

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

COAL MINE SAFETY AND HEALTH

AMENDED REPORT OF INVESTIGATION

Underground Mine

**Fatal Electrical Accident
November 4, 2005**

**Mine #1
Enterprise Mining Company, LLC
Gordon, Letcher County, Kentucky
ID No. 15-18506**

Accident Investigators

**Robert Bates
Supervisory Electrical Engineer**

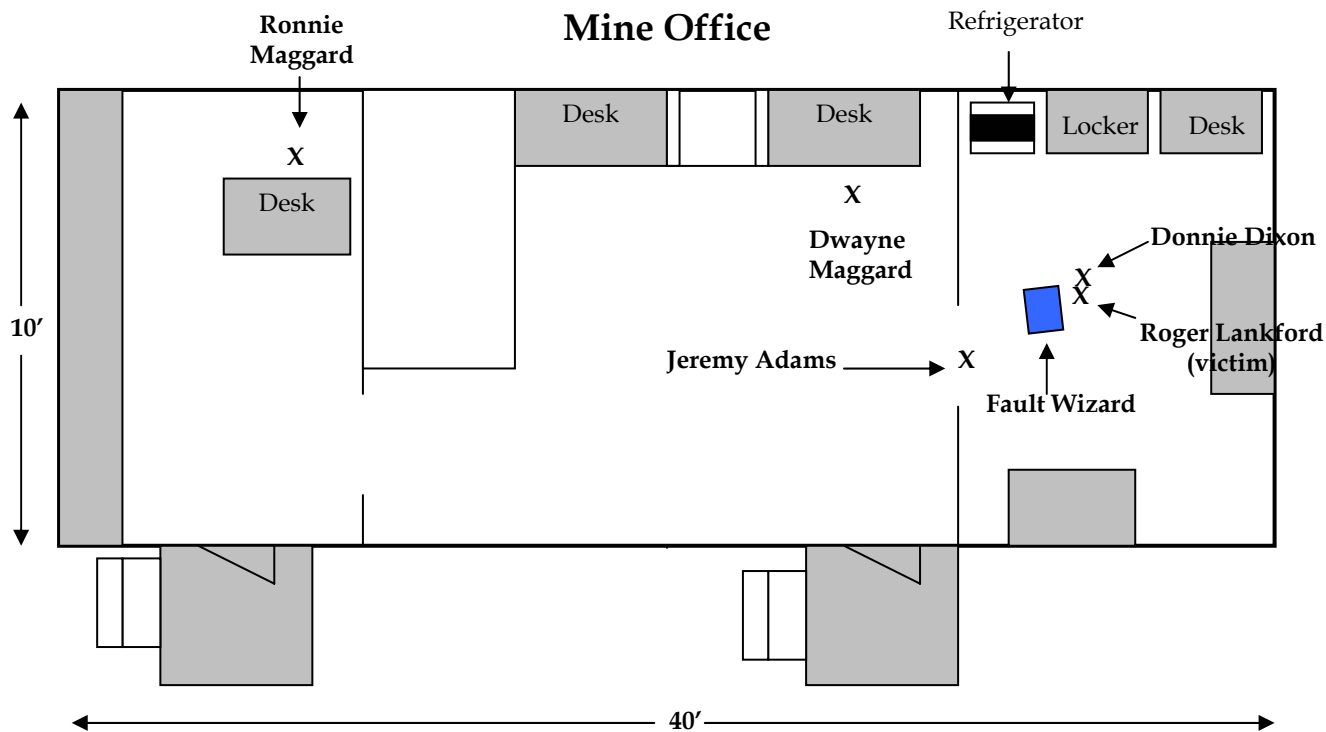
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Electrical Engineer**

**Originating Office
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Kenneth A. Murray, District Manager**

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Note: Paragraph 2 of page 4 was amended to reflect the fact that the victim was wearing rubber boots at the time of the accident.



Not to Scale

Source: Kentucky Office of Mine Safety and Licensing

Sketch of Accident Scene
 Fatal Electrical Accident
 Mine # 1 (I.D. No.15-18506)
 Enterprise Mining Company, LLC
 Gordon, Letcher County, Kentucky
 November 4, 2005

Overview

On November 4, 2005, at approximately 4:30 p.m., Roger Lankford, a thirty-nine year-old chief electrician, was fatally injured while demonstrating the use of a high-potential cable tester to another employee in the mine superintendent's office. During the demonstration, the victim came into contact with the energized output leads of the test unit and received a fatal electrical shock. The accident occurred because proper safety precautions, including the use of personal protective equipment, were not taken before the unit was operated in a high-voltage mode.

GENERAL INFORMATION

Enterprise Mining Company, L.L.C., Mine #1, is located approximately 0.5 miles northwest of Kentucky Route 510 near the city of Gordon in Letcher County, Kentucky. The company is a wholly owned subsidiary of Amfire, LLC of Abingdon, Virginia. The principal mine officials are Vernon King, Jr., Manager of Mines, and John David Hayes, Superintendent.

The mine began production on April 4, 2003, in the Upper Hamblin coal seam, which has an average mining height of 50 inches. The mine currently has two active sections, designated as 001 and 002. Coal is produced using continuous mining machines, shuttle cars, battery-powered scoops, and roof bolting machines. Coal is transported from each section to the surface using a series of belt conveyors.

The mine employs a total of 45 persons and operates two production shifts and one maintenance shift daily. Normally, the mine operates five days per week and produces an average of 2000 tons of coal per day.

The last regular safety and health inspection conducted by the Mine Safety and Health Administration was completed on September 22, 2005. The most current inspection was started on October 18, 2005, and was ongoing at the time of the accident.

DESCRIPTION OF ACCIDENT

On the day of the accident, Lankford and Donnie Dixon, Mine Electrician, entered the mine at approximately 6:00 a.m. During the shift, Lankford operated the continuous mining machine while Dixon performed routine maintenance duties on the working section.

At approximately 12:30 p.m., the circuit breaker protecting the continuous mining machine tripped due to a fault in the trailing cable. Lankford and Dixon began the process of locating the fault using the high potential cable tester located on the working section. (This unit, manufactured by Mine Products, Inc., was the tester normally used at the mine and was not involved in the accident later that afternoon.)

During the troubleshooting process, Lankford periodically communicated by mine telephone with Jeremy Adams, Mine Clerk, to inform him of the status of the job. Adams relayed this information to Hayes, who was located at the company's main office in Whitesburg, KY, at the time. After approximately one and one-half hours of troubleshooting without isolating the fault, Hayes made arrangements to have the Fault Wizard™ high potential cable tester delivered to the mine so that the fault in the continuous mining machine cable could be located more readily. At the time the tester was located at another mine operated by the company.

By the time the Fault Wizard™ tester arrived at the mine (approximately 2:30 p.m.), the fault in the continuous mining machine trailing cable had already been located by Lankford and Dixon. Adams received the tester and placed it in the mine superintendent's office. The unit was stored under the superintendent's desk and the door to the office was locked.

Lankford and Dixon finished repairing the fault in the continuous mining machine trailing cable at approximately 3:30 p.m. They boarded a rubber-tired personnel carrier and traveled to the surface of the mine, arriving outside at 4:00 p.m. At that time, Lankford had a telephone conversation with Hayes, regarding the storage of the Fault Wizard™ tester. Hayes instructed Lankford to place the tester in a storage cabinet in the superintendent's office.

At 4:30 p.m., Adams unlocked the door to the superintendent's office and entered the room, followed by Lankford and Dixon. Adams opened the cabinet located next to the desk and took measurements to determine whether or not the tester would fit in the cabinet. Lankford moved the tester from under the desk and measured it, concluding that it was too large to fit in the cabinet. Lankford said to Dixon "let's look at it". Lankford opened the lid on the tester and knelt directly in front of it. Dixon knelt beside of Lankford, on the left side of the unit.

The tester was not plugged into the electrical outlet in the office. The alligator clip for the grounding cord was lying on the left side of the lid and was unattached. The alligator clip for the black high-voltage output lead was attached to the metallic shorting bar, which was mounted in the lid of the unit.

The alligator clip for the red high-voltage output lead was located in the right side of the lid. (It is not clear whether or not the red alligator clip was attached to the shorting bar when the lid was first opened.)

Lankford turned the main power switch on and began demonstrating how to adjust the "Cable VP" setting for various sizes of mining cable. He rotated the "Voltage" control to 10KV and pressed the green "HV Start" button. An electrical arc flashed near the shorting bar mounted in the lid. A few seconds later, Lankford pulled his right hand away from the tester and said "it got me". Lankford attempted to stand and then collapsed on the floor. Adams immediately turned the main power switch off and closed the lid on the tester. He and Dixon attempted to revive Lankford, who had stopped breathing at this time. Ronnie Maggard, a mine examiner who was located in an adjacent room at the time of the accident, called "911" and requested assistance.

Personnel from Gordon Fire Department and Letcher County Fire and Rescue arrived on the scene and continued the attempt to revive Lankford. Paramedics from Medflight of East Kentucky also responded. John Cornett, Letcher County Coroner, arrived on the scene at 5:45 p.m. and officially pronounced Lankford dead at 6:05 p.m.

INVESTIGATION OF ACCIDENT

Vernon King, Jr., Manager of Mines, notified David Ison, supervisor of the MSHA field office in Whitesburg, KY, of the accident at 5:55 p.m. on November 4, 2005. MSHA personnel were immediately dispatched to the mine to begin the investigation, which was performed in cooperation with representatives of the Kentucky Office of Mine Safety and Licensing (KOMSL).

Preliminary interviews were conducted onsite and the scene was photographed and measured by the investigating team. The Fault Wizard™ tester was taken into custody by MSHA for further testing and evaluation.

Interviews were conducted by MSHA and KOMSL at the MSHA district office in Pikeville, KY, on November 6, 2005. Four miners and four management officials deemed to have information regarding the accident were interviewed.

On November 14, 2005, an additional interview was conducted with a sales representative for State Electric Supply Company in the MSHA office in Pikeville, KY. The sales representative was interviewed because he conducted a training session at Mine#2 on June 10, 2005, in which Roger Lankford received task training on the operation of the Fault Wizard™ tester.

The Fault Wizard™ tester was transported to the MSHA Approval and Certification Center on November 9, 2005. The unit was examined and tested on November 29-30, 2005, in the presence of company and MSHA representatives.

DISCUSSION

General

Electrocution was the official cause of death listed in the Letcher County Coroner's report and the medical examiner's report. Two small burn marks, identified as electrical burns by the medical examiner, were present on the victim's body. One mark was on the left index finger and the other mark was on the palm of the right hand. The victim was not wearing electrical gloves at the time of the accident. He was wearing plastic articulating knee pads and Iron Age™ rubber boots. The boots had an EH (Electrical Hazard) designation on the label.

The Accident Scene

The accident occurred in the superintendent's office, which was one of three rooms in the mine office building. The office floor was made of commercial tile and was dry and relatively clean. Lighting was provided by a fluorescent fixture that afforded adequate visibility. All electrical appliances in the superintendent's office were properly grounded. No defects were found in the office wiring or grounding system.

The Fault Wizard™ Tester

The tester involved in the accident was manufactured by Innovative Utility Products Corporation of Van Buren, Arkansas (see Appendix B, Photograph 2). This particular model of tester is currently used in the mining industry and in the power distribution (utility) industry. The model number of the unit involved in the accident was IUPFW1 and the serial number was FW0487. The manufacturer's published specifications for the tester are as follows:

- Maximum Charge Voltage - 10KV
- Maximum Hi-Pot Voltage - 10 KV
- Maximum Energy Storage - 350 Joules
- Maximum Cycle Time - 6 seconds for 10KV charge
- Discharge Capacitor - 10KV, 7 uF +/- 10%
- Weight - 53 lbs
- Size - 10" x 18" x 19"
- Battery Capacity - 7 AH at 24V

The unit was equipped with two insulated high-voltage output leads, approximately 40 feet in length, which terminated in large alligator clips. One of

the alligator clips was covered by a red rubber boot and the other clip was covered by a black rubber boot. The “black” output lead was electrically connected to the frame ground of the unit. The unit was equipped with an insulated #10 AWG external frame grounding lead, approximately 40 feet in length, which terminated in an alligator clip covered by a green rubber boot.

The heads of four large carriage bolts, connected to the frame of the unit, were exposed on the bottom of the case. According to the manufacturer, these bolts are designed to provide a path for earth currents when the unit is sitting on the ground.

The unit is designed for four basic modes of operation. The energy state of the high-voltage output leads in each of the modes is as follows:

- Cycle Mode – The capacitor is charged to the selected voltage level when the “HV Start” button is pushed. After the capacitor discharges through the output leads, the capacitor repeatedly charges and discharges with a maximum cycle time of approximately 6 seconds.
- Hipot Mode – The output leads are energized when the “HV Start” button is pushed. The voltage at the output leads increases as the voltage control is rotated in the clockwise direction. The capacitor is not used in this mode. The output voltage is supplied by the high-voltage DC power supply.
- High Voltage Time Domain Reflectometry (TDR) Mode – The “HV Start” button is pushed and the capacitor charges to the selected voltage level, but the output leads are not energized until the “Thump” button is pushed. When the “Thump” button is pushed, the capacitor discharges through the output leads and a low voltage TDR pulse is simultaneously initiated.
- Low Voltage TDR Mode – A low voltage TDR pulse is generated when the “LV TDR” button is pushed. No high voltage discharge occurs in this mode.

When investigators first arrived at the scene of the accident, the controls and output leads of the tester were configured as follows:

- The main power switch was in the off position.
- The mode selector was in the “Cycle” position.
- The voltage control knob was adjusted to 10KV.
- The charging cord was not plugged into a 120-volt receptacle.

- The black output lead was attached to the shorting bar installed in the lid of the unit.
- The red output lead was unattached, lying in the left-hand side of the lid.
- The green grounding lead was unattached, lying in the left-hand side of the lid.

Results of Testing by MSHA Approval and Certification Center

The tester appeared to be undamaged and functional. A suspected burn mark was found on the exposed surface of the cable retention bracket and three of the case mounting screws showed signs of burning or melting consistent with electrical arcing. It could not be determined what caused these anomalous markings, or when they occurred.

When tested, all controls functioned as intended by the manufacturer. Minimal effort was required to actuate the “HV Start” pushbutton. It operated with a force of 1.0 to 1.5 lbs. and a travel distance of 0.008 to 0.011 inches. A red light-emitting diode on the control panel of the tester, which illuminates when the high-voltage power supply is energized, functioned properly.

The high-voltage output leads were subjected to a 15KV hipot insulation test. The test revealed no defects in the dielectric strength of the insulation.

No output energy was noted during testing when the unit was deenergized. Similarly, there was no output noted when the unit was energized, without the “HV Start” pushbutton being depressed. From the results of testing, the maximum energy available between the red test lead and any point common to the unit’s frame ground was calculated as 742 Joules, which would most likely be lethal. (NFPA 70E, 2000 Edition, indicates that capacitive discharges of 50J or greater may cause ventricular fibrillation.) The maximum energy available between metallic portions of the case and facility (earth) ground was calculated as less than 1 Joule, which most likely would not be lethal. No energy was noted between the red test lead and a floor tile placed in contact with a metallic portion of the case.

Significant energy was available from the unit when it was configured as follows:

- no external load was connected;
- the main power switch was turned on;
- the voltage control knob was adjusted to 10 kV; and
- the “HV Start” pushbutton was depressed.

The voltage decayed slowly, allowing significant energy to be available between the red test lead and the frame for an extended time. This energy was between

167 Joules (after 5 minutes) and 260 Joules (after approximately 30 seconds).

The results of the testing indicated that the tester was in good condition and functioned as designed by the manufacturer.

Training

Lankford attended a training session conducted on June 10, 2005, in which the operation and use of the tester were demonstrated by a local sales representative. During the training session, the instructor did not wear high-voltage gloves while operating the tester, nor did he require the students to do so. Also, neither the instruction manual for the tester nor the manufacturer's demonstration video addressed the use of high-voltage gloves while operating the unit. Lankford did not use the tester again in the interim period between the training and the accident.

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, causal factors were identified that, if eliminated, would have either prevented the accident or mitigated its consequences. Listed below are causal factors identified during the analysis and corrective actions implemented to prevent a recurrence of the accident.

Causal Factor: Roger Lankford was not wearing high-voltage gloves at the time of the accident.

Causal Factor: The use of high-voltage gloves was not included and demonstrated in the task training given to the victim regarding the safe use of the tester.

Causal Factor: The controls and output leads of the tester were not configured properly to allow a safe demonstration of the unit. The output leads were not connected to a suitable test cable or other load before the unit was energized in "cycle" mode.

Corrective Actions: All of the electricians employed by the company received training, given by the manufacturer's representative, on the safe operation of the tester. The electricians were instructed that the use of high-voltage gloves is mandatory while operating the unit.

CONCLUSION

Roger Lankford received a lethal electrical charge while demonstrating the features of the Fault Wizard™ high-potential cable tester to another electrician in the mine superintendent's office. The accident occurred because proper safety precautions, including the use of personal protective equipment, were not taken before the unit was operated in a high-voltage mode.

Approved by:

Kenneth A. Murray

Date

ENFORCEMENT ACTIONS

1. 103(k) Order No. 7410797 was issued on November 4, 2005.

Condition or Practice: "This mine has experienced a fatal electrical accident in the mine office. This order is issued to ensure the safety of any person at this coal mine until an examination or investigation is made to determine that the mine power is safe. Only those persons selected from company officials, State officials, the miner's representative, and other persons who are deemed by MSHA to have information relevant to the investigation may enter or remain in the affected area."

2. 104(a) Citation No. 7408981 was issued to the company on February 15, 2006 for violation of 30 CFR 48.7(c).

Condition or Practice: "On June 10, 2005, the chief electrician for Mine #1 received inadequate task training regarding the safe use of the Fault Wizard high-voltage cable tester. The training session did not cover the use of high-voltage rubber gloves while operating the tester. Based on interviews, it is also evident that neither the person conducting the training nor the persons receiving the training wore rubber gloves while working with the unit during the session. On November 4, 2005, the chief electrician received a fatal electrical shock while demonstrating the operation of the tester to another electrician. He was not wearing high-voltage rubber gloves at the time of the accident."

3. 104(a) Citation No. 7408982 was issued to the company on February 15, 2006 for violation of 30 CFR 77.1710(c).

Condition or Practice: "On November 4, 2005, the chief electrician for Mine #1 received a fatal electrical shock while demonstrating the operation of the Fault Wizard high-voltage cable testing device to another electrician in the mine office. The chief electrician was not wearing high-voltage gloves at the time of the accident."

APPENDIX A

PERSONS PARTICIPATING IN THE INVESTIGATION

Enterprise Mining Company, LLC.

Vernon King Jr.	Manager of Mines
John David Hayes	Superintendent, Mine #1
Candace Morgan	Safety Representative

Alpha Natural Resources

Vaughn R. Groves	Vice President and General Council
Ricky A. Shelton	Engineer

Mine Safety and Health Administration

Robert M. Bates	Supervisory Electrical Engineer
Robert Boring	Electrical Engineer, Approval and Certification Center
Kevin Hedrick	Electrical Engineer, Approval & Certification Center
David Ison	Supervisory Mining Engineer
Lee Lowe	Coal Mine Safety and Health Inspector
Kedrick Sanders	Coal Mine Safety and Health Inspector (Electrical)
Mary Sue Taylor	Attorney, Solicitor's Office

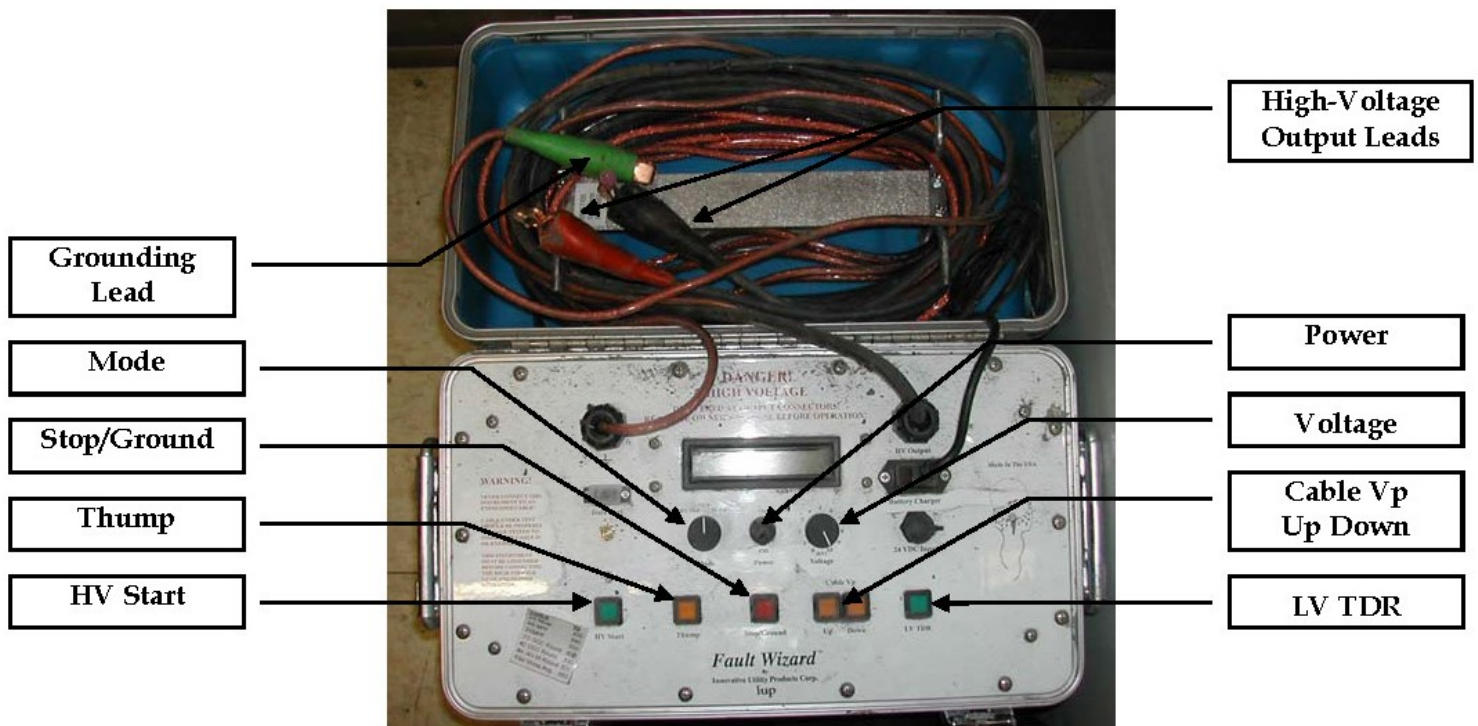
Kentucky Office of Mine Safety and Licensing

Tracy Stumbo	Accident Investigator
Tim Fugate	Accident Investigator
Wesley Gearheart	Electrical Inspector
Randy Campbell	Electrical Inspector

Appendix B



Photograph 1 - Accident Scene as Found by Investigators



Photograph 2 - Tester Involved in the Accident