece remained on the 1½-inch diameter nipple of the six-inch supply pipe. The tailpiece of the valve is attached to the supply nipple by a coarse threaded connection (see Appendix B). The water expelled from the dislodged outlet formed a pool of water, combined with mine dust and gravel covering the nipple. Green and Saunders used their hands to clean the loose mine dust and gravel from around the nipple to prepare for re-connection, but never visually observed the nipple or the tailpiece of the valve. The pool of water remained around the nipple due to a slight steady flow of water being expelled from the nipple. According to witness statements, the miners believed the water was residual water in the line and did not realize they had a supply line valve that was not fully closed. Because of the pooling water, they were

unable to gain a clear view of the nipple and valve tailpiece. They attempted to evaluate the condition of the threads by touching them with their hands. They visually evaluated the threads within the body portion of the ball valve for damage. The miners believed the threads on both components were still in usable condition.

Green and Saunders began by disconnecting the 2-inch Victaulic® water pipe connection from the manifold to enable them to turn the manifold onto the tailpiece and nipple. The two miners turned the manifold and ball valve onto the tailpiece and nipple to re-thread the two components back together. According to witness statements, they turned the manifold multiple times by hand before Saunders tightened the manifold with a pipe wrench. During this process water continued to flow through the nipple into the manifold and out through the open outlets. Water was allowed to flow through to reduce pressure on the manifold as they turned the manifold onto the tailpiece and nipple. According to witness statements, Addington did not participate, nor provide any supervision or guidance to the miners related to the repair of the damaged fire valve.

After installing the manifold, Green stood and turned away from Saunders to speak with another miner standing behind him. Billy Davis, Utility Person, helped Saunders complete the connection of the 2-inch Victaulic® line leading to the rock dust distribution machine, located in the adjacent crosscut. Prior to making the Victaulic® connection, the previously separated ball valve was placed in the closed position to stop the flow of water.

With the 1½-inch ball valve closed, pressure began to build in the six-inch line, due to a partially closed valve still allowing water to flow in the line. As the pressure increased, the threaded connection between the valve tailpiece and the valve body failed at the location of the repair. This caused the manifold to again separate from the nipple and valve tailpiece, striking Joe Saunders in the face and head. The manifold then traveled through the air and landed 23 feet and 4 inches from its original location. Saunders suffered serious lacerations to his face and forehead and lost consciousness at the time of impact. Emergency responders evaluated Saunders' vital signs, confirmed he had a pulse, was breathing, and then took action to control bleeding. Greg Smith, Assistant Shift Foreman, and Billy Davis placed Saunders on a backboard and transported him to the Contrary Portal hoist via a rail mounted mantrip. Addington stated in interviews that during this time he was in communication with the surface to ensure that proper medical arrangements had been made and communicating with personnel in the mine to ensure the track way was clear for transportation of the injured miner. Emergency evacuation plans were being made on the surface, but due to adverse weather conditions, air transport was not an option. Upon arrival on the surface, Saunders was transported by ambulance to nearby

Clinch Valley Medical Center in Richlands, Virginia. Saunders was later transported to the Bristol Regional Medical Center (BRMC) in Bristol, Tennessee. He was hospitalized in the intensive care unit at BRMC for seven days before passing away on January 18, 2012, at 4:12 p.m. from injuries sustained in this accident.

## INVESTIGATION OF THE ACCIDENT

On January 11, 2012, at approximately 7:45 p.m., Mark Hlywa, MSHA Inspector at the Buchanan Mine #1, was notified by Corey Boyd, General Laborer, that a serious accident had just occurred at the crosscut #61 along 3 east mains in the #5 entry (belt/track entry). Boyd encountered Hlywa after he had traveled six crosscuts outby the accident scene to the #9 vent construction and rehabilitation area, where Hlywa was engaged in inspection duties as part of the ongoing E01 inspection.

Hlywa, along with Greg Smith, immediately traveled to the crosscut #61 accident scene. At 7:50 p.m., Hlywa issued a 103(k) Order, closing the area to ensure the safety of all persons. This order prohibited all activity from crosscut #58, inby to crosscut #66. The order required the operator to obtain prior approval from MSHA for all actions to recover and/or restore operations to the affected area.

Following the first aid evaluation and transport of the victim out of the area, Hlywa immediately began to collect preliminary data from the accident scene. He took note of specific locations of the victim and the scene. Hlywa took photographs and measurements of the accident scene and locations of information pertinent to the accident investigation. Hlywa also collected brief statements from miners present at the accident location. At 8:20 p.m. Hlywa modified the 103(k) Order to permit the Freedom shuttle car, located on the lowboy hauler, to be moved approximately two crosscuts inby the accident site to prevent the mine's secondary escapeway from being blocked.

At 7:51 p.m. Brett Holbrook, Mine Superintendent, contacted the MSHA Hazardous Condition Hotline and reported the accident. At approximately 8:45 p.m., Scott Beverly, Acting MSHA Field Office Supervisor, contacted Donald K. Phillips, MSHA District 5 Field Office Supervisor by telephone at the Vansant, VA field office and informed him of the accident. Phillips immediately telephoned Jason D. Hess, Accident Investigator, and assigned him to travel to the mine to investigate the accident. Phillips then proceeded to the mine site.

At approximately 9:35 p.m., Phillips arrived at the Contrary Portal, where he met with Eric Smith, General Mine Foreman. Phillips spoke briefly on the mine

telephone with Hlywa, who was still underground. Phillips informed Hlywa that Hess was en route to the mine.

Hess arrived at the Contrary Portal surface area at 9:45 p.m. He met briefly with Phillips and Eric Smith in the mine office before proceeding underground. Hess traveled underground to the accident site with Dave Semones, Shift Foreman. Hess arrived at the accident site and met with Hlywa, Virginia Department of Mines Minerals and Energy (DMME) inspector, John Brown, and Consolidation Coal Company safety representative, Robert Baugh. They briefed Hess on the preliminary findings. Hess took additional notes and made measurements of the area. Hess conducted a brief interview with David Green and Greg Addington, witnesses to the accident.

At 10:50 p.m., prior to leaving the accident site, Hess modified the 103(k) Order to define the affected area as the #5 intersection of crosscut #61, along the 3 east mains and extending 20 feet into all four approaches. The order prohibited any further movement of the Freedom shuttle car and restricted all rail traffic in the affected area. A narrow walkway was established through the area by barricading each side with reflective ribbons. Upon completion of this portion of the preliminary investigation, the inspection party returned to the surface at the Contrary Portal. The inspection party met with Holbrook to inform him of the preliminary findings, and made arrangements to continue the investigation. The 103(k) Order and modifications were reduced to writing and served to mine management.

The accident investigation continued on the morning of January 12, 2012. Hess discussed the preliminary findings with John Hughes, Coal Mine Inspector, before leaving the Vansant Field Office. Hess and Hughes traveled to the mine, arriving at the Contrary Portal surface area at 9:25 a.m.

Hess and Hughes met Brett Holbrook, Mine Superintendent, in the mine office and notified him of their presence. Ray McKinney, MSHA District 5 Manager, and Hagel Campbell, Acting Staff Assistant for District 5, were also onsite. Duane Beggs, District 5 Mining Engineer, arrived shortly thereafter. Virginia DMME officials Opie McKinney, Inspector Supervisor; John Brown, Mine Inspector; Terry Ratliff, Mine Inspector; and Chris Whitt, Emergency Manager, were also onsite to participate in the accident investigation. Consolidation Coal Company representatives included Holbrook, Jack Richardson, Vice President of Central Appalachia Operations, Eric Smith, General Mine Foreman, and Darrel Johnson, Supervisor of Safety.

The investigation party met on the surface to discuss preliminary findings and to make plans for the underground investigation. The investigation party entered

the mine and traveled to the accident site. The accident site was measured, sketched, and photographed. The fire hose outlet manifold was reconnected to the 6-inch water supply line to recreate the accident scene. The two diesel locomotives connected to the lowboy carrying the Freedom shuttle car were repositioned at the accident location to recreate the scene of the initial impact between the shuttle car and the fire hose outlet and manifold. Measurements were taken of the mine track, Freedom shuttle car, and the water manifold.

Upon completion of the underground portion of the investigation, the 103(k) Order was modified to permit resumption of rail traffic, with the exception of wide loads. This modification also restricted movement of the Freedom shuttle car until the operator developed an action plan.

Upon arrival on the surface, Hughes completed chain of custody documentation for MSHA to take custody of the water valve manifold involved in the accident, as well as a 6-inch ball valve believed to have failed to close properly. Holbrook released the items to MSHA's custody.

The investigation party met at the Contrary Portal and developed a schedule for conducting interviews and the expectations for an action plan. Hughes modified the 103(k) Order after approval of the action plan to move the Freedom shuttle car.

On January 13, 2012, interviews were conducted in the MSHA District 5 Vansant, Virginia field office. Nine miners who witnessed the accident were interviewed. Additional interviews were held January 20, 2012, with the two locomotive operators and an outby foreman. Final interviews were conducted on February 2, 2012, with three shift foremen and one follow-up interview.

The 1½-inch ball valve closure and the 6-inch ball valve closure were shipped to the Mine Safety and Health Administration Approval and Certification Center's (A&CC) Mechanical and Engineering Safety Division (M&ESD) in Triadelphia, WV for non-destructive evaluations.

## DISCUSSION

### Accident Site

The accident occurred in the #5 entry (belt/track) in the 3 east mains at #61 crosscut. This particular area had been developed to a height of approximately 13.5 feet to facilitate a previous belt drive.

The #5 entry was an average 22 feet wide, extending the entire length of 3 east mains. A 54-inch belt conveyor was installed on the left side of the #5 entry and

a 48-inch wide track was located on the right side of the entry. The #5 entry contained three clearance zones, located left to right between the side of the coal pillar and the belt conveyor; between the belt conveyor and the track haulage; and between the track haulage and the opposite coal pillar. These clearance zones normally range in width from 12 inches, to 48 inches. The 6-inch fresh water line was positioned in the zone between the track haulage and the conveyor belt.

The location of the fire hose outlet and manifold prior to being damaged was in the #5 entry in the center of the #61 intersection. The manifold traveled approximately 23 feet 4 inches from its original position, after striking the victim.

A permanent rock dust distribution machine is located in the #6 intersection at Survey Station (S.S.) #21075. The rock dust machine receives rock dust through a borehole from the surface. It is provided with a sprinkler type fire suppression system that requires a connection to the fresh water supply. A 2-inch Victaulic® water pipe used to supply the fresh water supply to this fire suppression system was connected to the water valve manifold located in the #5 entry at cross cut #61 referred to in this accident (see APPENDIX A).

A 2-piece metal Victaulic® coupling was lying on the mine floor, adjacent to the original fire valve manifold connection point. This metal coupling had been removed by the miners in order to disconnect the 2-inch pipe from the manifold to allow the manifold to turn.

**Ladder system water supply**

The water supply system in the Buchanan Mine #1 consists of a dual supply line system, referred to as a ladder system. This system depicts a layout design which has a 6-inch supply line coursed through the mine's belt/track entry and a 10-inch supply line coursed through the adjacent entry. These two supply lines are connected routinely by 6-inch crossover lines forming an overall design resembling a ladder. This system is necessary to supply the required water supply volume needed for dust suppression and fire protection in the mine (see APPENDIX A).

**Water supply pressure**

The static water pressure in the mine averages 700 to 850 pounds per square inch, (psi) as a result of gravity effect. The water supply enters the mine through a bore hole, then free falls approximately 1,600 feet to the level of the coal seam. The difference in elevation increases the head pressure of the water flow prior to the water reaching the coal seam and beginning its course to the targeted areas of the mine. The water valves, manifolds, and components in service at this mine are subjected to this 700 to 850 psi static pressure.

**Fire hose outlets**

The 6-inch water supply line coursed through the mine in the belt/track entry has 1½-inch water outlet fire hose outlets located at 300 feet intervals. These fire hose outlets consist of a pipe nipple, a brass ball type closure valve, another pipe nipple, and a fire hose connector. The finished firehouse outlet normally ranges from 10 to 12 inches long, and extends up from and perpendicular to the water supply line.

**Water manifold outlet**

Various locations in the mine require a continuous supply of water. In these instances, the fire hose outlets are retro-fitted with additional plumbing to convert them into multi-outlet water manifolds. A manifold may contain two or more ball type closure valves to allow water to flow through to the areas requiring continuous water flow, while preventing the water from flowing through fire hose outlets. These manifolds normally range from 24 to 30 inches long and also extend perpendicular to the supply line.

**Crosscut #61 water manifold**

The crosscut #61 water manifold involved in the accident was a multi-valve outlet consisting of three outlet ports. Two of the outlet ports were fitted with fire hose outlets with ball type closure valves, and the third was fitted with a 2-inch steel Victaulic® coupler. The Victaulic® coupler was not provided with a closure valve. In order to stop the flow of water, the main valve at the base of the manifold had to be closed. This 2-inch Victaulic® coupler was connected to a 2-inch steel water line and was being used to provide continuous water flow to supply a fire suppression system for a rock dust supply unit positioned in the right crosscut between the #5 and #6 entries. The two 1½-inch water outlets installed on the manifold consisted of one, which had been used in the past to provide water to fill a water car, and the other was a standard fire hose connection. The 3 outlets on this manifold created a T-shaped design and extended perpendicular to the 6-inch water line. The 1½-inch nipple connector on the 6-inch supply line is 40½ inches from the left of the left side track rail (looking inby). This nipple is angled slightly toward the track entry, therefore extending the 26-inch long T-shaped manifold farther toward the mine track travelway. This resulted in the outermost projection of the manifold located 36 ¾ inches from the left track rail.

**1½-inch Brass constructed ball type valve**

The brass ball type valves used in assembling of the fire hose outlets and water outlet manifolds are constructed using a two piece valve body design. The two pieces that make up the valve body are referred to by the manufacturer as the body and the tailpiece. The body is the larger of the two pieces and contains the quarter turn rotating ball and stem. The smaller piece is the tailpiece, and is

threaded into the body portion, which compresses the outer seal and the rotating ball into position. These two pieces of the valve body are connected using fine machined threads. The tailpiece threads into the female portion of the valve body, completing the valve assembly (see APPENDIX B).

**The-6 inch ball type supply line valves**

The 6-inch steel ball type closure valves control water flow within the 6-inch supply lines. Prior to the accident, the miners closed three of these valves to isolate or stop the water flow through the portion of the line containing the damaged fire valve outlet at crosscut #61. A closure valve located at crosscut #62 did not completely close. This valve was used to control water flow from the 10-inch main supply line to the 6-inch line at a crossover. This resulted in water being backfed into the 6-inch line the miners were working on. This partially open valve allowed water pressure to increase as they worked on the damaged manifold (see APPENDIX A, APPENDIX B, and APPENDIX C).

These 6-inch ball type closure valves were provided with a 22.5-inch removable leverage handle when originally purchased. The manufacturer of this ball type closure valve designed this handle to be inserted into the short receiver handle on top the valve and to be secured in place with a cartridge pin, also provided from the manufacturer. Inserting this 22.5-inch handle into the receiver handle gives the person turning the valve a total leverage handle surface of 28.13 inches. This leverage handle is necessary to give the person turning the valve the proper leverage needed to turn the large heavy gauged steel quarter turn closure ball and stem. Also, this handle being of a length that would extend perpendicular to the valve when closed, would enable a person to determine if the valve is setting in a 90 degree angle and therefore fully closed. The 6-inch ball valve, located at crosscut #62, was not provided with the leverage bar to provide proper use of the valve.

**Victaulic® pipe coupling to fire suppression system**

The 2-inch Victaulic® pipe connection consists of two grooved pipe ends joined together with a rubber seal over the seam. A two-piece coupling band is clamped over the rubber seal to prevent separation.

**Freedom Car (shuttle car) being transported**

The width of the shuttle car being transported was 10 feet, 1⅞ inches. This was an oversize load for the track haulage entry and created clearance problems with coal ribs, water lines, high voltage cables, and belt infrastructure. The shuttle car projected out from the side of the low boy hauler 38 inches and therefore, into the path of the crosscut #61 fire hose outlet manifold.

**Summary of findings of examinations of ball valves conducted at MSHA A&CC**

**1½- inch ball valve**

The handle was attached to the valve body, but had been bent from its original orientation when compared to a new valve of the same model. The valve body had three noticeable identification markings cast into the body: *1 1/2, 600 WOG*; and a unique symbol identifying the manufacturer. The manufacturer of the ball valve was Milwaukee Valve Company, Inc.

A non-contributing 104 (a) citation was issued to Consolidation Coal Company, Buchanan Mine #1 for violation of 30 CFR § 75.1100-3 for the use of firefighting equipment which was not rated for the high water pressures at this mine.

The female threads where the tailpiece would normally thread into the valve body appeared damaged and worn. The National Pipe Thread (NPT) threads appeared to be undamaged, but the male threads of the tailpiece, which would have threaded into the valve body, were damaged. The straight threads connecting the two sections together was the location where the valve separated when impacted by the piece of mobile equipment prior to the accident. Upon examining the straight threads on the tailpiece and comparing those to the threads on an exemplar valve, it appeared the crest of the accident valve threads were rounded, as well as gouges and cuts were noted. The tailpiece of the accident valve could be inserted into the valve body without rotating or threading the tailpiece into the valve body. These normally must be threaded together to achieve proper thread engagement. The accident valve was damaged by the impact of the mobile equipment, resulting in the male tailpiece threads to pull through the female threads of the valve body, which caused damage to both the female and male threads. Both outside diameter (OD) and inside diameter (ID) measurements were taken of the accident and exemplar valves. The OD measurement was 2.212 inches on the accident tailpiece and 2.246 inches on the exemplar tailpiece. The ID measurement was 2.215 inches on the accident valve body and 2.194 inches on the exemplar valve. The manufacturer recommends that the two-piece valve assembly not be disassembled once placed in service. These type and model of valves are considered "throw away" valves and should be replaced if any damage is suspected according the manufacturer's written recommendations.

Magnified photographs were taken of the threads at the separation point between the valve body and tailpiece. Photographs illustrated the damage sustained by both the male threads of the tailpiece and female threads of the valve body. The thread heights of the tailpiece threads of the accident valve were less than the same measurements on the new exemplar valve. The threads

were noticeably rounded resulting in approximately 25 per cent reduction in thread height, when compared to new tailpiece. The damage to the female threads of the accident valve body consisted of threads not running parallel with one another, threads cut, gouged or no longer straight, and pieces of brass threads broken off and deposited into the root of the thread layout.

**6-inch ball valve**

The manufacturer and model information was cast into the exterior body of the 6-inch ball valve. These markings indicate that the valve was constructed of ductile iron, Series 721 six-inch ball valve, manufactured by Victaulic. The valve was designed for 800 Pounds per Square Inch Gauge **(**psig) water, oil, and gas (WOG) service, with reinforced tetrafluoroethylene (TFE) seats.

The ball valve was not in the fully closed position when received at the A&CC. There was an opening between the ball and the valve seat that measured approximately 0.472 inches (12 mm) at its widest point and would have permitted water to flow through the valve. The valve body was secured against movement and the valve was closed from the "as received" position, until the valve stem contacted material that had built up between the valve stem and the valve stop. This material measured approximately 0.13 inches (3.3 mm) and prevented the valve stem from completely contacting the valve stop.

**Key facts gathered during witness interviews**

- Contacting and damaging fire valves along the belt/track haulageway was common at the Buchanan Mine during equipment moves.
- Foreman Addington had searched for replacement fire valves at the shaft bottom area at the start of the shift, which were to be used if a valve was damaged during the equipment move for which he was preparing.
- Miners who have engaged in equipment moves at the Buchanan Mine in the past recollect fire valves being hit and torn off.
- Miners had identified the crosscut #61 fire valve and manifold as being a problem area in the past.
- At least one other fire valve had been contacted and damaged with the Freedom car load on the day shift prior to the accident involving Saunders.
- Miners have disassembled fire valves and or manifolds in the past to prevent them from contacting wide loads.
- Miners had witnessed this same type of separation (body and tailpiece) during similar incidents prior to the day of the accident. Many of the fire outlets in this mine were originally installed, projecting the fire outlet toward the mine track. When these fire outlets were damaged, they were repaired and/or replaced without improving the design.

## ROOT CAUSE ANALYSIS

An analysis was conducted to identify the most basic causes of the accident that were correctable through reasonable management controls. During the analysis, numerous root causes were identified that, if eliminated, would have either prevented the accident or mitigated its consequences.

**Root Cause**
This accident occurred as result of the mine operator's failure to develop effective policies, procedures, and training to protect miners as they carry out their respective duties and assignments relating to water line installations and track haulage.

**Corrective Action**
The mine operator has developed written safe work instructions (SWI), which include standard and specific policies, procedures and training to be followed while completing the tasks that led to the occurrence of this accident. These written policies and procedures give specific guidance and direction, both during the transportation of large mining equipment on the track haulage and during the repair and/or replacement of high pressure water lines and their components. The operator has included training on these policies and procedures as part of the curriculum in the revised training plan to be used during all annual, newly employed, hazard and task training sessions.

**Root Cause**
The mine operator failed to provide the necessary leverage bar for 6-inch ball type closure valve at the #62 crosscut, to ensure that miners could close the valve during repairs.

**Corrective Action**
The operator has taken the defective #62 crosscut 6-inch ball-type closure valve out of service and replaced it with a new ball type closure valve and leverage bar capable of properly closing to prevent bypass water flow.

**Root Cause**
The mine operator failed to maintain adequate clearance between the track haulage and the fire valves and to train the miners in how to move mining equipment safely on haulage trips.

**Corrective Action**
The mine operator retro-fitted all the fire hose outlets in this mine to project the fire hose outlets away from the mine track to prevent them from being contacted with equipment as it passes. The safe work instruction developed by the mine

operator includes provisions for moving equipment on the track haulageway, including procedures to be followed to prevent inadvertent contact between the equipment being moved and mine structures. These procedures include the use of a gauge mounted to the lead locomotive to alert motor tram operators of locations with insufficient clearance. The procedures also include specific training for anyone involved in the movement of oversize loads. All movement of oversized loads will be performed under the direct supervision of a properly trained, qualified, and certified foreman.

## CONCLUSION

This accident occurred due to mine management's failure to recognize the hazards associated with the high water pressure and the location of water valves along the mine haulage track. The water valves located between the mine track and the belt conveyor had been damaged repeatedly during transportation of equipment on the mine track haulage way. Mine management failed to develop effective policies and procedures for movement of large equipment and repair of high pressure water lines. The accident occurred when a 1½-inch ball-type closure valve connected to a water manifold separated catastrophically. The valve used to control 700 to 850 psi water flow, was damaged when the manifold was struck by a large unit of mining equipment being transported on the mine track haulageway. The water pressure built against the damaged ball valve due to an improperly closed 6-inch closure valve. As the damaged water manifold was being repaired, the 1½-inch ball valve was closed to prevent water flowing from the manifold. As repairs continued, water pressure increased, resulting in failure of the damaged valve. The valve separated violently, allowing the water manifold to strike the victim in the face/head, resulting in serious head trauma injuries. These injuries later resulted in the victim's death.

Approved By:

Gregory B Meikle

**Gregory B. Meikle**
**District Manager**

9/10/2012

**Date**

## ENFORCEMENT ACTIONS

**Section 103 (k) Order No. 8192570,** issued on January 11, 2012 to Consolidation Coal Company, Buchanan No.1 Mine states:

A serious injury accident occurred at this operation on January 11, 2012 at approximately 19:35 when a 1.5" water cutoff valve catastrophically failed and struck a miner in the face/head at crosscut #61 along the 3 East mains track way. This order is issued to assure the safety of all persons at this operation. It prohibits all activity from crosscut #58 to crosscut #66 along the track way until MSHA has determined that is safe to resume normal mining operations in this area. The mine operator shall obtain prior approval from an authorized representative for all actions to recover and/or restore operations to the affected area.

**104 (d)(1) Citation No. 8190902,** issued to Consolidation Coal Company, Buchanan No.1 Mine for violation of 30 CFR § 75.1725(a) states:

The operator of this mine failed to maintain its equipment in safe operating condition. On January 11, 2012, a serious injury accident occurred at crosscut #61 along the 3 east mains, and the injured miner subsequently died due to the injuries he sustained during the accident. The accident occurred when the miner was struck in the face/head with 1½-inch water valve assembly. This water valve assembly was propelled through the air and into the face/head of this injured miner when the 1½-inch main ball type closure valve catastrophically separated at its base. The separation occurred at a threaded connection of the ball type closure valve and a portion of the ball valve remained on the nipple attached to the 6-inch pipe line. During the investigation of this accident, static water pressure readings in excess of 800 psi were measured in this immediate area. Therefore it was determined that this ball type closure valve, rated at only 600 psi, would have been subjected to water pressures exceeding its rating during its service life (see non-contributory citation for exceeding the rating). This ball type closure valve had been previously damaged and weakened from its original integrity when it was struck by a Freedom shuttle car being transported on a rail haulage low-boy. The manufacturer's recommendations for these ball type closure valves state that these are "throw away" type devices and should not be taken apart or repaired at the threaded connection.

Prior to beginning the repairs on this damaged 1½-inch water valve assembly, three 6-inch water feed valves were activated to close off the water fed to the 1½-inch fire valve assembly being repaired. One of the three valves failed to close properly, resulting in a continuous flow of water being expelled from the open port created at the broken valve. This expelling of water continued as the repairs

were conducted, even traveling up through the fire valve manifold as it was reattached. This continuous flow of water was evidence that the water flow had not been ceased, and repairs should have been stopped. The act of reusing this damaged ball type closure valve is a failure to maintain equipment in safe operating condition. This failure resulted in the serious injury and subsequent death of the miner.

The operator and its agent displayed aggravated by allowing this damaged and separated ball type closure valve to be reused. Mine management, including the foreman assigned to supervise the miners making the repairs, were aware that the water valve assemblies were frequently struck and damaged during movement of oversized equipment. This knowledge should have prompted the operator and its agent to take extra care in the repair or replacement of these water valve assemblies. This extra care would include following the ball valve manufacturer's recommendations, which state that this is a throw away item and should not be repaired or rethreaded if a separation within the threaded portions occur. Also, management, despite the numerous previous times when fire valve assemblies were struck and damaged, failed to improve the design and layout of the fire valve assemblies in this mine to prevent them from being struck during equipment moves This is an unwarrantable failure to comply with a mandatory standard.

**104 (d)(1) Order No. 8190903,** issued to Consolidation Coal Company, Buchanan No.1 Mine for violation of 30 CFR § 75.1100-3 states:

The firefighting equipment which was in service at this mine on January 11, 2012, was not being maintained in usable and operable condition. The 6-inch quarter turn ball valve closure located at crosscut 62 along the 3 east conveyor belt mains was not being maintained in a usable and operable condition. This valve was plumbed into the 6-inch water feed crossover line, and was used to control the flow of water between the 10-inch water supply line located in the adjacent mine entry and the 6-inch supply line.

A serious injury accident occurred on January 11, 2012, which subsequently resulted in fatal injuries when a miner was struck in the face/head with a 1½-inch water valve assembly which was projected off the 6-inch water supply line. This accident occurred when water pressure was permitted to build up against the 1½-inch water valve assembly from within the 6-inch water supply line. Static water pressure in excess of 800 psi was measured from the 1½-inch water outlets in this area during the investigation.

Miners making the repairs to the 1½-inch water valve assembly used three 6-inch ball type closure valves, including the CC 62 crossover valve, in an attempt to

isolate the area and stop water flow from entering the portion of the 6-inch supply line being repaired. When the miners turned the valve at CC 62 to stop the water flow, the valve failed to close completely. There remained an opening in the valve as large as 12 mm wide through which water was allowed to flow.

The failure of this 6-inch valve to close completely resulted in the water bypassing this valve and pressure building up in the 6-inch supply line after the damaged 1 ½ inch water valve assembly was re-attached. It was determined during testing and investigation that this 6-inch valve failed to close as a result of two factors. First, the track by which the quarter turn handle connected to the ball and stem within the valve was clogged with mine dust and grime which added a resistance for the handle to travel through to completely turn and stop the water flow. Second, this valve was not maintained with the leverage bar provided by the manufacturer for turning the handle and ball stem. This 6-inch valve consists of a short fabricated steel handle that remains connected to the ball stem exiting the valve. This handle is constructed with a circular opening in the end which allows a long steel extension bar to be inserted into the handle to provide leverage to turn the valve. As a result of the leverage handle not being available, miners had to use less effective means of turning this handle. Statements provided during witness interviews indicated that a hammer was used to strike the short handle in an attempt to close the ball valve.

The operator and its agents displayed aggravated conduct through two failures which resulted in the occurrence of this accident. First, the operator failed to ensure that the 6-inch ball valve in use at this mine was provided with the necessary leverage handle to be used when closing and opening the valve. These valves are provided with these leverage handles when purchased from the manufacturer to provide the necessary leverage when closing and opening the valve. It is the responsibility of the consumer to maintain them for use. The second display of aggravated conduct was on the part of the foreman assigned to supervise the miners making the repairs. This foreman failed to provide adequate supervision of the miners making the repairs. This foreman was aware that it was common for the fire valve assemblies in this mine to be struck and damaged during the movement of oversized loads. This foreman was also aware of the extremely high water pressures at this mine. These factors should have prompted this foreman to take extra care and provide guidance and instruction to the miners, particularly to ensure that the water line was properly isolated to prevent an inadvertent pressure build up. The foreman was in the immediate area and in plain sight and sound during the repair and took no actions to ensure that the repairs were being conducted properly and safely. This is an unwarrantable failure to comply with a mandatory standard.

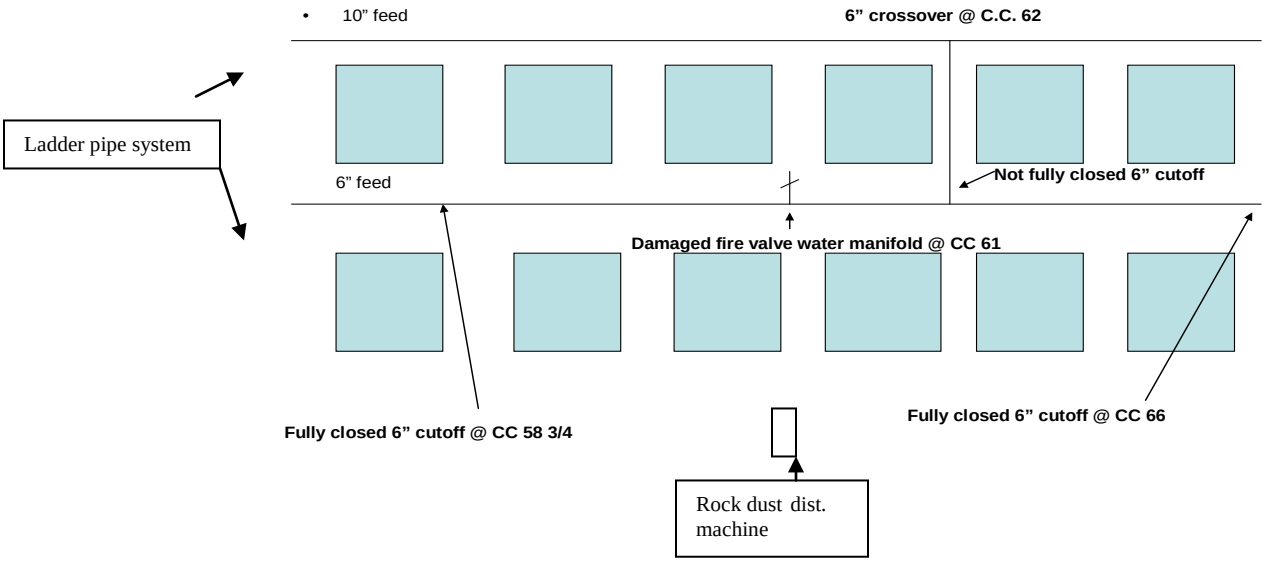
**Section 316 (b) Safeguard, No. 8190904**, was issued to Consolidation Coal Company, Buchanan No.1 mine in accordance with 30 CFR § 75.1403 states:

A serious injury accident, which subsequently resulted in the death of one miner ,occurred at this mine on January 11, 2012. This accident occurred when a previously damaged ball type closure valve connected to a water water valve assembly catastrophically separated propelling the assembly into the face/head of the victim. The separation occurred at a threaded connection of the ball type closure valve and a portion of the ball valve remained on the nipple attached to the 6-inch water line. The static water pressure on the ball type closure valve was in excess of 800 psi when it was measured during the investigation of the accident. The ball type closure valve had been previously damaged, and its original integrity was weakened, when the water valve assembly was struck by a Freedom shuttle car being transported on a rail haulage low-boy. The shuttle car struck the water valve assembly due to the operator's failure to evaluate and address prevalent track haulage problems and to establish and maintain a clear and safe travel way when moving oversized equipment on the track way.

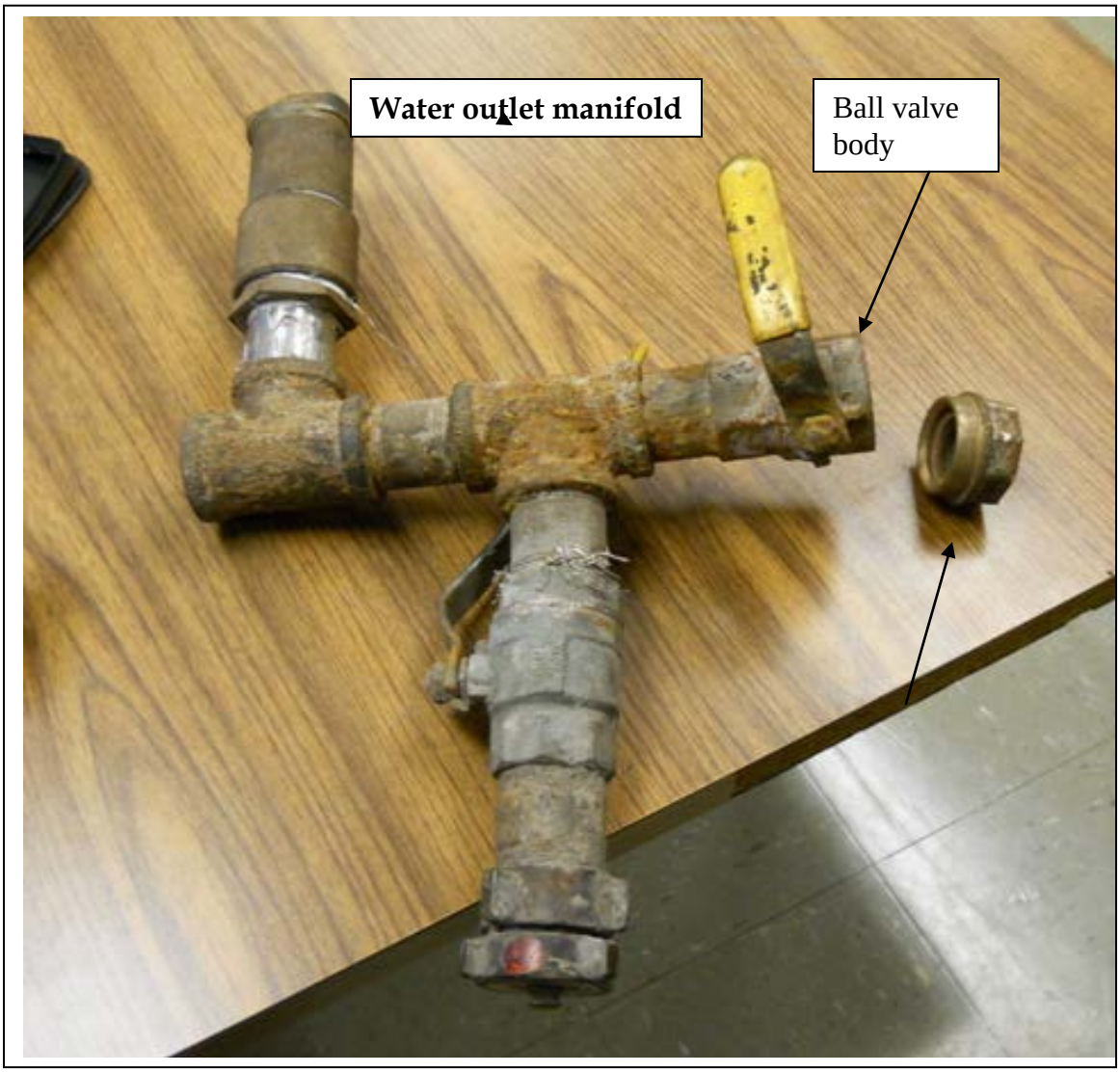
This is a notice to provide safeguard (s) requiring the operator to evaluate and address track haulage clearance when moving oversized loads; to maintain adequate clearance in all areas where there is not a permanent fixed obstacle such as a coal rib, head drive etc., and to establish a written plan to provide manpower resources, supervisory oversight and specific guidance to move oversize loads through the mine.

## APPENDIX A

# Accident site C.C. 61 of 3 East Mains



## APPENDIX B



**APPENDIX C**


6 Inch Ball Type
Closure Valve


Partial opening in 6
Inch closure valve

## APPENDIX D

### Persons Participating in the Investigation

### CONSOLIDATION COAL COMPAY

**Jack Richardson……..V.P. Central Appalachian Operations**
**Brett Holbrook……General Mine Superintendent**
**Danny Atwell……Assistant Superintendent**
**Craig Dickerson…….. Assistant Superintendent**
**Eric Smith……...…General Mine Foreman**
**Darrel Johnson……...Supervisor of Safety**
**Michael Canada……Manager of Safety**

### MINE SAFETY AND HEALTH ADMINISTRATION

**Ray McKinney……District Manager**
**Jason D. Hess……..……Coal Mine Inspector**
**Hagel Campbell…….. Conference Litigation Officer**
**Mark Hlywa……..…….. Coal Mine Inspector**
**John Hughes……..…….. Coal Mine Inspector**
**Duane Beggs……..…… Mine Engineer**
**Steven Hale……Coal Mine Inspector/Family Liaison**
**Daniel Johnson…….. Staff Assistant**
**Michael A. Hockenberry.....Fire Protection Engineer**

### VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

**Opie McKinney…… Supervisor**
**Christopher Whitt……..…… Emergency Manager**
**Terry Ratliff…… ……..Mine Inspector**
**John Brown……..……..Mine Inspector**

## APPENDIX E

### Persons interviewed

**Bill J. Davis……Tram operator/General Labor**
**William D. Green……..Tram Operator**
**Dexter A. Presley……..Tram Operator**
**Tony Atwell……Tram Operator**
**Michael Taylor Jr.……Tram Operator**
**Corey Boyd……General Labor/Belt Rover**
**Willard Rife…….. General Labor/Belt Rover**
**Gregory K. Addington……..Foreman**
**Cecil R. Beavers……General Labor**
**Darrel Keen…….. Foreman**
**Charles R. Scott……..Tram Operator**
**Joshua E. Whitt……..Tram Operator**
**Steve R. Ball……..Page Foreman**
**Jim Mullins……..Owl Shift Assistant Shift Foreman**
**David Semones……Eve Shift Assistant Shift Foreman**

## APPENDIX F

Accident Investigation Data - Victim Information
Event Number: 4 4 1 3 2 7 4

**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. Last Four Digits of SSN: | 5. Degree of Injury: |
|---|---|---|---|---|
| *Joe E. Saunders* | *M* | *44* | | *01 Fatal* |

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:
*a. Date: 01/18/2012 b.Time: 16:12*

7. Date and Time Started:
*a. Date: 01/11/2012 b.Time: 15:30*

8. Regular Job Title:
*016 Laborer/Locomotive Operator*

9. Work Activity when Injured:
*098 Repairing firehose outlet*

10. Was this work activity part of regular job?
Yes X No

11. Experience

| | Years | Weeks | Days | | Years | Weeks | Days | | Years | Weeks | Days | | Years | Weeks | Days |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a. This Work Activity: | *0* | *25* | *0* | b. Regular Job Title: | *0* | *25* | *0* | c: This Mine: | *0* | *25* | *0* | d. Total Mining: | *1* | *32* | *0* |

12. What Directly Inflicted Injury or Illness?
*088 Steel pipe manifold*

13. Nature of Injury or Illness:
*180 Laceratioin of head/face*

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

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

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

17. Part 50 Document Control Number: (form 7000-1)

18. Union Affiliation of Victim: *9999 None (No Union Affiliation)*

**Victim Information:**

| 1. Name of Injured/Ill Employee: | 2. Sex | 3. Victim's Age | 4. Last Four Digits of SSN: | 5. Degree of Injury: |
|---|---|---|---|---|
| | | | | |

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

7. Date and Time Started:

8. Regular Job Title:

9. Work Activity when Injured:

10. Was this work activity part of regular job?
Yes | No

11. 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: | | | |

12. What Directly Inflicted Injury or Illness?

13.Nature of Injury or Illness:

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

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

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

17.Part 50 Document Control Number: (form 7000-1)

18. Union Affiliation of Victim: