
Virginia Department of Mines, Minerals & Energy
Division of Mines

Accident Investigation Report
Underground Coal Mine

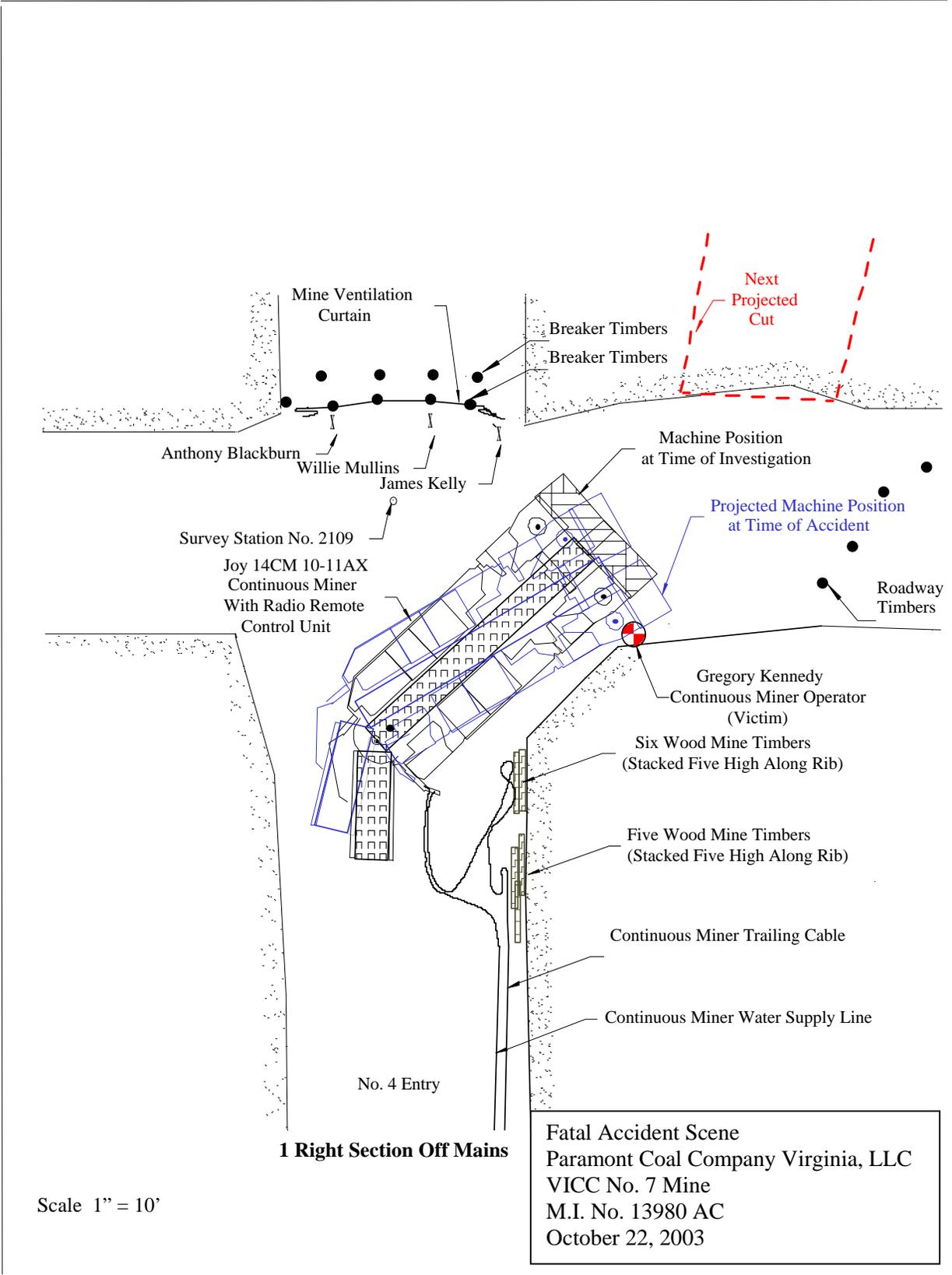
Machinery Fatality Investigation Report
October 22, 2003

Paramont Coal Company Virginia, LLC
VICC No. 7 Mine

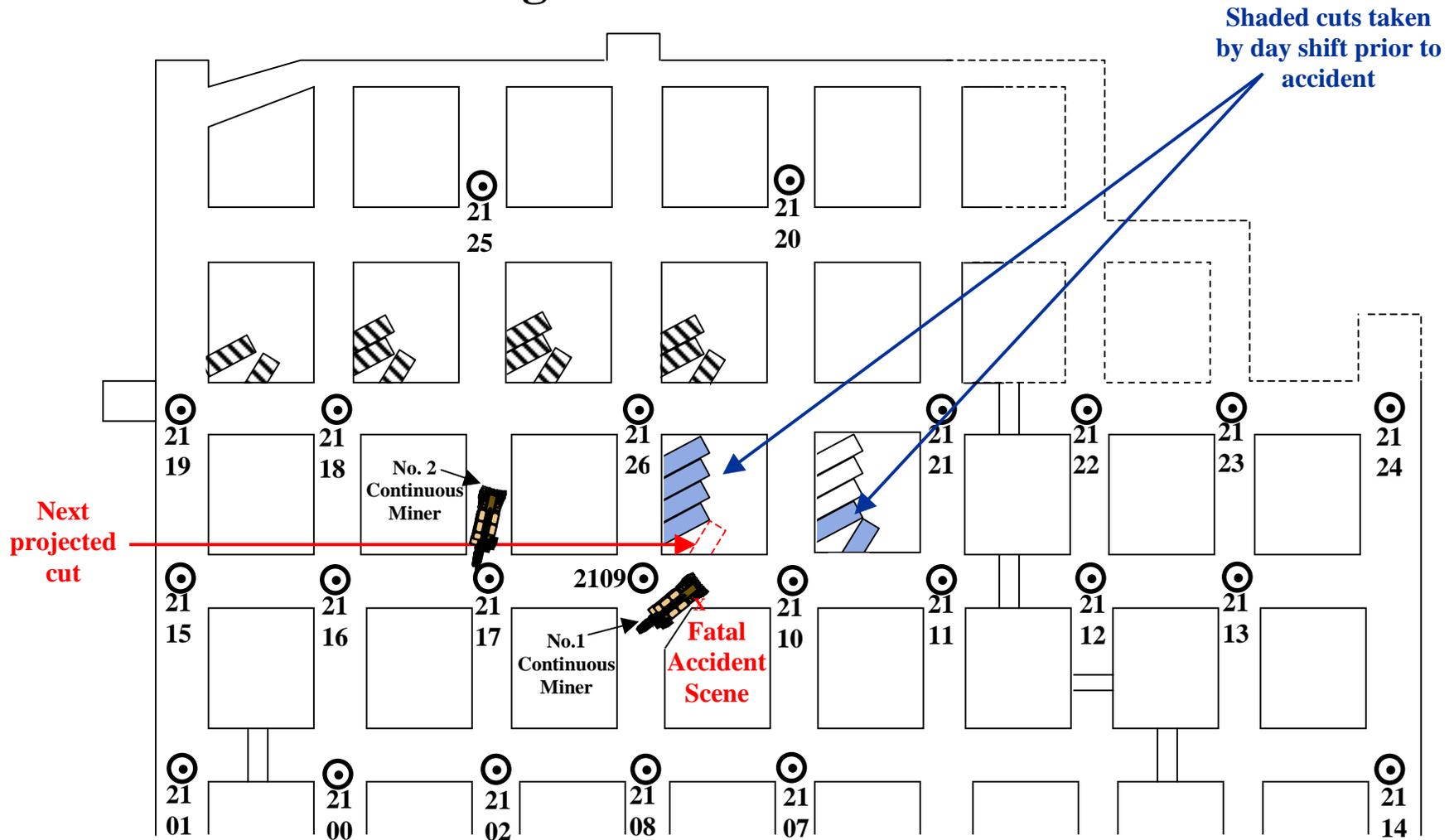
Mine Index No. 13980AC
Wise County, Virginia

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1 Right Section Off Mains

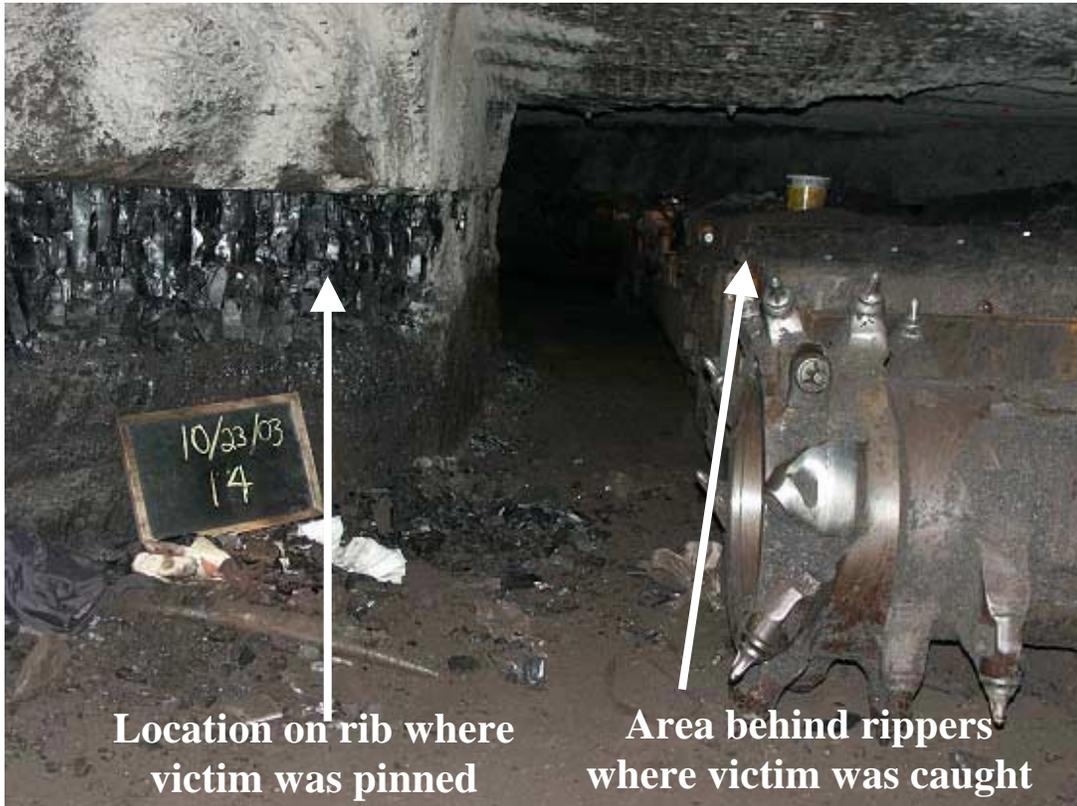


⊙ Survey Stations

Not to Scale
For Reference Only

Fatal Accident Scene
Paramont Coal Company Virginia, LLC
VICC No. 7 Mine
M.I. 13980AC
October 22, 2003

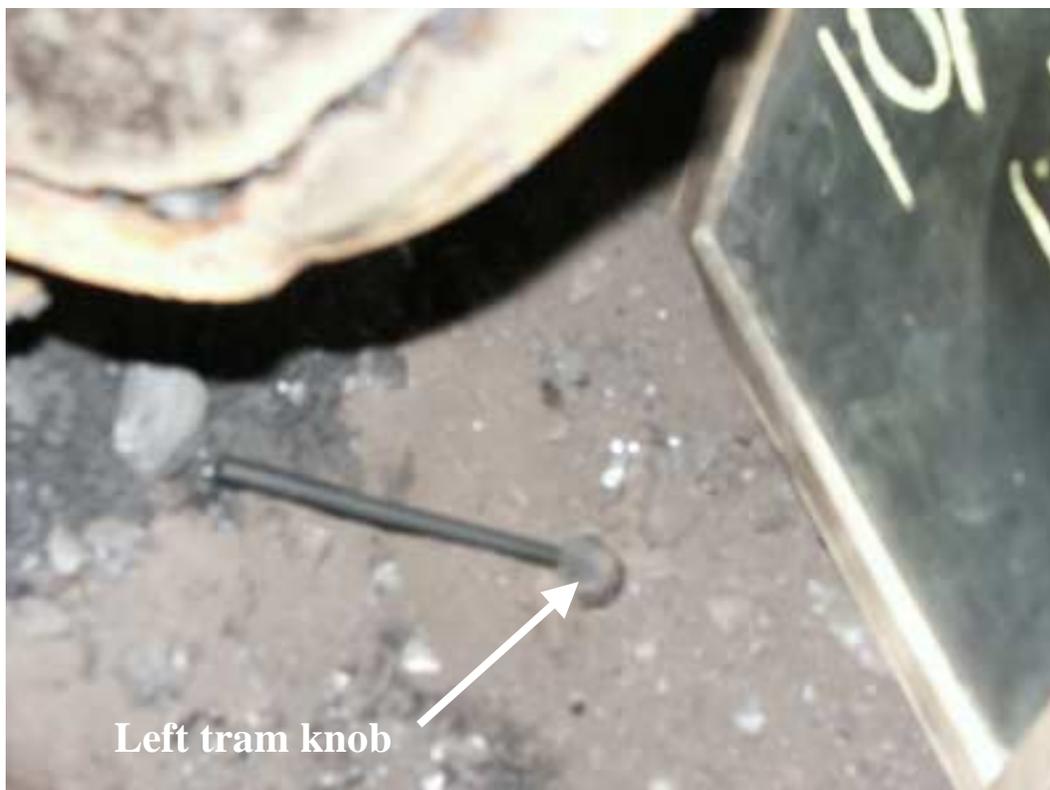
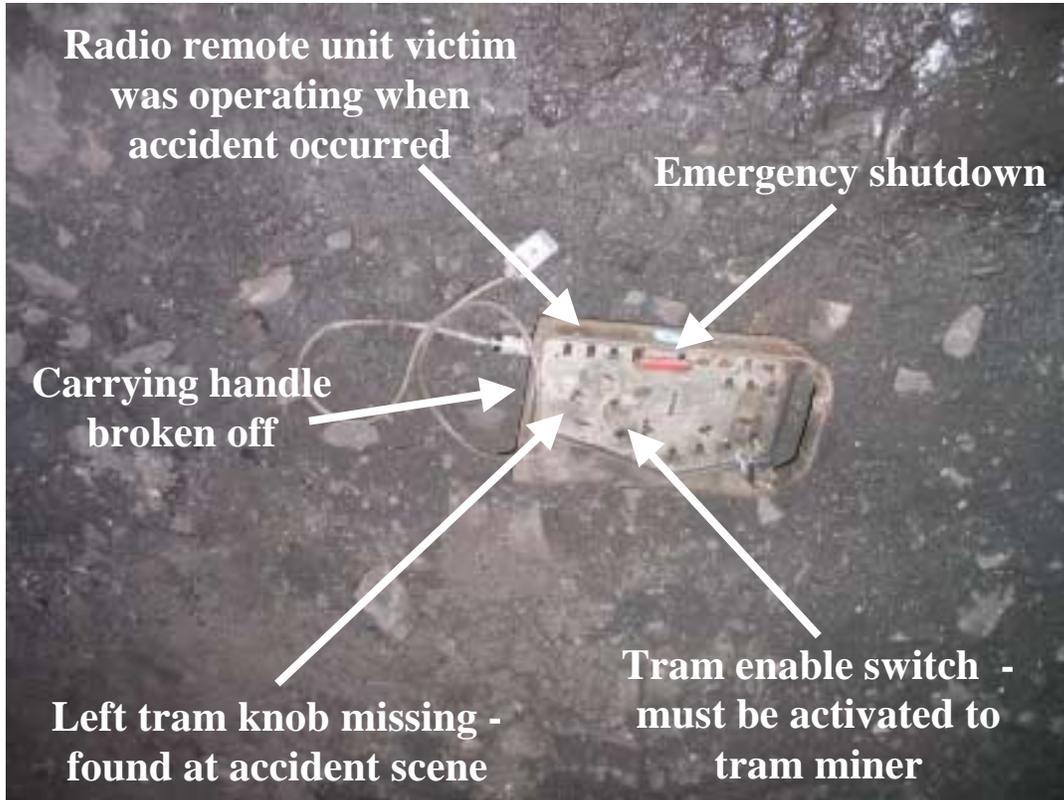
**Fatal Accident Scene
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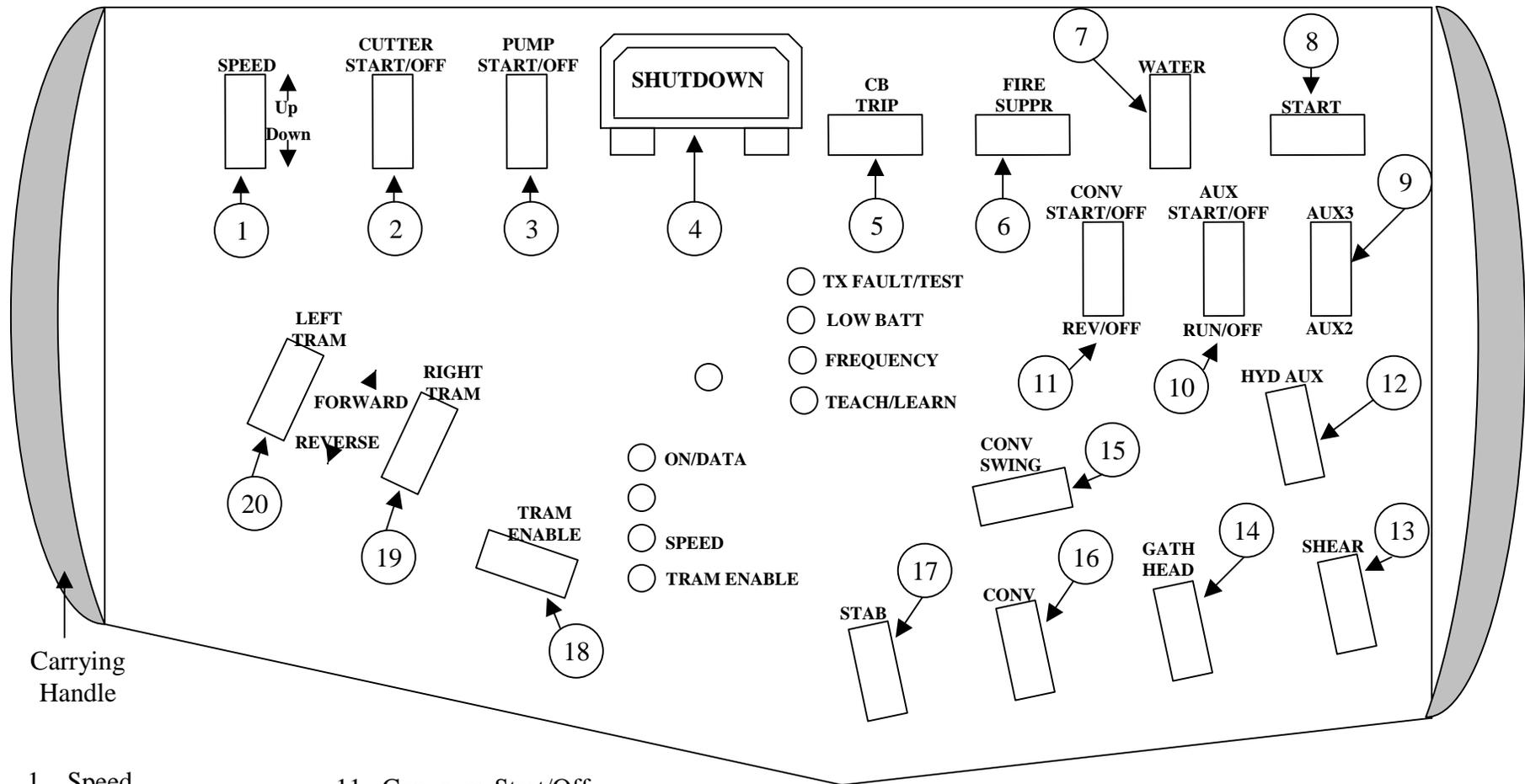
**Fatal Accident Scene
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**Fatal Accident Scene
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Joy Remote Control Unit



- | | |
|-------------------------|-------------------------|
| 1. Speed | 11. Conveyor Start/Off |
| 2. Cutter Start/Off | 12. Hydraulic Auxiliary |
| 3. Pump Start/Off | 13. Shear |
| 4. Shutdown Handle | 14. Gathering Head |
| 5. Circuit Breaker Trip | 15. Conveyor Swing |
| 6. Fire Suppression | 16. Conveyor |
| 7. Water | 17. Stabilizer Jack |
| 8. Start | 18. Tram Enable |
| 9. Auxiliary 2 & 3 | 19. Right Tram |
| 10. Auxiliary 1 | 20. Left Tram |

Joy Remote Control Unit
 Paramount Coal Company Virginia, LLC
 VICC No. 7 Mine
 M.I. 13980AC
 October 22, 2003

**MACHINERY FATALITY INVESTIGATION REPORT
PARAMONT COAL COMPANY VIRGINIA, LLC
VICC NO. 7 MINE
MINE INDEX 13980AC**

On October 22, 2003, at approximately 10:00 a.m., an underground machinery accident occurred at Paramount Coal Company Virginia, LLC, VICC No. 7 Mine, Mine Index No. 13980AC. Gregory Ray Kennedy, continuous miner operator, was fatally injured while operating the No. 1 continuous miner by radio remote control on the 1 Right section, No. 4 entry, right crosscut, approximately 23.5 feet to the right of survey station No. 2109. Mr. Kennedy was pinned between the continuous miner ripper head motor gear case and the right coal rib. Mr. Kennedy, age 41, had twenty-three years total mining experience and eight months experience at Paramount Coal Company Virginia, LLC. The Department of Mines, Minerals and Energy's, Division of Mines was notified of the accident at 10:20 a.m. on October 22, 2003, and a joint investigation with the Federal Mine Safety and Health Administration was initiated the same day. This mine is scheduled to receive four regular inspections per year. The last regular inspection of this mine was completed on July 21, 2003.

COMMENTARY

Paramont Coal Company Virginia, LLC, VICC No. 7 Mine, is located approximately seven miles northeast of Coeburn, Virginia, off State Route 652 in the Middle Fork section of Sandy Ridge. This mine was previously licensed as Coastal Coal Company, LLC, VICC No. 7 Mine. The underground mine is a single section drift mine, which has been developed approximately 8,450 feet in the Splashdam coal seam. The mining height is approximately 50 inches. Approximately 1,200 raw tons of coal are produced daily by the dayshift and third shift production crews. Maintenance and other mine related work is performed on the evening shift. This operation employs 37 mining personnel and produces coal utilizing two Joy 14/10 continuous mining machines, four Joy 21SC shuttle cars, two Fletcher DDO-15 dual boom roof bolting machines with ATRS, and two Eimco 550 battery powered scoops.

Mining personnel had completed development (advance) mining and had begun retreat mining (pillaring) on the 1 Right section. The number of cuts that would be taken from the left side of the coal pillars depended on the size of the pillars. Four cuts were taken from the left side of larger coal pillars while less cuts were taken from smaller pillars. Timbers were being installed according to the approved roof control plan. The coal pillars being mined when the accident occurred were 80 feet in length and 40 feet in width (100' x 60' crosscut centers). Mining personnel had completed pillaring operations on the first designated row of coal pillars and were mining in the second row of pillars when the accident occurred. Mining personnel were pillaring from the right side toward the left side of the section as allowed in the approved roof control plan. The third shift personnel had taken three side cuts from the side of the No. 4 coal pillar (No. 4 pillar from the right side of the section).

On Wednesday, October 22, 2003, the dayshift crew had a safety talk and held prayer prior to entering the mine at 7:00 a.m., under the supervision of Mr. Johnny Kiser, section mine foreman. The crew arrived on the 1 Right section at approximately 7:20 a.m.

The equipment operators performed checks on the equipment prior to beginning operation to ensure the equipment was working properly. The third shift personnel had reported that the No. 1 miner had been shutting down during the shift and they believed that the power cord was defective. Mr. Kennedy brought in a new power cord from the surface at the beginning of the shift and installed it on the No. 1 continuous miner remote control unit.

The No. 2 continuous miner was located in the number three entry and was blocking the crosscut travelway between No. 3 and 4 entries. Mr. Kiser instructed Mr. Blackburn, No. 2 continuous miner operator, to move the No. 2 miner forward in No. 3 entry to clear the crosscut for a shuttle car travelway. The No. 1 continuous miner was located in the number five entry outby the No. 4 coal pillar. Dayshift personnel mined the one remaining side cut and the end cut from the No. 4 coal pillar, installed timbers and ventilation curtain at the required locations and moved the No. 1 continuous miner to the No. 4 entry while preparing to start mining the No. 5 coal pillar. Dayshift personnel mined four side cuts from the No. 5 coal pillar and were making preparations to mine the end cut from the No. 5 coal pillar when the accident occurred. The 1 Right section is a "super section" in that two continuous miners are used to produce coal. The No. 1 continuous miner, involved in the accident, was normally utilized to mine on the right side of the section while the No. 2 continuous miner was used to mine on the left side of the section. Section personnel operated only one continuous miner at a time while producing coal. Mr. Kennedy, continuous miner operator, normally operated the No. 1 continuous miner and Mr. Anthony Blackburn, continuous miner operator, normally operated the No. 2 miner on the dayshift.

After mining four side cuts from the No. 5 coal pillar, Mr. Kennedy backed the continuous miner outby into the number four entry while repositioning the trailing cable to mine the final and end cut from the No. 5 coal pillar. Mr. Willie Mullins, shuttle car operator, Mr. Blackburn, and Mr. James Kelly, section repairman, were setting breaker timbers and hanging a ventilation curtain in the number four entry between coal pillars No.'s five and six. At this time, Mr. Kiser was located in No. 5 entry, approximately two crosscuts outby survey station No. 2109. Mr. Tony Lyall and Mr. Barry Miller, shuttle car operators, were located in No. 5 entry, near where Mr. Kiser was located. Mr. Okie Grimmitt, Mr. Wayne Johnson and Mr. Darrell McGloltin, roof bolter operators, were installing timbers in No. 7 entry.

While hanging the ventilation curtain on the breaker timbers with assistance from Mr. Mullins and Mr. Kelly, Mr. Blackburn heard the No. 1 continuous miner crawler chain ("cat") making a spinning sound and turned around toward where Mr. Kennedy was located. Mr. Kennedy appeared to be facing the No. 5 coal pillar as he was positioning the miner for the final end cut. Mr. Blackburn looked at Mr. Kennedy's face

and realized that something was wrong and said “Oh, Lord”. Mr. Blackburn and Mr. Mullins ran around to the front of the continuous miner to where Mr. Kennedy was located. The continuous miner left side crawler chain (“cat”) was activated in the forward position and was still spinning. Mr. Kennedy was pinned between the continuous miner and the right coal rib. Mr. Blackburn deenergized the continuous miner by activating the “emergency shutdown” switch on the remote control unit. Mr. Blackburn was unable to get the remote control box away from Mr. Kennedy, due to the tightness of the remote control box shoulder/neck strap, and instructed Mr. Mullins to go around to the back of the miner and between the right rib and the continuous miner and see if he could free the remote box. Mr. Blackburn instructed Mr. Mullins to go to the mine telephone and call to the surface for help. Mr. Mullins traveled to the mine telephone and called to the surface reporting the accident and also reported that Mr. Kennedy had been injured and requested an ambulance and Med-Flight. Mr. Mullins traveled back to the accident scene to assist Mr. Blackburn. Mr. Blackburn used a utility knife to cut the shoulder/neck strap to free the remote control unit. Mr. Blackburn removed the remote control unit from Mr. Kennedy and attempted to restart the continuous miner in order to move it away from Mr. Kennedy. Mr. Blackburn attempted to restart the continuous miner but when the miner would not restart, he yelled for help and for someone to get the remote control unit from the No. 2 continuous miner. Mr. Blackburn thought the power cord for the No. 1 continuous miner might be damaged, so he was planning to use the power cord from the No. 2 continuous miner to restart and move the No. 1 miner.

At the time of the accident, Mr. Kiser was traveling on a battery powered three-wheel mantrip in the number five entry, two crosscuts outby from where the accident occurred. Mr. Kiser heard Mr. Barry Miller and Mr. Tony Lyall, shuttle car operators, yell that Mr. Kennedy was pinned against the coal rib by the continuous miner and he then started toward the accident scene. Mr. Kiser heard Mr. Blackburn yell for someone to get the other remote control unit and then he ran to the No. 2 miner located in the No. three entry to retrieve it. Mr. Kiser, being out of breath, gave the remote control unit to Mr. Kelly and instructed him to take it to Mr. Blackburn. Mr. Kelley delivered the remote control box to Mr. Blackburn who removed the power cord from the No. 2 remote control unit, installed it on the No. 1 remote control unit and restarted the No. 1 continuous miner. Mr. Blackburn then moved the continuous miner approximately three feet away from the right coal rib to free Mr. Kennedy.

Mr. Kiser, Mr. Blackburn, and Mr. Mullins began administering first aid to Mr. Kennedy. Mr. Kennedy was breathing and a faint pulse was detected. Mr. Kiser removed Mr. Kennedy’s coat and mining belt. Mr. Kennedy was stabilized on a backboard. Mr. Tim Keen, mine foreman and certified in Advanced First Aid, and Mr. Anthony Yates, mine superintendent, arrived at the scene. Mr. Keen began administering rescue breathing. Mr. Kennedy was loaded onto a Mac 8 battery powered mantrip and transported to the surface. Mr. Blackburn, Mr. Mullins and Mr. Kelly transported Mr. Kennedy to the surface as quickly as possible while Mr. Keen continued rescue breathing to Mr. Kennedy. After arriving on the surface, Mr. Mullins, certified in Advanced First Aid, initiated cardiopulmonary resuscitation (CPR) on Mr. Kennedy. Two rescue

personnel from the Sandy Ridge Rescue Squad assumed control and continued cardiopulmonary resuscitation (CPR) on Mr. Kennedy.

Med Flight medical personnel arrived at the mine site and began to administer first aid. Med Flight personnel transported Mr. Kennedy to St. Mary's Hospital located in Norton, Virginia, where he was pronounced dead on arrival at 10:55 a.m. by Dr. Stephan Heinz, emergency room physician.

STATEMENTS FROM MINE PERSONNEL AND OTHER FACTORS

Statements from mine personnel interviews and other factors determined during the investigation revealed the following:

1. There were no eyewitnesses to the accident.
2. The accident occurred on the right coal rib in the No. 4 entry right crosscut, approximately 23.5 feet from survey station No. 2109.
3. Mine personnel stated that the third shift personnel reported that they had experienced problems with the No. 1 continuous miner shutting down and thought the problem was in the power cord. Mr. Kennedy took a new power cord to the section and installed it on the No. 1 continuous miner remote control unit. A "power cord" is connected from the continuous miner operator's battery cap light to the remote control unit and provides the electrical power necessary to operate the remote unit.
4. Mine personnel further stated that the only problems that they had experienced with the remote control unit was shutting down due to power cords wearing out or the remote control unit becoming dirty. When either malfunction occurred, they would install a new cord or exchange remote control units.
5. Mr. Blackburn stated that Mr. Kennedy had informed him that the "power cord was not the problem" and that he was still having trouble with the continuous miner shutting down even after installing the new power cord.
 - Mr. Blackburn stated that he heard the crawler chain ("cat") on the No. 1 continuous miner spinning and thought that something didn't sound right.
 - Mr. Blackburn stated that when he moved closer to the miner, he observed Mr. Kennedy pinned between the No. 1 continuous miner and right coal rib.
 - Mr. Blackburn stated that he observed the following when he saw Mr. Kennedy entrapped: Mr. Kennedy's hands were not on the remote control unit, which indicates the left tram switch remained activated for some unknown reason; Mr. Kennedy's head was facing the No. 5 coal pillar where the end cut would be mined; Mr. Kennedy's front side was turned toward the continuous miner on a slight angle and his back was against the coal rib; and the remote control unit was angled slightly to Mr. Kennedy's right side with the bottom of the unit against his abdomen.
 - Mr. Blackburn stated that the crawler chain ("cat") on the left side of the No. 1 continuous miner was activated in the forward position and was still spinning, when he and Mr. Mullins arrived where Mr. Kennedy was pinned between the miner and coal rib.

- Mr. Blackburn stated that he deenergized the continuous miner by activating the “emergency shutdown” switch on the remote control unit. Mr. Blackburn stated that he attempted but could not free the remote control unit from Mr. Kennedy, so he then instructed Mr. Mullins to go around to the back of the miner and up between the right rib and continuous miner and see if he could free the remote unit. Mr. Blackburn stated that he instructed Mr. Mullins to go to the mine telephone; to call surface personnel reporting the accident; and request an ambulance and Med-Flight.
 - Mr. Blackburn stated that he used a utility knife to cut the neck/shoulder strap on the remote control unit to remove the control unit from Mr. Kennedy.
 - Mr. Blackburn stated that he was unable to restart the continuous miner and yelled for someone to get the remote control unit from the No. 2 continuous miner. Mr. Kelly brought him the No. 2 miner remote unit with the attached power cord. Mr. Blackburn removed the power cord from the No. 2 continuous miner remote unit; installed it on the No. 1 miner remote unit and restarted the No. 1 continuous miner.
 - Mr. Blackburn stated that both tram levers were centered on the remote control unit when he restarted and moved the No. 1 continuous miner approximately three feet to the left to free Mr. Kennedy, and then he deenergized the machine.
6. Mr. Kiser stated that he removed Mr. Kennedy’s coat and mining belt and that Mr. Keen initiated rescue breathing on Mr. Kennedy.
 7. Mine personnel stated that everyone had been instructed to stay out of pinch points and that no one was allowed to be in the “Red Zone” pinch point locations when positioned near a continuous miner.
 8. Mine personnel stated that they had never observed Mr. Kennedy position himself in a pinch point location and did not know why Mr. Kennedy was in the location where he was pinned between the continuous miner and coal rib.
 9. Mine personnel stated that they had not experienced any previous problems with the continuous miner making any unexpected or slewing movements.

PHYSICAL FACTORS

The investigation of physical factors revealed the following:

1. The machinery accident occurred on October 22, 2003, at approximately 10:00 a.m. The accident scene was located on the 1 Right working section off the Mains, in the No. 4 entry, right crosscut, approximately 23.5 feet to the right of survey station No. 2109.
2. The average mining height in the No. 4 entry where the accident occurred was 57 inches.
3. The No. 1 continuous miner involved in the accident was a Joy 14CM10-11AX, serial No. JM 5356, powered with a 995-volt alternating current (AC), 3-phase electrical system. The associated radio remote control unit involved in the accident was a Joy, serial No. 75203AC023B. The continuous miner has a receiver located on top of the miner and the remote control unit has a transmitter

- that sends operation command signals to the receiver located on the miner. The remote control unit is powered through a special power cord that is connected to a particular plug-in attachment located on the miner operator's battery cap light.
4. The mine floor was dry, near level and did not contain any irregularities that would enhance any abnormal movement of the continuous miner.
 5. Physical evidence was observed on the mine floor in the vicinity of the left and right crawler chains, respectively, that verified the left tram had been activated in the forward position and the right tram was in the neutral position when the accident occurred. Mr. Blackburn also verified that the left tram was activated in the forward position ("crawler chain - cat spinning") when he observed Mr. Kennedy pinned between the continuous miner and coal rib.
 6. The radio remote control unit observed during the investigation revealed the following: (1) the shoulder/neck strap, which the continuous miner operator wears around his neck to support the remote control unit when operating the continuous miner, was cut; (2) the left carrying handle was broken off the remote control unit; and (3) the knob that fits on top of the left tram lever was missing from the remote control unit. The broken carrying handle and the missing left tram lever knob were found in the immediate vicinity where the accident occurred.
 7. Test, evaluations and accident re-enactment with the Joy 14CM10-11AX, continuous miner, and associated remote control unit conducted at the mine site, revealed the following:
 - A visual examination and operational tests of the remote unit controls were performed with no electrical power supplied to the unit and all controls appeared to be working freely with no obvious deficiencies that would affect safe operation of the continuous miner. (Sent to MSHA – Tests).
 - On-site examinations and tests were conducted on the remote control unit, except the power cord, that the victim was operating when the accident occurred. The power cord, that provides electrical power from a battery cap light to the remote control unit, had been transferred from the No. 2 miner remote control unit and installed on the No. 1 miner remote control unit by Mr. Blackburn that was necessary to move the continuous miner to gain access to Mr. Kennedy. Mr. Blackburn disconnected the remote control unit from his battery cap light (power source for the remote control unit) after moving the miner to extricate Mr. Kennedy.
 - During the investigation, the remote control unit was reconnected to a battery cap light using the No. 2 miner remote control unit power cord, to conduct various energized operational tests of the remote control unit and the No. 1 continuous miner. All operational controls of the remote control unit, except the fire suppression and water sprays, were examined and tested with the unit energized and all were working properly except the circuit breaker (CB) trip control. The CB trip control on the remote control unit was activated with the continuous miner pump motor operating causing the pump motor to deenergize;

however, the circuit breaker located on the distribution power center (section transformer) would not trip (deenergize) as designed by the manufacturer. The CB trip control is designed by the manufacturer and approved by the Mine Safety and Health Administration's Approval and Certification staff to activate either the continuous miner onboard circuit breaker or the power distribution center circuit breaker, depending on the machine specification as requested by the customer.

- The following tests were performed with the No. 1 continuous miner and remote control unit to demonstrate the speed that the miner would tram from a stop position to the rib contact point where the victim was pinned:

- Left tram in the forward position with the right tram in the neutral position;

- Slow speed – 15.3 seconds

- Medium speed – 6.5 seconds

- Turbo speed – 4.6 seconds

- Right tram in the reverse position with the left tram in the neutral position;

- Slow speed – 8.1 seconds

- Medium speed – 4.4 seconds

- Turbo speed – 3.2 seconds

- Left tram in the forward position with the right tram in reverse position (“splitting the cats”);

- Slow speed – 7.1 seconds

- Medium speed – 2.9 seconds

- Turbo speed – 3.3 seconds

* The variation between the medium and turbo speeds appears to be abnormal as compared to the other two tram lever positioning tests, but difficulty in repositioning the continuous miner to an exact start location was difficult to achieve and a variation in operation of the stopwatch is apparently responsible for the time disparity.

- The continuous miner left tram while activated in the forward position with the right tram in the neutral position most accurately aligned the continuous miner with the contact point on the coal rib where the victim was entrapped.

- It could not be determined which tram function (speed) had been activated when the accident occurred as all three (slow, medium and turbo) speed tests provided a similar contact point between the continuous miner and coal rib where the victim was entrapped.

- The right, front end of the continuous miner would slew toward the right rib when operated by the radio remote control unit with the left tram switch activated in the forward position and the right tram switch in the neutral position or when the right tram was activated in the reverse position and the left tram in the neutral position. The right,

front end of the continuous miner would also slew toward the right rib when operated by the radio remote control unit with the left tram switch activated in the forward position and right tram switch activated in the reverse direction (“splitting the crawler chains”).

- The continuous miner and associated radio remote control unit operated properly and no erratic behavior was observed while testing to reenact the accident.
8. The Mine Safety and Health Administration’s Approval and Certification staff coordinated examinations and tests of the radio remote control unit system components and machine power components. The appendix contains details of the examinations and tests.
 9. As described by the manufacturer, the remote control unit is equipped with certain controls that provide the continuous miner operator with specific ways to stop the machine quickly in the event of an emergency. The three controls that provide this safety function are the pump start/off switch, emergency shutdown and circuit breaker (CB) trip switch. Activating any of the three remote control unit functions will deenergize the pump motor, thus resulting in stopping of the continuous miner.
 10. The remote control unit has an “emergency shutdown” switch located in the front top area of the unit. The continuous miner has two “emergency shutdown switches” with one located on each side of the mining machine. In the event of an emergency, any of the three “emergency shutdown switches” is activated to de-energize and stop the continuous miner. All three “emergency shutdown” switches were tested during the investigation and all were operating properly.
 11. No hazardous conditions had been recorded in the weekly electrical equipment examination record book for the No. 1 continuous miner and associated radio remote control unit from October 1 to October 20, 2003.
 12. The No. 2 continuous miner and associated radio remote control unit were idle and were not in operation, when the accident occurred involving the No. 1 continuous miner and associated remote control unit.
 13. The two remote control units that are used to operate the No. 1 and No. 2 continuous miners, respectively, are interchangeable but a special teach/learn recognition programming process must be followed using a “teach/learn” power cable before the two remote control units can be interchanged. The teach/learn process sets the frequency of the particular remote control unit to the frequency of the receiver located on the applicable continuous miner.
 14. The methane spotter, located inside a leather carrying case that was attached to Mr. Kennedy’s mining belt, was crushed.

DISCUSSION

The radio remote control unit, as identified by mining personnel, is referred to as the “remote station” by Joy Mining Machinery, the manufacturer. The following are operation procedures and safety features of the remote station as contained in a Joy Mining Machinery Technical Publication No. TJCM0074-0800:

- **Emergency Shutdown**

The “emergency shutdown” switch is designed to deenergize/stop the continuous miner in the event of an emergency. Pressing the emergency shutdown switch on the remote station or the continuous miner will shut down the pump motor and stop the machine. Activating the emergency shutdown handle in either direction deenergizes the continuous miner pump motor that results in stopping of the machine.

- **Stuck Button Check**

A stuck button check is performed by the remote station every time it is turned on by the operator. No button may be depressed when the transmitter is turned on. A second stuck button check is performed every time the pump is started. No buttons, other than the start and pump/off buttons, may be depressed when starting the pump motor. The TX fault/test light emitting diode (LED) will flash slowly when the remote station is powered. At this point, the operator is required to activate the shutdown bar in both directions. The TX fault test Led will flash quickly if a button is stuck or activated. Use the following procedures to clear a stuck button condition that was detected while turning on the remote station:

1. Turn off the transmitter by disconnecting the cap lamp battery or the umbilical cord;
2. Reconnect the cap lamp battery or umbilical cord;
3. Activate the “shutdown” bar in both directions;
4. If a stuck button is still present, replace the faulty switch with a new switch. If the condition persists, return the remote station to Joy Mining Machinery for service.

- **Teach/Learn Transmitter-Receiver Recognition Programming**

The teach/learn procedure must be performed before using the remote station for the first time, whenever the remote station is changed, or if the remote station is connected to a battery charger. The teach/learn process sets the frequency of the remote station to the frequency of the receiver and establishes a secure communication link between the transmitter and receiver. The following procedure is used to perform the teach/learn process:

1. Connect the remote station to the receiver’s teach/learn port with the special teach/learn cable;
2. The teach/learn light-emitting diode(LED), located on the front of the remote station, will flash while the teach/learn process is

in progress, and will steadily illuminate when completed. This process takes less than 2 seconds.

3. Remove the teach/learn cable to use the remote station to operate the continuous miner.

The teach/learn process should be repeated at the start of each shift, or whenever the remote station has been removed from the location of the machine. This will prevent the accidental operation of a nearby machine.

- The teach/learn cable must be removed from the remote station and a standard power cord must be installed to operate the continuous miner.
- The remote station cannot be powered down with the stop button while in the teach/learn mode. The cable must be removed.

- **Tram Enable Switch**

The remote station is equipped with a “tram enable switch” that must be activated to tram the continuous miner. The tram levers must be activated within two seconds or the tram enable function will drop out and the machine cannot be trammed. The “tram enable” switch is moved away from the tram levers to disable the tram function.

- **Circuit Breaker (CB) Trip**

The remote station is equipped with a circuit breaker (CB) trip switch that is identified on page 11 with other emergency controls. Pressing and holding the CB trip switch for one-fourth second shuts down the continuous miner pump and all pump electrical interlocked functions while stopping the machine. The CB trip switch of this particular remote station and associated continuous miner was designed to trip (deenergize) the circuit breaker at the power distribution center (section transformer).

CONCLUSION

On October 22, 2003, at approximately 10:00 a.m., an underground machinery accident occurred at Paramount Coal Company Virginia, LLC, VICC No. 7 Mine, Mine Index No. 13980AC. Gregory Ray Kennedy, continuous miner operator, was fatally injured while operating the No. 1 continuous miner by radio remote control on the 1 Right section, No. 4 entry, right crosscut, approximately 23.5 feet to the right of Survey Station No. 2109. Mr. Kennedy was pinned between the continuous miner ripper head motor gear case and the right coal rib.

ENFORCEMENT ACTION

The following enforcement action was taken as a result of the investigation:

1. An order of closure, No. SDF0003436, was issued under 45.1-161.91.A.(ii) of the Coal Mine Safety Laws of Virginia, to preserve the scene of the accident pending an investigation. The order of closure was modified to allow work and production to be conducted at the mine.
2. A notice of violation, No. SDF0003443, was issued under 45.1-161.123.D. of the Coal Mine Safety Laws of Virginia. A fatal accident occurred on October 22, 2003, at approximately 10:00 a.m. Mr. Gregory Kennedy, continuous mining machine operator, received fatal injuries while operating the Joy 14CM10-11AX continuous miner with a radio remote control unit on the 1 Right Section, No. 4 entry, right crosscut, approximately twenty-three feet and six inches to the right of survey station No. 2109. Mr. Kennedy was positioned in a pinch point between the continuous miner and the coal rib. The Coal Mine Safety Laws of Virginia, Section 45.1-161.123.D requires that while equipment is in operation or is being trammed, no miner shall position himself or be placed in a pinch point between such equipment and the face or ribs of the mine or another piece of equipment in the mine.
3. A notice of violation, No. SDF0003444, was issued under 45.1-161.193.B. of the Coal Mine Safety Laws of Virginia. The radio remote control box, serial no. 75203AC02313, being used to operate the Joy 14CM10-11AX continuous miner, serial No. JM5356, was not maintained in a permissible condition in that the circuit breaker trip (CB) switch was inoperative when tested during the fatality investigation. The Joy 14CM10-11AX continuous miner, serial no. JM5356, was not maintained in a permissible condition in that the methane monitor readout assembly was not secured. This violation did not contribute to the fatal accident.

RECOMMENDATIONS

1. While equipment is in operation or is being trammed, no miner shall position himself or be placed in a pinch point between such equipment and the face or ribs of the mine or another piece of equipment in the mine.
2. All permissible equipment shall be maintained in permissible condition.
3. All equipment operators should receive effective training to ensure that they are familiar with all operational controls, safety devices and hazards inherent with the operation of machinery and associated components.
4. All mining personnel should receive periodic training on the identification of “Red Zone” pinch point locations and mining methods to avoid potential pinch point areas.

APPENDIX

- VICTIM DATA SHEET
- PERSONS PRESENT DURING THE INVESTIGATION
- MINE LICENSE INFORMATION
- MINE SAFETY AND HEALTH ADMINISTRATION (MSHA) APPROVAL AND CERTIFICATION STAFF FIELD AND LABORATORY EVALUATIONS OF CABLES AND CONTROL SYSTEM COMPONENTS

VICTIM DATA SHEET

Name:	Gregory Ray Kennedy
Occupation:	Continuous Miner Operator
Mailing Address:	HC05 Box 556, Coeburn, VA 24230
Date of Birth:	December 16, 1961
Total Mining Experience:	Twenty-three years
Experience with Coastal Coal Company:	Three years and seven months
Experience at VICC No. 7 Mine:	Three years and seven months
Experience with Alpha Natural Resources, LLC (present company)	Eight months

PERSONNEL

The following personnel provided information and/or were present during the investigation:

Paramont Coal Company Virginia, LLC

Eddie Bateman	President	
Ram Tankersley	Safety Director	
Jeff Smith	Safety Department	
Jerry Bledsoe	Safety Department	
Candace Morgan	Safety Department	
Marty Stanley	Secretary, Safety Department	
Robert Gordon	Operations Manager	
Rick Shelton	Manager of Maintenance	
Anthony Yates	Mine Superintendent	
Tim Keen	Mine Foreman	
Mike Cox	Mine Clerk	
Johnny Kiser	Section Mine Foreman	Day Shift
Anthony Blackburn	Continuous Mining Machine Operator	Day Shift
Willie Mullins	Shuttle Car Operator	Day Shift
Bryon Salyers	Chief Electrician	Day Shift
James Kelly	Repairman	Day Shift
Bill Brooks	Maintenance Foreman	Evening Shift
Harold Keen	Section Foreman	Third Shift
David Jessee	Continuous Mining Machine Operator	Third Shift
Danny Fannon	Continuous Mining Machine Operator	Third Shift
Ricky Roark	Repairman	Third Shift

Legal Counsel

Suzan Moore	Attorney At Law, Alpha Natural Resources, LLC
Steve Hodges	Attorney At Law, Pennstuart

Joy Mining Machinery

Gabe Johnson	Serviceman
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Mine Safety and Health Administration

Edward Morgan	District 5 Manager
Norman Page	Assistant District Manager
Russell Dresch	Electrical Engineer
Arnold Douglas Carico	Mining Engineer
Jack Bartley	Coal Mine Safety and Health Inspector
James R. Baker	Educational Field Services Specialist
James W. Poynter	Conference and Litigation Representative
Kevin Hedrick	Technical Support
Patrick Retzer	Technical Support
Fred Martin	Coal Mine Safety and Health Inspector
Richard Salyers	Supervisory, Mine Safety and Health Inspector

Virginia Division of Mines

Frank Linkous	Chief, Division of Mines
Carroll Green	Mine Inspector Supervisor
John Thomas	Mine Inspector Supervisor
Daniel Perkins	Coal Mine Inspector
Sammy Fleming	Coal Mine Inspector
Danny Mann	Coal Mine Inspector
Jerry Scott	Coal Mine Inspector
Robert Garrett	Coal Mine Technical Specialist

Mine License Information

Official Corporation:	Paramount Coal Company Virginia, LLC
Official Business Name of Operator:	Paramount Coal Company Virginia, LLC
Person With Overall Responsibility:	Anthony Yates
Person in Charge of Health and Safety:	Anthony Yates

List of Persons Interviewed

Johnny Kiser	Section Mine Foreman	Day Shift
Anthony Blackburn	Continuous Mining Machine Operator	Day Shift
Willie Mullins	Shuttle Car Operator	Day Shift
James Kelly	Repairman	Day Shift
Bryon Salyers	Chief Electrician	Day Shift
Bill Brooks	Maintenance Foreman	Evening Shift
David Jessee	Continuous Mining Machine Operator	Third Shift
Danny Fannon	Continuous Mining Machine Operator	Third Shift
Ricky Roark	Repairman	Third Shift

April 23, 2004

MEMORANDUM FOR RUSSELL A. DRESCH

Mine Safety and Health Specialist, Coal Mine Safety and Health,
District 5

FROM: STEVEN J. LUZIK
Chief, Approval and Certification Center

SUBJECT: Executive Summary of Evaluation of Control Cables and Control System Components for a Joy 14CM Continuous Mining Machine Recovered from a Fatal Mine Accident and a Non-fatal Incident at Paramount Coal Company Virginia, LLC's VICC No. 7 Mine

The Approval and Certification Center (A&CC), as requested by Coal Mine Safety and Health, conducted field and laboratory investigations of control system components and machine power components recovered from a fatal mine accident at Paramount Coal Company Virginia, LLC's VICC No. 7 Mine (I.D. 44-06503) that occurred on October 22, 2003 and from a non-fatal incident that occurred on December 2, 2003.

BACKGROUND

A continuous mining machine operator was fatally injured when he was pinched between a continuous mining machine and the coal rib. It was reported by an eyewitness that the victim was positioning the machine with the remote control transmitter for an end-cut while second mining a coal pillar. As the continuous mining machine was being trammed toward the next cut, it pivoted to the right; crushing the victim between the machine's motor compartment of the ripper head and the rib of the outby coal pillar.

Furthermore, it was reported by coworkers of the victim that while the victim was operating the continuous mining machine during the shift in which the accident occurred, and while at least one other operator on the midnight shift before the accident was operating the same machine, that the machine had experienced power interruptions, or drop-outs. The drop-outs were described by some parties as momentary; others reported that the machine could not be restarted until approximately 10-15 seconds had elapsed.

An eyewitness reported that, at the time of the accident, the left tram drive continued to operate without corresponding operation of the tram control lever on the remote control. The remote control transmitter, receiver, demultiplexer and SCR firing package were recovered from the machine along with the cap lamp that supplied power to the transmitter and various interconnecting cables. Replacement components were installed on the machine by the operator, and the machine was returned to service.

Subsequent to the accident, the A&CC was informed by CMS&H District 5 personnel of an incident that occurred on December 2, 2003. It was reported that the left side tram drive of the continuous miner involved in the October 22, 2003, fatal accident continued to operate after both tram levers on a replacement remote control transmitter were released, causing the machine to slew to the right. The control system components (remote control transmitter, antenna, receiver, demultiplexer, and firing package) were recovered along with the SCR diode bridges for the tram motor drives. A field inspection noted some damage to two of the power cables feeding the left side SCR diode bridge. The power cables were recovered along with the harness for the firing package.

In late December 2003 and early January 2004, other cables, selector switches, and contactors associated with the machine tramming controls were recovered from the machine and delivered to the A&CC for inspection and evaluation. The purpose of this work was to examine and test each of these to identify any areas where insulation failure or mechanical or electrical faults could have caused the machine's tram controls to not operate as expected.

Attachment 1 is a listing of all equipment recovered and tested.

LABORATORY TESTING AND EXAMINATION

Tests and examinations of the recovered equipment were performed at various locations in December 2003; January, February, March, and April 2004. These locations were MSHA's Approval and Certification Center in Triadelphia, WV; Matric Limited's manufacturing facility in Seneca, PA; Magnetek's manufacturing facility in Pittsburgh, PA; and Joy Mining Machinery's manufacturing facility in Franklin, PA. Attachment 2 is a listing of the results of all tests and examinations performed.

Equipment from October 22, 2003, Accident

The equipment from the October 22, 2003, accident consists of equipment that was recovered on October 23, 2003, and equipment that was recovered later that was reported to have been in use at the time of the accident. In the following list, the equipment with identification numbers of PE-1 through PE-9 was recovered on October 23, 2003. The methane monitor module designated PE-20 was recovered on October 29, 2003. All other equipment was recovered on various dates in December 2003 and January 2004.

- PE-1, Remote Control Transmitter,
- PE-2, Left tram knob for Remote Control Transmitter,
- PE-3, Power cord for TX3 used to move CM after the accident,
- PE-4, Power cord for TX3 used by midnight shift operator
- PE-5, Power cord for TX3 used during accident
- PE-6, Joy/Matric receiver
- PE-7, Joy/Matric demultiplexer
- PE-8, Joy/Magnetek firing package

- PE-9, Koehler Cap Lamp
- PE-14, Joy/Magnetek SCR bridge, left side
- PE-15, Joy/Magnetek SCR bridge, right side
- PE-16, P2C Firing Package Harness
- PE-17, White lead “B” phase between traction breaker and overload block for left SCR bridge
- PE-18, Red lead “C” phase between traction breaker and overload block for left SCR bridge
- PE-19, Joy/Matric Antenna
- PE-20, General Monitors Methane Monitor Module,
- Cable #53,
- Cable #54,
- Left traction control switch,
- Right traction control switch,
- Pump control switch, and
- Left tram motor contactors.

The inspection and testing of the control components revealed that one fault which could have allowed the left tram function to continue upon release of the tram lever. A rubber gasket was found between the cover plate over the switch actuators and the case of the remote control transmitter seen in Figure 1 in Attachment 4. The areas of the gasket around the tram levers, as shown in Figure 2 in Attachment 4, did not conform to the actuator stems. The tram levers measured 6.25 mm x 6.25 mm, and the openings in the cover plate were 15.65 mm x 7.93 mm. As shown in Figure 3 of Attachment 4, the margins of the gasket material at the opening for the tram levers were uneven and did not occupy the space between the lever and cover plate. This allowed an accumulation of dust in the sockets for the tram levers, as shown in Figure 4 of Attachment 4. The socket for the left tram lever was nearly full of dust and dirt, restricting its free travel. The results of the switch calibration test seemed to verify this, as the full range of the output of the left tram switch was only 78% of that of the right tram switch. This accumulation could have also caused the left tram lever to fail to return to its centered position. This could have then caused a forward signal to continue to be transmitted to the continuous mining machine after the tram lever was released.

The left tram lever was reportedly centered during the fatal accident, and the left tram drive continued operating. Therefore, testing was conducted to determine the minimum forward lever travel required for the remote control transmitter to send a tram signal to the machine. This travel was measured 12° from the centered position of the lever. When viewed from various angles, it was difficult for the observer to distinguish between the tram lever at this position and a tram lever in the centered position.

The gasket was not included in the original approved design of the remote control transmitter. The original design concept was that the switch actuators were positioned in open wells which could be periodically flushed with water to remove any accumulated debris. However, after receiving complaints from mine operators at two mines concerning the potential for switches to stick or operate sluggishly, MSHA contacted Joy

and requested that the wells for the actuators be protected from wet debris accumulation. In response, Joy provided a gasket to users of this model remote control transmitter in 2001. Initially, this gasket was neoprene, but was later changed to latex to enhance the life of the gasket. Field trials revealed that the gasket failed to solve the problem; therefore, the gasket was not added to the approval documentation. Subsequently, a switch “boot” was designed to cover the open pockets of the remote. A field trial was begun in January 2002, and Joy stated that they would perform retrofits between June and September of 2002. In December 2002, MSHA approved the design that included the boots on all toggle switches on the remote control transmitter.

Because of screws missing from the printed circuit board, a loose internal antenna, and hardware loose inside the case, it appeared that the unit had been previously disassembled. The presence of the loose washers between the hall-effect sensors for the left tram function and its magnet actuator caused the unit to either (a) fail to provide the tram signal or (b) provide a tram signal later than expected or stop the tram signal earlier than expected. This was dependent on the number of washers in that area. Additionally, it was found to be unlikely that the loose conductive parts could have short-circuited the power supply leads of the hall-effect switch to its output.

Testing revealed two possible causes for the machine drop-outs. First, dirt was present on the remote control transmitter contacts for the power cord that connected the remote control transmitter to the cap lamp battery. This dirt was sufficient to cause power interruptions to the remote control transmitter, which led to a lack of signal to the receiver, causing the machine tramming and hydraulic functions to stop. Second, the methane monitor module was loose in its base. This could cause a momentary power interruption to the machine, or an interruption of power to the machine and methane monitor, requiring the monitor to repeat its 19.5 second power-up cycle.

With the exception of the cap lamp, the components that were involved in the fatal accident that were also MSHA-approved were compared with the approval documentation. The cap lamp was not compared with the approval documentation because it was determined that it did not play a role in the accident. There were several discrepancies that could be attributed to mismanufacture or improper maintenance; none of these were judged to have contributed to the fatal accident. Attachment 3 is a listing of the discrepancies that were found.

Equipment from December 2, 2003, Incident

The equipment from the December 2, 2003, accident consists of equipment that was recovered on December 5, 2003, and equipment that was recovered later that was reported to have been in use at the time of the incident and also at the time of October 22, 2003, fatal accident. In the following list, the equipment with identification numbers of PE-10 through PE-19 were recovered on December 5, 2003. All other equipment was recovered on various dates in January 2004. All equipment except that with identification numbers of PE-10 through PE-13 were reported to have been use at the time of the October 22, 2003, fatal accident.

- PE-10, Joy/Matric radio transmitter,
- PE-11, Joy/Matric receiver,
- PE-12, Joy/Matric demultiplexer,
- PE-13, Joy/Magnetek Firing Package,
- PE-14, Joy/Magnetek SCR bridge, left side,
- PE-15, Joy/Magnetek SCR bridge, right side,
- PE-16, P2C Firing Package Harness,
- PE-17, White lead “B” phase between traction breaker and overload block for left SCR bridge,
- PE-18, Red lead “C” phase between traction breaker and overload block for left SCR bridge,
- PE-19, Joy/Matric Antenna,
- Cable #53,
- Cable #54,
- Cable No. 56,
- Left traction control switch,
- Right traction control switch,
- Pump control switch, and
- Left tram motor contactors

The inspection and testing of the control components recovered after the incident on December 2, 2003, revealed no faults that could have contributed to the incident.

Inspection of Wires and Cable

The examination of the wires and cables did not reveal any conditions that would have caused the tram control circuits to malfunction by allowing the left tram function to continue upon release of the left tram lever on the remote control transmitter. The insulation damage to the wires supplying power for the left side SCR bridge, as seen on Figures 5 and 6 of Attachment 4, could have been sufficient to interrupt or reduce current flow to the left tram motor, if a short circuit occurred between the two phase conductors with damaged insulation. It is unlikely that operation of the tram control components would have been adversely affected by this type of short circuit. Testing also showed that it was unlikely that a short circuit between the damaged B-phase power conductor and ground would result in unintended operation of the left tram drive.

SUMMARY

To summarize the significant findings of this investigation:

- One potential fault with the remote control transmitter from the fatal accident could have caused the left tram drive to continue after the tram lever was released. Debris could have lodged between the tram lever and cover plate
- Two potential causes of the reported power interruptions of the machine are an unsecured mounting of the methane monitor module and a dirty power connection for the remote control transmitter.

- No causes were identified for the December 2, 2003, incident.

Comprehensive test results can be obtained from the Chief of the A&CC, RR 1, Box 251, Industrial Park Road, Triadelphia, West Virginia 26059.

ATTACHMENT 1
LIST OF EQUIPMENT RECOVERED

Exhibit Number	Description	Model Number	Serial Number
PE-1	Joy/Matric radio transmitter	TX3	75203AC023B
PE-2	Left tram knob for a Joy/Matric Model TX3	-	-
PE-3	Power cord for TX3 used to move CM after the accident	-	-
PE-4	Power cord for TX3 used by midnight shift operator	-	-
PE-5	Power cord for TX3 used during accident	-	-
PE-6	Joy/Matric receiver	100017329	83502AD026D
PE-7	Joy/Matric demultiplexer	100042863	90205AC013D
PE-8	Joy/Magnetek firing package	601849-124	4041102-27
PE-9	Koehler Cap Lamp	-	-
PE-10	Joy/Matric radio transmitter	TX3	75207AD001D
PE-11	Joy/Matric receiver	100017329	83511AD042D
PE-12	Joy/Matric demultiplexer	100042863	90207AE003F
PE-13	Joy/Magnetek Firing Package	601849-0124	4041003-01
PE-14	Joy/Magnetek SCR bridge, left side	RP601849-0121	34736-001
PE-15	Joy/Magnetek SCR bridge, right side	RP601849-0121	42350-108
PE-16	P2C Firing Package Harness	-	-
PE-17	White lead "B" phase between traction breaker and overload block for left SCR bridge	-	-
PE-18	Red lead "C" phase between traction breaker and overload block for left SCR bridge	-	-
PE-19	Joy/Matric Antenna	601843-0251	5016373-000
PE-20	General Monitors Methane Monitor Module, unique identifier ABE9626	S800	E48683
-	Cable #53 identifier 53	-	-
-	Cable 54 identifier "54"	-	-
-	Left traction control switch, identifier "left trac switch"	-	-
-	Right traction control switch, identifier "right trac switch"	-	-
-	Pump control switch, identifier "pump switch"	-	-
-	Left contactors, identifier "left"	-	-
-	Cable No. 56, identifier "Cable 56"	-	-

ATTACHMENT 2
TESTING/EXAMINATION RESULTS

- 1 Equipment Recovered From Fatal Mine Accident
 - 1.1 Control System. The system, consisting of the PE-1 transmitter and PE-2 tram lever knob, PE-5 power cord, PE-6 receiver, and PE-7 demultiplexer gave the expected outputs when tested as a system after the connector on the PE-5 power cord was cleaned.
 - 1.2 Matric Limited Model TX3 Transmitter, PE-1 and tram lever knob, PE-2. This unit, and the associated PE-2 knob from the left tram lever, gave the expected outputs, with few exceptions, during testing. The exceptions are detailed below.

The switch calibration testing revealed that the left tram switch gave a smaller-than-expected output voltage range across the full travel of the lever. The range was 78% of the range of the right tram switch. This suggested that the travel of the actuator for the left tram was restricted as compared to that of the right tram. The same test revealed that orientation of the transmitter had little effect on the operation of the tram levers.

Inspection of the knob and left tram lever revealed no damage to the internal threads of the lever or to the screw hole through the knob. Additionally, the inspection revealed that the socket for the left tram lever was packed with coal dust, as was the socket for the right tram lever, albeit to a lesser extent. A rubber gasket was found between the cover plate over the switch actuators and the case. The areas of the gasket around the tram levers, and especially the left tram lever, were not tight against the actuator stems. The lever measured 6.25 mm x 6.25 mm, and the opening in the cover plate was 15.65 mm x 7.93 mm. The gap between the lever and the cover plate allowed an accumulation of dust in the sockets for the tram levers. The gasket material was not effective for excluding dust and other contamination at the area of the tram levers.

The frequency and power output of the transmitter were within the manufacturer's specifications. The unit continued operating properly under low voltage conditions; once its low voltage threshold was reached, it turned off. It was not possible to accidentally operate the controls of the unit by introducing an external magnetic field in the vicinity of the controls using small magnets, such as those on small screwdrivers or those used during calibration of the methane monitor.

Because of screws missing from the printed circuit board, a loose internal antenna, and hardware loose inside the case, it appeared that the unit had been previously disassembled. Among the hardware found were three small washers. Testing was conducted to determine the effect of these loose washers if placed between the hall-effect sensors for the left tram function and its magnet actuator. This caused the remote control transmitter to either (a) fail to provide the tram signal or (b) provide a tram signal later than expected or stop the tram signal earlier than expected. This was dependent on the number of washers in that area.

Additionally, it was found to be unlikely that the loose conductive parts could have short-circuited the power supply leads of the hall-effect switch to its output.

Testing was conducted to determine the minimum forward left tram lever travel required for the remote control transmitter to send a tram signal to the machine. This travel was measured 12° from the centered position of the lever. When viewed from various angles, it was difficult for the observer to distinguish between the left tram lever at this position and a tram lever in the centered position.

Several discrepancies were found between the PE-1 and the MSHA approved design of the unit. The most significant were: the inclusion of the rubber gasket between the cover plate and case; and the fact that the internal antenna and hardware were loose.

- 1.3 Matric Limited Receiver, PE-6. The unit operated within the manufacturer's specifications and provided the expected functions during testing. Several discrepancies were found between the PE-6 and the approved design of the unit. None of these discrepancies were significant to this investigation.
- 1.4 Matric Limited Demultiplexer, PE-7. The unit operated within the manufacturer's specifications and gave the expected outputs during testing. An LED labeled 'MAINTENANCE' was on. Data stored in the unit indicated that the temperature to which it had been exposed was abnormally low and that an internal CPU communication error had occurred or noise had been present at some time on the serial data. These errors were found not to cause a left tram forward signal to continue to be transmitted to the continuous mining machine after the tram lever was released. Several discrepancies were found between the PE-7 and the MSHA approved design of the unit. None of these discrepancies were significant to this investigation.
- 1.5 Power Cords, PE-3, PE-4, AND PE-5. The power cord used to operate the continuous mining machine during the shift before the accident (PE-4) had no physical or electrical faults. The power cord in use at the time of the fatal accident (PE-5) was missing an O-ring at the connector for the transmitter and the strain relief for the cap lamp connector was missing; it had no electrical faults. The power cord used to move the machine after the fatal accident (PE-3) was bent at the cap lamp connector and the strain relief was not connected; it had no electrical faults. Even with the damage, it was possible to power the transmitter with this power cord. No comparison with approval documentation was possible, as these cables are not shown on the approval documents.
- 1.6 Koehler Cap Lamp, PE-9. The unit gave an output voltage of 3.27 volts approximately 6 ½ weeks after the accident; the electrolyte level was noticeably low. The output voltage was insufficient to operate the TX3 transmitter at the time of testing. The unit was not compared with the approval documentation, because it was determined that it did not play a direct role in the accident.

- 1.7 Magnetek Firing Package, PE-8. The unit met the manufacturer's specifications when tested. This included testing at ambient temperature and 80°C. It was not affected by the electromagnetic fields or noise generated in their test, nor was it affected negatively by variations in power supply voltage. It was not compared with approval documentation, as it was neither MSHA-approved nor required to be approved.
- 1.8 General Monitors S800 Methane Monitor, PE-20. Only the module and its associated mounting bracket, along with short lengths of the cables were recovered. The bracket was found to be broken, and the module was not secured to the base when inspected in the field. Before the module was broken during testing, the testing of the module revealed that it could be dislodged so as to cause an interruption of power to the machine, requiring machine power to be recycled. Testing on similar equipment showed that the interruption could be momentary. Several discrepancies were found between the PE-20 module and its approved design. None of these discrepancies were significant to this investigation.

2 Equipment Recovered From Non-Fatal Incident

- 2.1 Control System. The system, consisting of the PE-10 transmitter, PE-11 receiver, and PE-12 demultiplexer gave the expected outputs when tested as a system.
- 2.2 Matric Limited Model TX3 Transmitter, PE-10. This unit operated properly during testing. The switch calibration testing gave the expected range of values for all functions. The same test revealed that orientation of the transmitter had little effect on the operation of the tram levers.

The unit featured boots around all switch actuators to protect against dirt entry; these boots were intact.

The frequency and power output of the unit were within the manufacturer's specifications. The unit continued operating properly under low voltage conditions; once its low voltage threshold was reached, it turned off.

The unit was not compared with the approval documentation, as this part was not involved in the subject accident.

- 2.3 Matric Limited Receiver, PE-11. The unit operated within the manufacturer's specifications and gave the expected functions during testing. The unit was not compared with the approval documentation, as this part was not involved in the subject accident.
- 2.4 Matric Limited Demultiplexer, PE-12. The unit operated within the manufacturer's specifications and gave the expected outputs during testing. Data stored in the unit indicated that it had not been exposed to abnormally high temperatures and that no internal errors had occurred. The unit was not compared with the approval documentation, as it was not involved in the subject accident.

- 2.5 Magnetek Firing Package, PE-13. The unit met the manufacturer's specifications when tested. This included testing at ambient temperature and 80°C. It was not affected by the electromagnetic fields or noise generated in their test, nor was it affected negatively by variations in power supply voltage. It was not compared with approval documentation, as it was neither MSHA-approved nor required to be approved.
- 3 Equipment Recovered After Non-Fatal Incident, And Also Reported To Be In Use At The Time Of The Fatal Accident
 - 3.1 Magnetek SCR Bridge, Left Side, PE-14. The unit met the manufacturer's specifications when tested. This included testing at ambient temperature and 80°C. What had appeared to be insulation damage on the wiring for a current transformer was apparently a splice featuring heat-shrink tubing. The current transformer was not damaged, nor was there evidence of arcing on the busbar adjacent to the spliced wire. The unit was not compared with approval documentation, as it was neither MSHA-approved nor required to be approved.
 - 3.2 Magnetek SCR Bridge, Right Side, PE-15. The unit met the manufacturer's specifications when tested. This included testing at ambient temperature and 80°C. There was no apparent damage to the unit. It was not compared with approval documentation, as it was neither MSHA-approved nor required to be approved.
 - 3.3 Firing Package Wiring Harness, PE-16. Only minor physical, and no electrical, issues were noted with this harness, which was assembled by Magnetek. A connector did not completely cover the insulation on one wire, and the insulation was flattened on several others. These issues could not have caused the machine's tram controls to not operate as expected.
 - 3.4 Antenna, PE-19. The housing for the antenna was damaged, but the antenna was not.
 - 3.5 B-Phase Cable, PE-17. The cable had a damaged area that had conductor strands that appeared to be fused or melted together, having a copper-like appearance. The insulation material in the immediate vicinity of the damaged area appeared to be discolored. The effect of grounding the damaged area of the cable was tested by bringing it into continuous contact, and intermittent contact, with the grounded machine frame at the mine site. The left tram function did not continue to operate after the tram levers were released during this testing. Tests were also conducted on a similar machine, with the PE-8 firing package, and the PE-13 and PE-14 SCR bridges installed, by intermittently grounding using controlled contacts at higher frequencies, with no continuation of left tram function.
 - 3.6 C-Phase Cable, PE-18. The cable had insulation damage in one area. The conductor strands did not appear to be fused. The wire strands had a silver-like appearance. The insulation material in the immediate vicinity of the damaged area did not appear to be discolored.

- 3.7 Cable 53. Insulation resistance tests in the field showed that the insulation between conductors was at least 100 megaohms. Laboratory inspection revealed that none of the wires or terminal connections showed signs of insulation failure or other conditions, such as frayed wire strands, that could provide alternate paths for current flow.
- 3.8 Cable 54. Insulation resistance tests in the field showed that the insulation between conductors was at least 4.8 megaohms. Laboratory inspection revealed that none of the wires or terminal connections showed signs of insulation failure or other conditions, such as frayed wire strands, that could provide alternate paths for current flow.
- 3.9 Cable 56. Insulation resistance tests in the field showed that the insulation between conductors was at least 100 megaohms. The conductor insulation for several of the wires in the area where the conduit housing the cable was damaged was found to be deformed, but not visibly damaged. Laboratory inspection revealed that none of the wires or terminal connections showed signs of insulation failure or other conditions, such as frayed wire strands, that could provide alternate paths for current flow.
- 3.10 On-Board Pump/Control, Left Traction, and Right Traction Switches. No unexpected operations of the switches were noted during laboratory testing. The insulation withstand between unconnected terminals was at least 2500 volts. No damage was noted.
- 3.11 Left Traction Contactors. The contactors operated as expected during field testing and within the manufacturer's specifications during laboratory testing. Inspection did not reveal any significant damage, and the resistance of the contacts was less than 0.08 ohms when closed and greater than 20 megaohms when opened.

ATTACHMENT 3
COMPARISON TO APPROVAL DOCUMENTATION

- 1 Matric Limited Model TX3 Transmitter, PE-1
 - 1.1 From Drawing Number MA 500-752 Rev 1:
 - 1.1.1 Several components in different areas on the printed circuit board shown in the upper left of the drawing were different on the unit. Review of the parts layout on sheet 2 of drawing number MA 95-1206 Rev 2 seems to indicate that the layout sketch on MA 500-752 Rev 1 was not revised from Rev 0.
 - 1.1.2 A sleeve was found covering the wiring from the external connector to J1 and J2 on the printed circuit board; this sleeve is not shown on the drawing.
 - 1.1.3 Note 6 indicates that “Enclosure connectors and switches are dust-tight.” Varying amounts of dust were found in the sockets for the switch actuators.
 - 1.1.4 The right side carrying handle was broken off; this most likely occurred during the accident.
 - 1.1.5 The knob for the left tram lever was not on the lever and its securing screw was missing. There was no evidence that its securing screw was broken or that the threads inside the lever were stripped.
 - 1.1.6 There was a Joy logo on the lower right side of the enclosure near the controls that is not shown on the drawings.
 - 1.1.7 The content of a label is given on the drawing as: “MATRIC LIMITED, TYPE TX3 TRANSMITTER, MUST BE POWERED BY AN MSHA APPROVED 4 VOLT CAP LAMP, 250 MILLIAMPS MIN. ACCESSORY CAPACITY.” The content of the label on the unit, which was partially obstructed by a reflector, was: “WARNING (illegible) EXTERNAL CO(illegible) ACCORDANCE (illegible) SYSTEM CONNE(illegible) MA001096-0036. IN (illegible) CAP LAMP CONNEC(illegible) TO AN MSHA APPROV(illegible) LAMP WITH 250 MILLI(illegible) ACCESSORY RECEPTACLE (illegible).
 - 1.1.8 Two screws, two star washers, one flat washer and one nylon clamp were found loose inside the unit. While not documented completely, the internal antenna is apparently normally held in place with the nylon clamp, one of the screws, and the flat washer. The drawing shows twelve screws securing the printed circuit board to the case; only eleven were in place. This seems to indicate that the second screw found loose inside the unit was intended for this purpose. Also, there were star washers associated with eight of the eleven screws. In the location of the other three screws, there were markings in the conformal coating suggesting that the star washers had been in place previously. This seems to indicate that the three star washers had been removed and not reinstalled, with two of them left inside the case.
 - 1.1.9 There was a rubber gasket material between the case and the switch cover plate; this is not shown on the drawing.

- 1.2 From Drawing number MA 205-1629, Sheet 1, Rev 2: Component R52 is shown as “NP”; however, this component was installed on the board.
- 1.3 From Drawing number MA 205-1629, Sheet 3, Rev 2: Component U46 is shown on the drawing as “MAX338”; however, the component in the unit was marked “DG408DY”. It should be noted that the markings on several components were not legible due to the conformal coating on the board.
- 2 General Monitors S800 Methane Monitor, PE-20, Unique Identifier ABE9626
 - 2.1 From Drawing Number 21029 Rev D:
 - 2.1.1 Item 20 (#6 split lock washer) and item 21 (#6 flat washer) were missing from unit.
 - 2.1.2 Item 22 (pad, neoprene) was missing from the unit.
 - 2.1.3 The “bar code and part number” shown on the left side view of the electronics assembly was missing.
 - 2.2 From Bill of Material 21010-1 Rev A:
 - 2.2.1 Item 17 is listed as ‘IC PRPHL DRVR 80P UCN5801’; the component in the unit was ‘MIC5801.’
 - 2.2.2 Item 18 is listed as ‘IC PRPHL DRVR 40P UCN5800’; the component in the unit was ‘MIC5800.’
- 3 Matric Limited Demultiplexer, PE-7
 - 3.1 From drawing number MA 500-200, sheet 3 of 3, Rev 2: A gasket, not shown on the drawing, was between the enclosure and base on the unit.
 - 3.2 From drawing number MA 205-1520, sheet 1 of 2, Rev -:
 - 3.2.1 Component C16 is shown glued to the circuit board; it was found on the unit to be glued to the circuit board and to Transformer T1.
 - 3.2.2 Components Q1 and Q2 are shown as ‘NPD6060’; they were ‘NDP6060’ on the unit.
- 4 Matric Limited Receiver, PE-6
 - 4.1 From drawing number MA001096-0028, Rev 5 June 1998:
 - 4.1.1 The 125Ma/125-Volt fuse shown in the wiring for the T/L connector was not found in the unit.
 - 4.1.2 The wording shown on the cover plate of the unit was different from that shown on the drawing. The information in the “APPROVAL INFORMATION AREA” was in a different location. The marking “TYPE RX1

RECEIVER” was in a different location and modified. Other markings present on the unit are not shown on the drawing.

4.1.3 The marking “MA001096-0029” was not found on printed circuit board in the unit.

4.2 From drawing number MA001096-0029, Rev 5 June 1998: Note 4 states “PCB ASSEMBLY IS CONFORMAL COATED”; an additional unnumbered note indicates “PRINTED WIRING BOARDS ARE TO BE PROTECTED BY AT LEAST TWO LAYERS OF AN ADHERENT INSULATING COATING HAVING A VOLTAGE RATING OF 200 VOLTS PER 0.025mm (0.001 in) OF THICKNESS.” The areas around D1, J1, J2, J3 and LK1 were not coated.

Figure 1. PE-1 Transmitter Front Panel

ATTACHMENT 4



PHOTOGRAPHS



Figure 2, PE-1 Transmitter, tram levers with knobs removed



Figure 3. PE-1 Transmitter, Front Panel cover plate, gasket side view, detail, tram lever openings



Figure 4. PE-1 Transmitter, tram lever sockets (two in center top)



Figure 5. Damaged Area of B-Phase Power Cable



Figure 6. Damaged Area of C-Phase Power Cable