



COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF MINES, MINERALS AND ENERGY  
DIVISION OF MINES

DOUBLE R COAL COMPANY, INCORPORATED  
MINE #1  
MINE INDEX NUMBER 11427AA

INVESTIGATION REPORT  
(Underground Coal Mine Explosion)

**December 26, 1987**

Double R Coal Company, Incorporated

Mine #1

Investigation Summary

Facts: At approximately 5:00 P.M., on December 26, 1987, an explosion occurred underground at the Double R Coal Co., Inc., Mine #1. One coal miner was killed. The victim was the only person in the mine.

Investigation Results: The investigation revealed that the volume of air on the active section was inadequate to render harmless and carry away flammable and explosive gases. Methane gas entered the active section from a large crack in the mine floor near the face of the #1 entry. The failure to maintain the air flow in its proper volume and direction allowed methane to accumulate to the explosive range. The methane/air mixture was possibly ignited by one of the following sources:

1. Battery-powered scoop that the victim operated which was located at survey station A646 in the #3 entry.
2. Section power center located in the #4 entry approximately 200 feet outby the face.
3. The energized power cable connected between the battery charger and batteries located at the battery charging station in the #2 entry.

4. Battery charging station power center located inby survey station A468 in the #2 entry.

A pack of cigarettes was found on the victim. However, neither a cigarette lighter nor matches were found on the victim or in the area of the explosion where the victim's body was found.

Contributing factors to the explosion were:

1. Failure to provide adequate ventilation to the active section.
2. Failure to make a proper preshift examination.
3. Methane entering the mine through cracks in the mine floor.

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Double R Coal Company, Incorporated

Mine #1

Mine Explosion

December 26, 1987

An explosion occurred at approximately 5:00 P.M. on December 26, 1987, at Double R Coal Company Inc., Mine #1. This coal mine is located off Rt. 625, Frying Pan Creek, Dickenson County, Virginia. One (1) coal miner was underground at the time of the explosion. The following is data gathered on the victim:

FATALITY VICTIM:

Name: Ted C. Street

Occupation: General laborer

Total Mining Experience: Approximately 25 years

Experience with Present Company: 3 months

Age: 47

Social Security Number: 228-50-6741

Family Status: Married

Dependent Children: 2

## MINE OVERVIEW

### Mine History

Double R Coal Company, Inc.'s Mine #1 is located off Rt. 625, Frying Pan Creek, Dickenson County, Virginia. Initially this mine began production as A & O Mining, Inc. which was licensed on March 26, 1979. The operation was relicensed as Laurel Mountain Mining Company on February 13, 1980. The mine was relicensed as A & O Corporation of Virginia on April 15, 1980, and operated until June, 1981. The mine remained idle and unlicensed until November 6, 1986, when it was licensed as Double R Coal Company, Incorporated.

This one-section drift mine is developed approximately 4,800 feet into the Raven coal seam which averages six feet (6') in thickness. This seam lies approximately 136 feet over the Tiller coal seam in the area of Clinchfield Coal Company's old Moss #3 mine which was previously mined from 1957 to 1979. The face area of the active section of Double R Coal Company, Inc., Mine #1 is presently overlying a section of pillared workings of the Moss #3 mine.

### Mining Methods

The Double R Coal Company, Inc., Mine #1 employs 28 workers on two (2) production shifts and one (1) general maintenance shift. Approximately 500 tons of coal are produced daily by conventional mining methods. Section

equipment being used at this mine includes: a Long Airdox coal drill, 488 S&S scoops, a Galis roofbolter, a 15-RU Joy cutting machine and conveyor belt haulage.

### Ventilation

Initially, a 72-inch Paul Elswick exhaust fan, powered by a 40-horsepower, 440 volt Alternating Current (AC) electric motor, ventilated the Double R Coal Company, Inc., Mine #1. Metal tubing and concrete blocks directly coupled the fan to a diversion entry. The diversion entry was connected to the main return air courses of the mine.

During the last inspection completed on October 14, 1987, a quantity of 20,520 cubic feet per minute of air was measured at the last crosscut of the active section with no methane detected. The mine records dated October 22, 1987, revealed that 0.2% to 0.4% of methane was detected in the working faces. Also, the mine records revealed that on December 15, 1987, the air quantity for the main return was 96,000 cubic feet per minute, and the air quantity in the last open crosscut of the active section was 19,200 cubic feet per minute.

At the time of the explosion, the mine was ventilated with a 42-inch Joy, series 2000, axivane exhaust fan. The fan was powered by a 100-horsepower, 440 volt AC electric motor and connected to the main return air courses in a similar manner as the previous fan. Interviews during the investigation revealed that this fan had been installed on December 21, 1987. The mine records on December 22, 1987, revealed an air quantity at

the last open crosscut of the active section of 28,650 cubic feet per minute, and gave no indication of air measurements taken in the main return after the new fan had been installed.

The intake air courses for the active section were the #3 and #4 entries. The #5 and #6 entries were designated as neutral air courses with the belt conveyor haulage system located in the #5 entry. The #7 entry was the active section's main return air course. The #1 and #2 entries were developed to be used as return air courses once a split-type ventilation system was incorporated at this mine. At the time of the explosion, these entries were being used as return air courses to ventilate the battery charging station to the #7 return entry via overcasts outby this area. Interviews during the investigation revealed that the battery charging station had been moved from the surface to an underground area near the active section during the first week of December, 1987.

Permanent stoppings, constructed of concrete blocks, provided required separation and isolation of air courses. Line brattice and check curtains were being used to direct the ventilating air current to the working faces.

#### Coal Dust

Application of rockdust was the primary means for rendering coal dust inert. During development of the working faces, rockdust was applied by hand, and periodically, by a portable rockdust machine. Loose coal, including coal dust, in all entries was cleaned with scoops and loaded onto the belt conveyor. Dust was controlled along the beltline, at the the belt

drives and the face area by ventilation, water and rockdust. The primary duty of the third shift crew was to clean, rockdust and construct ventilation controls.

#### Explosives

The Double R Coal Company, Inc., Mine #1 utilized conventional mining methods. Permissible explosives and detonators were used to dislodge coal from the working face. The underground storage magazines contained explosives and detonators at the time of the explosion. These explosives and detonators were found in the storage magazines. These magazines were damaged by the explosion.

#### Smoking

The company had established a search program for smoking articles, and records indicated that it had been enforced. The Medical Examiner's report revealed that a package of cigarettes was found among the personal effects of the victim during the autopsy. However, matches or a cigarette lighter was not found on the victim.

## Electricity

Three-phase power is purchased from Appalachian Power Company at 69,000 volts, reduced to 7,200 volts and transmitted to a surface substation near the mine. The power is connected at the surface substation to a bank of three 250 KVA transformers in a 7200 Delta-7200 Wye manner.

The secondary neutral is properly grounded through a 25-ampere (amp) current limiting resistor. A grounding circuit, originating at the grounding side of the resistor, is used to ground the metallic frames of all electric equipment supplied from the underground high-voltage distribution center.

The PR 400-amp breaker and oil filled switch in the surface substation was equipped with Westinghouse relays designed to provide overload, short-circuit, ground-phase, and undervoltage protection for the underground high-voltage system.

The power is transmitted underground through a #2 AWG three conductor type MGGC 8 KV cable. Power was transmitted from the surface to an Ohio Brass 150 KVA step-down transformer. Two (2) three-phase 480 volts electrical circuits were provided at the secondary side of the transformer feeding the #2 and #3 belt drives. This transformer was located approximately 1,500 feet underground, one break outby survey spad #4026.

The 7200 volts were then transmitted from a feed through on the Ohio Brass transformer to a 300 KVA Line Power Manufacturing Company transformer at the battery charging station. This power center provided five (5) three-phase 480 volts circuits for the battery chargers. This transformer was

located approximately 2,600 feet inby the Ohio Brass transformer just outby survey spad #A468.

The 7200 volts were then transmitted from a feed through on the Line Power transformer at the battery charging station to a 750 KVA Line Power Manufacturing Company combination AC-DC (Direct Current) power center.

Three-phase 480 volts AC and 300 volts DC provided power for the electrical equipment on the working section. This power center was located in the #4 entry approximately 500 feet inby the battery charging station.

The following equipment and cables were located underground:

1. Approximately 200 feet of #4/0 AWG, 8 KV, 3 conductor, type ITT mp GC mine power cable supplying power to the battery charging station power center;
2. Approximately 450 feet of #4/0 AWG 8 KV, 3 conductor, type ITT mp GC mine power cable supplying 4,160 3-phase power to the active section;
3. Power center in battery charging station - one Line Power Manufacturing Company 300 KVA, 7,200 volts AC/480 volts AC, power center, serial number 1642, supplying 480 volts, 3-phase power to the four battery charging units in the charging station:
  - A. Approximately 125 feet of #6 AWG, 2,000 volts, 3 conductor, type G-GC portable power cable supplying 480 volts, 3-phase power to the #1 battery charger in the charging station,

- B. Approximately 200 feet of #4AWG, 2,000 volts, type G-GC portable power cable supplying 480 volts, 3-phase power to the #2 battery charger in the charging station,
  - C. Approximately 250 feet of #6 AWG, 2,000 volts, 3 conductor, supplying 480 volts, 3-phase power to the #3 battery charger in the charging station, and
  - D. Approximately 300 feet of #4 AWG, 2,000 volts, 3 conductor, type G-GC portable power cable supplying 480 volts, 3-phase power to the #4 battery charger in the charging station;
4. Battery-powered Equipment:
- A. One S&S Corporation permissible scoop, model number 488, serial number 1649,
  - B. One S&S Corporation permissible scoop, model number 488, serial number 1757, and
  - C. One S&S Corporation permissible scoop, model number 488, serial number 1847;
5. Section Power Center - One Line Power, 750 KVA, 7,200 volts AC/480 volts, AC/300 volts DC, combination power center was located approximately 320 feet outby the face in the #4 entry. This power

center supplied 480 volts, 3-phase power and 300 volts direct current power to the electrical equipment used on the active section:

- A. Approximately 490 feet of 2/0 3 conductor, type G-GC 2,000 volts, Royal Electric cable supplying power to the cutting machine on the active section,
- B. Approximately 250 feet of 2/0 3 conductor, type G-GC 2,000 volts cable supplying power to the Ingersoll Rand feeder on the active section,
- C. Approximately 460 feet of #6 AWG, 3 conductor, type G-GC 2,000 volts Royal Electric cable supplying power to the Long Airdox coal drill on the active section,
- D. Approximately 450 feet of Carol Super Vu-tron #6 AWG, 3 conductor, type G-GC 600-2,000 volts cable supplying 300 volts DC power to the Galis 300 roof bolter,
- E. Approximately 470 feet of Royal Electric #6 AWG, 3 conductor, type G-GC 2,000 volts cable supplying 480 volts, 3-phase power to the Lee Norse roof bolter, and
- F. Approximately 420 feet of Royal Powerflex #4 AWG, 2,000 volts, type G cable supplying power to the Galis 320 roof bolter;

6. Other cables located underground at the time of the explosion were:
- A. Approximately 4,800 feet of ITT mine telephone cable,
  - B. Approximately 4,600 feet of Pyott Boone fire detection cable,
  - C. Approximately 4,600 feet of #14 AWG, 2 conductor, type SO belt control cable,
  - D. Approximately 250 feet of 2/0, 3 conductor type G-GC 2,000 volts cable supplying power to the #3 belt drive, and
  - E. Approximately 650 feet of Royal Powerflex #6 AWG, 3 conductor, type G-GC 2,000 volts cable supplying power to the #2 belt drive.

#### Transportation and Haulage

Coal is loaded at the working faces and hauled to the belt feeder by battery powered scoops. The belt conveyor haulage system transports the coal from the working section to the surface.

Mantrip transportation for the miners was provided by battery powered scoops, which were also used to transport supplies to the underground workings at this mine.

### Communication

The mine communication system consisted of telephones located in the mine office on the surface, at each belt transfer point and at the belt feeder on the active section. A commercial telephone was provided in the mine office on the surface.

### Illumination

Illumination was provided on mobile electric equipment by permissible, mounted lighting systems. Permissible battery powered cap lamps were worn by the miners.

### Fire Protection

The Double R Coal Company, Inc., Mine #1 had no fire evacuation plan approved by the Virginia Division of Mines. However, the mine records revealed that the day and evening shifts had conducted fire drills that consisted of training in the location and use of fire fighting equipment, location of escapeways and routes of travel and evacuation procedures. Examinations of the escapeways were recorded in the mine records.

Dry chemical fire suppression systems were provided on all mobile electric face equipment. All electrical installations, oil storage stations

and surface areas had dry chemical fire extinguishers. The belt conveyors were monitored for fire by a system utilizing point-type heat sensors. Also, the belt conveyor drives were protected against fire by water deluge systems.

A two-inch waterline paralleled the belt conveyor and was provided with outlets for fire fighting.

#### Mine Rescue

The Double R Coal Company, Inc., Mine #1 was provided mine rescue services from Clinchfield Coal Company. Clinchfield maintains two (2) mine rescue teams, which are the Dante and McClure #1 teams. The mine rescue station is maintained at Dante, Virginia.

Statements indicated that miners at the #1 mine provided or were provided with a one-hour, filter-type self-rescuer which is worn on the miners' belts. Each miner was provided with a self-contained self-rescuer which was stored on the working section. The miners were trained in the use of the rescuer. A check-in and check-out system was maintained in the mine office. The system utilized a check board and tags corresponding to similar tags worn on the miners' belts. However, no identification check was found on the victim.

## Explosion

By the first week of December, 1987, the construction of the overcasts was completed, and the battery charging station was moved from the surface to an underground area near the active section. A split-type ventilation system utilizing the overcasts was to be later incorporated at this mine. At this time, the overcasts were used only as a return ventilation control for the battery charging station.

Members of the day shift on December 21, 1987, completed the planned installation of a new fan and maintenance on the battery powered scoops. Once the fan was placed in operation, Kenneth L. Brooks, the evening shift foreman, entered the mine and performed a pre-shift examination. Brooks returned to the surface, and the evening shift crew entered the mine at its normal work time. The evening and third shifts performed their normal work duties.

During the day shift on December 22, 1987, the fan stopped due to a short-circuited motor. The miners were withdrawn from the mine and sent home, except those needed to change the fan motor. After the motor was replaced and the fan operated for two to three hours, Brooks entered the mine and performed the pre-shift examination. The evening shift crew entered the mine at its normal work time. The evening shift and third shift crews performed their normal work duties.

The day shift on December 23, 1987, was the last scheduled shift to work prior to the upcoming Christmas holidays. A fuse in the power circuit of the fan blew at 12:00 P.M. as a result of grounded conductors of the cable entering the line starter. The conductors were restocked, the fuse was replaced and the fan was restarted. The remainder of the shift progressed normally.

No work was scheduled and no one entered the mine on December 24, 1987 and December 25, 1987. Kenneth L. Dorton, the evening shift outside man and the watchman, was at the mine during the day of December 24, 1987. Dorton stated that while he was on duty the fan operated continuously.

At 8:30 A.M. on December 26, 1987, Johnny K. Ratliff, the day shift foreman, arrived at the mine site. Johnny Ratliff was instructed by Bill Ratliff, the President of Double R Coal Company, Inc., to check water levels in the working places, examine the belt conveyor system and charge the scoop batteries. Ratliff and Dorton entered the mine at 9:00 A.M. with the #3 battery scoop. Ratliff and Dorton stopped at the battery charging station and placed the batteries on charge. The next stop was at the section power center. A bonder that Dorton needed to weld the mine property entrance gate was loaded in the scoop bucket. Dorton proceeded to the surface with the scoop. Ratliff proceeded outside walking the belt entry. The working places were not examined. Both Ratliff and Dorton were on the surface by approximately 10:45 A.M. Ratliff instructed Dorton to de-energize the underground electric power in approximately four to five hours. At approximately 11:30 A.M., Ratliff left the mine site.

At 4:00 P.M. on December 26, 1987, Ted C. Street and his son arrived at the mine entrance gate. Dorton was welding on the gate with a bonder connected to the batteries of the #3 scoop. Street informed Dorton that he wanted to get a load of house coal. Dorton informed Street that he would finish welding the gate and accompany him. Street's son took the pick-up truck to the mine office. Dorton and Street walked to the mine office. Dorton gave a cap light to Street and returned to the gate. After Dorton finished welding the gate, he took an end loader to the mine office. Street had taken scoop serial number 488-1847 underground. Dorton went into the mine office and asked Street's son to go to the night watchman's trailer and get coffee. While at the night watchman's trailer, at approximately 5:00 P.M., Dorton and Street's son heard the explosion.

#### Recovery Operations

On December 26, 1987, at approximately 5:00 P.M.,<sup>6:20</sup> the night watchman, Ken Dorton, and the victim's son, Ted C. Street, Jr., were located in the night watchman's trailer when the power went off and they heard a noise. They looked outside and saw smoke coming from the mine portals. They ran outside and observed heavy smoke and dust at the portals. Mr. Dorton proceeded on foot to a nearby mine, Buffalo Land Company, Inc., Mine #1, and informed the night watchman at that mine of the explosion at Double R Coal Company, Inc., Mine #1. The night watchman for Buffalo Land Company, Inc. telephoned the mine operator, Larry Long, who, in turn, notified the Mine

Safety and Health Administration (MSHA) of the explosion. Mr. Dorton then notified Bill and Ira Ratliff, the operators of Double R Coal Company, Inc., about the explosion.

Ken Howard, MSHA's District Manager, notified Harry D. Childress, Chief of the Virginia Division of Mines, at approximately 7:00 P.M. of the explosion. Mr. Childress notified appropriate Division of Mines personnel and proceeded to the mine site. When Mr. Childress arrived at the mine site at approximately 8:15 P.M., such conditions existed and the following events transpired:

1. Smoke was present at the #2 mine portal;
2. High carbon monoxide and methane readings were detected at the mine portals;
3. The main power supply was off due to damage to the surface substation;
4. The mine fan was intact, but not running;
5. The weak wall in the #4 entry was partially destroyed;
6. The conveyor beltline in the #3 entry was damaged;
7. The office trailer was rolled over the hill on top of the coal stockpile and a front end loader;

8. The victim's pick up truck, which was located in front of the #2 portal, was damaged;
9. A mine rescue team had entered the portals and attempted to explore;
10. A mine map was retrieved from the office trailer;
11. The only form of available communication was a portable unit in contact with the rescue squad and fire department;
12. Tom Asbury, Clinchfield Coal Company, and John Ratliff and Ken Brooks, foremen for Double R Coal Company, Inc., Mine #1, briefed Mr. Childress, Chief of the Division of Mines, of the condition of the operation from the mine map;
13. Clinchfield's mine rescue team was present at the mine site.

At approximately 9:00 P.M., Bill Clemons from MSHA arrived and was briefed on the situation and underground status. Several attempts were made to explore the underground area. However, on December 27, 1987, at approximately 5:50 A.M., all persons were withdrawn from the mine because 6 per centum of methane gas and carbon monoxide in excess of 3,000 ppm were encountered.

A decision was made to monitor the mine atmosphere at the fan while a six inch (6") diameter hole was drilled from the surface into the #2 entry

in the face area of the active section in order to obtain air samples from the mine atmosphere.

On December 28, 1987, the drill site was prepared for the borehole, and the drilling process started at 8:26 P.M. The hole was drilled 415.5 feet before intersecting the #2 entry at 2:17 A.M. on December 29, 1987. Smoke and 37 per centum methane erupted from the hole. The drill steel was removed from the hole at 2:55 A.M. Samples taken from the top of hole revealed that 12,400 ppm carbon monoxide, 28 per centum methane and 10.5 per centum oxygen were present in the mine atmosphere. A decision was made to continue monitoring the hole.

On December 30, 1987, a decision was made to drill a 24 inch (24") hole near the six inch hole in order to install an exhaust fan to ventilate the mine. On December 31, 1987, site preparation was started for the 24 inch hole. After a day of construction, the site that was prepared from the drilling company's specifications was not large enough to accommodate the drill rig. Additional work had to be done. On January 1, 1988, a decision was made to install a high pressure exhaust degas pump on the six inch hole. The degas pump was installed and began pumping at 12:00 Noon on January 2, 1988. By 4:00 P.M. that evening, the level of carbon monoxide and methane had dropped rapidly to 800 ppm of carbon monoxide and 8.5 per centum, respectively.

At 12:01 A.M. on January 3, 1988, the reading had dropped to 2.8 per centum methane and 560 ppm carbon monoxide. The levels continued to drop throughout the morning. At 7:00 A.M., the carbon monoxide was 400 ppm and the methane was 2.5 per centum.

At 8:00 A.M., a decision was made to call the mine rescue teams for a recovery briefing. The teams contacted were Clinchfield Coal Company's Dante and McClure #1 teams, Jewell Smokeless Coal Corporation's "A" and "B" teams and Paramount Mining Corporation's Silver and Blue teams. While the teams were briefed on the recovery plan, preparations were made on the surface for the teams to enter and to explore the mine. The first mine rescue team entered the mine at 2:34 P.M., and the recovery operation continued until 10:33 P.M. when the victim was found in an upright position in the operator's compartment of the scoop at Crosscut #32. Placing the victim on a stretcher, they transported the victim to the surface. Arriving on the surface at approximately 11:43 P.M., the victim was transported to the Grundy location of Buchanan General Hospital by the Haysi Rescue Squad. The victim was later transported to the office of the Chief Medical Examiner at Roanoke, Virginia.

The mine rescue teams and members that participated in the recovery operations following the explosion are listed below:

Jewell Smokeless

No. 2 "B" Team

Rick Waddell, Captain  
Dennis Wimmer  
Rodney Lee  
Marty Potter  
William Salyers  
Bill Messick, Trainer  
Steve Vance

No. 5 "A" Team

Elmer Vandyke, Captain  
John Parris  
Steve Ratliffe  
Terry Baldwin  
Wayne Dye  
Richard Taylor, Co-Captain  
Mike Horn

Paramont Coal Company

No. 1 Blue Team

Mike Clark, Captain  
Wendell, Collinsworth, Trainer  
Rick Shelter  
Tim Vickers  
Eddie Bateman  
Roy Mullins  
Hughie Carter  
Jerry Bledsoe

No. 3 Silver Team

Gary Sweeney, Captain  
Barry Wright  
Jim Rose  
Mike Mullins  
Steve Lovell  
Homer Phipps  
Robert Bledsoe

Clinchfield Coal Company

Dante Team

Ed Rudder  
Wayne Fields, Captain  
Danny Mann  
James Stanley  
Ray Robinette  
Vernon Johnson  
Jeb Turner  
Tom Asbury, Trainer

McClure #1 Team

Milton Kiser, Captain  
Norman Lewis  
Donald Duncan  
Steve Hale  
Ronald Neece  
Lee Ratliff  
George Willis

INVESTIGATION

The ventilation was re-established fully to the active section by January 4, 1988, utilizing a temporary stopping line constructed of line curtains. The ventilation reduced the carbon monoxide and methane concentrations in the mine to safe levels. The air quantity at the last open crosscut of the active section was 24,000 cubic feet per minute.

An underground investigation was begun on January 12, 1988, with the State investigating team meeting at the mine site at approximately 8:00 A.M. with representatives from MSHA, the company and UMWA to discuss investigation procedures.

The investigation teams entered the mine at approximately 9:30 A.M. plotting all pertinent data on a mine map. The equipment, electrical installations, stoppings, overcasts and the extent of flame and forces, as near as could be determined by visual observation, were plotted. The investigation continued until January 26, 1988, with the Division of Mines, MSHA, UMWA and Double R Coal Company, Inc. representatives participating.

As a part of the investigation into the cause of the explosion, interviews were conducted with numerous company officials and employees. The last interview was conducted by telephone with Gary Johnson on January 26, 1988, who stated that he worked with Ted C. Street, victim, on the midnight shift prior to the explosion and that Street told him that he (Street) planned on getting coal Saturday, December 26, 1987.

In addition, Mrs. Ted C. Street and Ted C. Street, Jr., son, were interviewed. Ted C. Street, Jr. stated that he saw his dad put a pack of cigarettes (brown and gold cover) and a green cigarette lighter on the hood of their truck prior to his dad going underground on the day of the explosion.

## DISCUSSION-EVALUATION

### Factors Relevant to the Explosion

#### Methane and Ventilation

The Double R Coal Company, Inc., Mine #1 was classified by the Division as a non-gassy mine. The last inspection of the mine conducted by Division personnel was conducted from October 14, 1987 to October 20, 1987. During this inspection, the air quantity at the last open crosscut of the active section was 20,520 cubic feet per minute with no methane detected. The mine records revealed that on one occasion, October 22, 1987, 0.2 per centum to 0.4 per centum of methane was detected in the working faces of the active section.

After the explosion, the initial mine rescue and recovery work was delayed due to high concentrations of methane and carbon monoxide. Additional ventilation to the mine, through a borehole that was drilled, reduced the concentration of methane and carbon monoxide. During the final mine rescue and recovery work, 0 per centum to 2.7 per centum of methane was detected. The majority of the ventilation controls for the mine were destroyed by the explosion, and a temporary stopping line of brattice curtain was constructed. The temporary stopping line directed 24,000 cubic feet per minute of air to the last open crosscut of the active section.

During the underground investigation, cracks in the floor of the #1 working face were injecting methane into the mine. The methane appeared to be migrating from the underlying, abandoned Moss #3 mine of Clinchfield Coal

Company. Line curtains, which directed the ventilating air current into the #1 working face, diluted the methane. A methane build-up of over 2.0 per centum that was encountered in the main headings was diluted.

The interviews that were conducted during the investigation indicated that the main exhaust fan for the mine was operating at the time of the explosion. The quantity of ventilating air delivered in the mine appeared to be adequate. Failure of ventilation controls could have reduced the quantity of ventilating air being delivered to the active section allowing a methane accumulation.

#### Coal Dust/Rock Dust

Testimony indicated that rock dust was applied frequently. The mine floor was wet, and the extent of coking, force and flame indicated that coal dust did enter significantly into the explosion.

#### Electricity

Electrical personnel of the investigation team thoroughly tested and examined all electric equipment and cables located in the areas of the mine in which evidence of heat or flame was found or supplied power to electric equipment in the immediate area to determine if the source of the ignition was electrical. Tests and examinations revealed possible evidence that the

ignition source of the explosion was provided by the electric equipment or cables.

#### Extent of Forces

Due to the extent of damage, the accident was primarily a methane explosion with moderate forces associated with the occurrence. The forces indicated that coal dust did enter into the explosion. Damage, as a result of the force of the explosion, was observed throughout the mine and on the surface. Damage to the equipment, the belt conveyor haulage system, the battery charging station, the stoppings and overcasts, the surface facilities and other materials on the active section was evidence of force.

The coal drill, located near spad number A806, suffered damage to the rear of the machine which made it impossible to pull the cable from the reel. In addition, the headlights on the coal drill were destroyed, the auger boom was twisted and distorted and the fire suppression system was damaged and inoperative.

The curtain boards in the working places, which were attached to the mine roof by roof bolts, were displaced. Some of the curtain boards were blown down and away from their original position. Other curtain boards were spun around or broken.

The section power center suffered damage to internal parts and the high voltage disconnect switches were destroyed. The lids were blown off the section power center, and the majority of the cable plugs were blown from

the power center. Other material which was on or near the power center was scattered approximately 75 feet in the direction of the working face.

The belt conveyor system was damaged from the belt feeder to the #2 belt drive. A belt starter box for the #3 drive was overturned.

The lids were blown from the battery trays and chargers located at the battery charging station which was eight (8) crosscuts from the working face. The cable plugs of the battery charging station were torn off the charger transformer, and the cables were severed. The majority of the battery trays were dislodged from their respective battery stands, and the leg of a stand was broken by a repositioned battery. The internal parts of the battery chargers and the charger transformers were damaged. The canopy of a scoop that was located at the battery charging station was repositioned. There was very little damage to the scoop the victim was riding.

Of the 151 stoppings installed in the mine, 136 of the stoppings were completely destroyed, 8 were partially damaged and 7 were left intact. The stoppings were constructed of concrete blocks, stacked dry and plastered. The overcasts were destroyed. The steel rails and sheet metal used in the construction of the overcasts were bent and damaged.

On the surface, the mine office trailer was overturned from its foundation and lying on its top on an end loader. The surface belt conveyor system was damaged. The mine portal canopies were blown away. A portion of the fence surrounding the surface substation was blown down, and some of the transformers were overturned. The victim's pick-up truck was damaged and moved by the force of the explosion. The debris from the surface areas was found several hundred feet from the mine site.

### Extent of Flames

Evidence indicated that coal dust did enter significantly into the explosion. It was undetermined if the flame extended to the surface area, although evidence of heat was present on the surface. Coking and soot were found approximately 3,050 feet outby the face area of the active section. Melted plastic brattice material was found throughout the mine and on the surface. The victim's clothing, hard hat and hat liner exhibited signs of heat.

### Potential Sources of Ignition

The following is a list of possible ignition sources and the condition in which they were found during the investigation:

#### High Voltage Cable and Equipment:

The investigation revealed the entire underground high-voltage system was energized at the time of the explosion. The investigation revealed that the high-voltage circuit breaker in the surface substation was tripped at or about the time the explosion occurred. The ground fault relay in the high-voltage circuit breaker showed a target indicating that the circuit breaker had tripped due to a ground fault. There were no targets showing on the phase overcurrent relays associated with the circuit breaker indicating that

an overcurrent condition or short-circuit had not caused the circuit breaker to trip.

Tests and examinations conducted during the investigation revealed that none of the fuses installed in the high-voltage system from the surface substation to the active section power center had cleared, which is further indication that a short-circuit in the high-voltage system had not occurred.

Electrical personnel found no evidence to indicate that a short-circuit or ground fault occurred in the high voltage cables or equipment located underground in the explosion area immediately before or as a result of the explosion. Electrical personnel concluded that the high voltage cables and equipment did not provide the ignition source for the explosion.

#### Section Power Center:

This Line Power transformer was a 750 KVA combination AC/DC transformer located approximately 320 feet outby the face in the #4 entry. The manually operated, high voltage, load-break switch in the power center was in the closed position at the time of the explosion. The power center was energized at the time of the explosion.

The investigation revealed that:

- A. All trailing cables' end plugs were disconnected and blown in the direction of the face,
- B. There was severe damage to the power center with all of the top covers blown in the direction of the face,

- C. The high voltage disconnect switch located in the back of the power center was completely destroyed,
- D. The cover over the high voltage switch was torn off the power center,
- E. The plexiglass inspection cover for the high voltage fuses on the left side of the transformer was broken and melted,
- F. The low voltage panels were torn loose, but were still on the power center,
- G. There was internal damage to the power center, and
- H. The low voltage AC circuit breakers were in the trip position.

The direction of the explosion forces and damage to both ends of the power center indicated that the explosive forces traveled both inby and outby. Although these conditions existed, there was no evidence found to indicate that this power center provided the ignition source for the explosion.

Power Center Battery Charging Station:

The battery charging station power center was a 300 KVA Line Power transformer which was located approximately 650 feet outby the face in the #2 entry. The manually operated high-voltage load-break switch in the power center was in the closed position at the time of the explosion. The power center was energized at the time of the explosion. This power center supplied power to four battery charging power units located in the charging station. The investigation revealed:

- A. The four circuit breakers were found to be in an electrical trip position due to the loss of control power,
- B. Examination of the power center revealed that no short-circuit or ground fault was present within the high voltage or low voltage portion of the power center,
- C. One cover was blown off, and two other covers were turned around,
- D. The two high voltage cables, the input and the output, were pulled from the power center,
- E. Two 400 amp breaker panels were torn loose,
- F. The cover over the right side of the high voltage fuses was missing,
- G. One high voltage fuse was lying in the bottom of the transformer,
- H. The center high voltage insulator was broken where the cable was pulled from the power center, and
- I. The 100 amp circuit breaker on the front of the power center was pushed in and broken.

The damage to the power center indicated that the explosion forces traveled both inby and outby. Although these conditions existed, there was no evidence found to indicate that this power center provided the ignition source for the explosion.

Battery Charging Units:

The charging station located approximately 550 feet outby the face in the #2 entry contained four (4) battery charging units. Evidence indicated that all four charging units were in use at the time of the explosion.

The investigation revealed the following information:

- A. The timers that had an eight hour charging time had approximately five and one-half hours to six hours remaining on the timers,
- B. The timers that had a twelve hour charging time had approximately nine hours to nine and one-half hours remaining on them,
- C. Two of the chargers were connected to the two scoops that were in the charging station,
- D. Two chargers were connected to the two extra sets of batteries in the charging station, and
- E. All of the battery chargers received severe damage to the housings and internal parts.

All of the battery chargers were equipped with devices to regulate the time and rate of charging. Electrical personnel found no evidence of arcing or short-circuits to indicate that any of the battery chargers provided an ignition source for the explosion.

Power Cables in the Charging Station:

The investigation revealed that the 2 AWG cables, type G-2 conductor W/G extending from the #3 charger to the battery on scoop #1649 had evident signs that arcing had occurred between the positive conductor and the

grounding conductor and arcing evidence between both ends of both the positive and negative conductors. There was evidence of electrical arcing at the battery charging station which indicates a potential ignition source of the explosion.

Battery-powered Scoop:

Ted C. Street, victim, was found sitting in the operator's compartment of this scoop. This S&S scoop, model 488, was located five crosscuts outby the face in the #3 entry. The investigation revealed the following information:

- A. The master switch was in the reverse position.
- B. The batteries were connected to the machine.
- C. The main circuit breaker was open.
- D. The cover lids were off the batteries.
- E. The main control panel was checked for sealing with a .004" feeler gauge and no openings were found.
- F. The breaker panel was checked with a .004" feeler gauge and no openings were found.
- G. The conduit covering the cable supplying power between the two rear lights was broken at the operator's side.
- H. The scoop was removed to the surface where the methane monitor was tested with a known mixture of methane. The element in the sensor head was defective. Another element was installed, but the monitor failed to work.

- I. The light switch was not operating properly. It had to be turned several times to get it to operate.
- J. The scoop batteries were damaged.

Although these deficiencies existed, there was no evidence of electrical arcing found to indicate that the scoop provided the ignition source for the explosion.

#### Probable Point of Origin

No definite source of ignition could be determined from the investigation of the explosion area. All possible sources of ignition were examined and evaluated. Elimination of equipment as potential ignition sources was based on the condition of the electrical system and lack of evidence of electrical arcing. Based on the direction of forces, it would appear that the explosion originated somewhere between crosscut #26 and crosscut #33. The relevant calm in the area of the scoop and the condition of the victim, who suffered burns with evidence of smoke inhalation with no sufficient contusions, abrasions or lacerations found on the victim's body, leads the investigation teams to believe that the victim was located near the ignition source before the forces became destructive.

## Conclusion

The investigation revealed that the volume of air on the active section was inadequate to render harmless and carry away flammable and explosive gases. Methane gas entered the active section from a large crack in the mine floor near the face of the #1 entry. The failure to maintain the air flow in its proper volume and direction allowed methane to accumulate to the explosive range. The methane/air mixture was possibly ignited by one of the following sources:

1. Battery-powered scoop that the victim operated which was located at survey station A646 in the #3 entry.
2. Section power center located in the #4 entry approximately 200 feet outby the face.
3. The energized power cable connected between the battery charger and batteries located at the battery charging station in the #2 entry.
4. Battery charging station power center located inby survey station A468 in the #2 entry.

A pack of cigarettes was found on the victim. However, neither a cigarette lighter, nor matches were found on the victim or in the area of the explosion where the victim's body was found.

### Contributing Factors to the Explosion

1. Failure to provide adequate ventilation to the active section,
2. Failure to make a proper preshift examination, and
3. Methane entering the mine through cracks in the mine floor.

## Finding of Facts

The following is a list of violations cited at Double R Coal Company, Inc., Mine #1, relating to the December 26, 1987 explosion:

No. of Violations of Title 45	Section of Title	Date Issued	Date Corrected
1	45.1-54(e)	01/28/88	02/12/88
1	45.1-85(a)	01/28/88	02/26/88
1	45.1-20(c)	01/28/88	02/12/88
1	45.1-65(i)	01/28/88	02/12/88
1	45.1-56(d)	01/28/88	02/12/88
1	45.1-56(c)	01/28/88	02/26/88
1	45.1-97	01/28/88	02/12/88
1	45.1-98(a)	01/28/88	02/12/88
1	45.1-59(b)	01/28/88	02/26/88
1	45.1-81(a)	01/28/88	02/12/88

The following is a summary of the above-listed violations:

01. 45.1-54(e): No records of main fan examination on December 23, 1987 and December 25, 1987.
02. 45.1-85(a): No records of weekly examination of scoop #488-1847.
03. 45.1-20(c): No records of a preshift examination on December 26, 1987.
04. 45.1-65(i): No records of weekly examinations for dangerous conditions in intake airway, return airway and escapeway during the week of the explosion.
05. 45.1-56(d): No records of weekly measurements of the volume of air entering the main intakes, leaving the main returns and passing through the last open crosscut in the 001 section were recorded the week of the explosion.
06. 45.1-56(c): The volume and velocity of air currents ventilating the 001 section on December 26, 1987, were not sufficient to dilute, render harmless and carry away flammable and harmful gasses which accumulated into explosive quantities in this area.
07. 45.1-97: An adequate check-in and check-out system was not maintained. Positive identification was not provided

upon the person of the victim of the mine explosion on December 26, 1987.

08. 45.1-98(a): The Medical Examiner's report indicated that smoking material was found on the body of the victim of the explosion.
09. 45.1-59(b): Visual evidence was present in the general area of the third crosscut outby the face to show that the break-through was not closed between the intake and return air courses.
10. 45.1-81(a): Information from interviews indicated that a responsible person who could hear the underground communication facilities and respond in the event of an emergency was not on duty on the surface when men were underground on December 26, 1987.

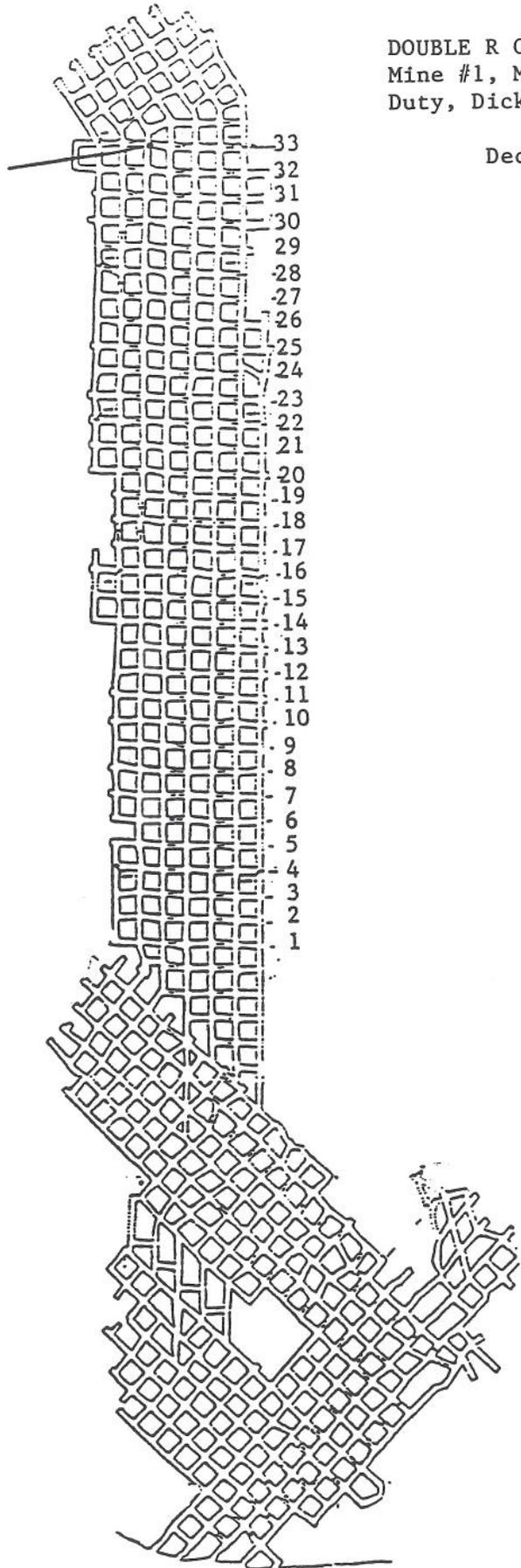
The following appendix , IIA through and including IIC, are described below:

- Appendix IIA: A mine map showing the location where the victim was found and how the crosscuts were numbered.
- Appendix IIB: Pages 1 through 5 are maps showing the mine as found during the investigation.
- Appendix IIC: A mine map showing the location of the active section in relation to the underlying pillared area of the Jawbone seam of coal.
- Appendix IID: A topographical map showing the linear/fracture zone projections.
- Appendix IIE: A sketch showing the location of the victim and the Model 488 S & S scoop, serial number 1847, in which Mr. Street was riding.
- Appendix IIF: A sketch of the battery charging station as found during the investigation.
- Appendix IIG: A sketch of the face power center located in the #4 entry as found during the investigation.

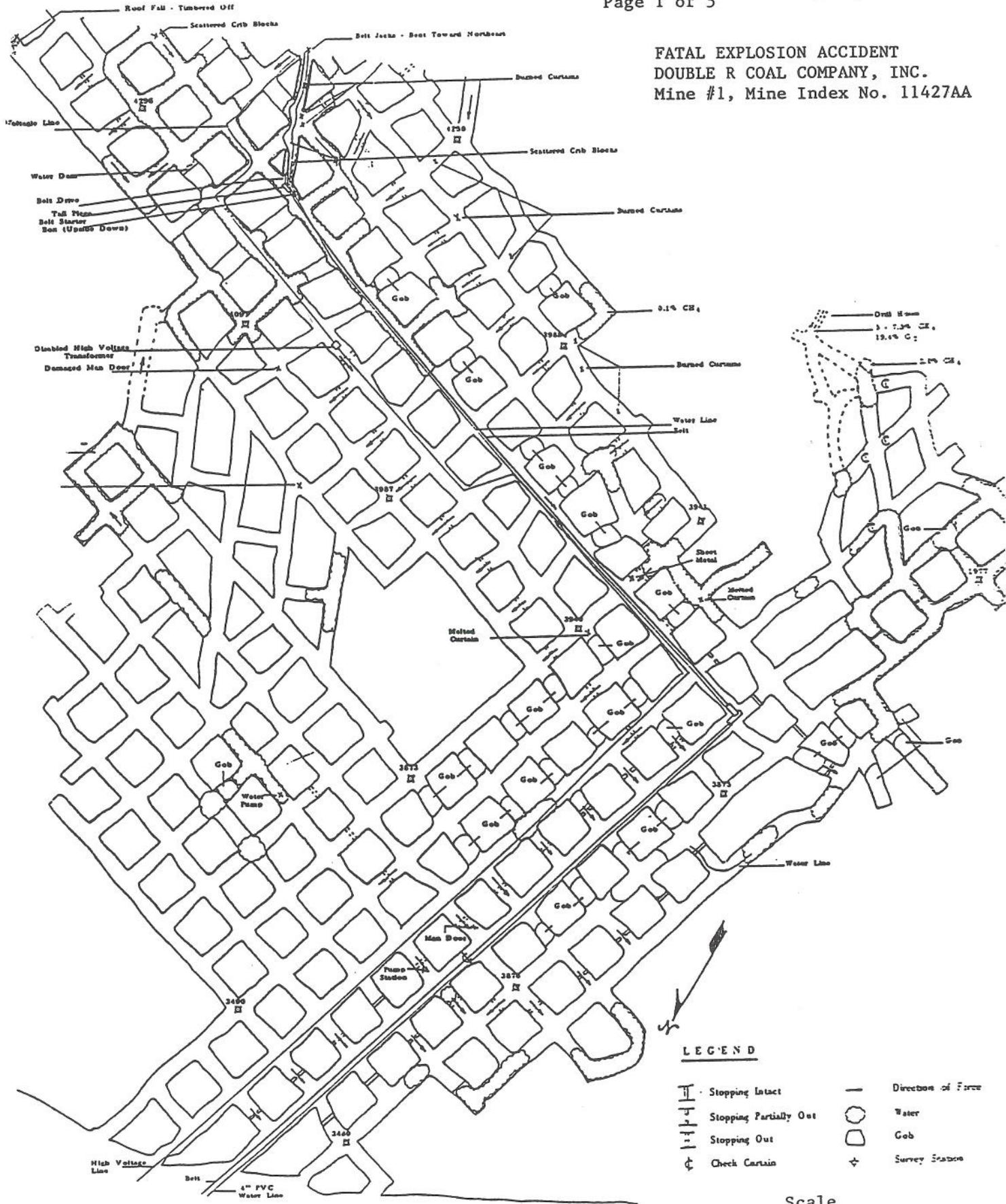
DOUBLE R COAL COMPANY, INC.  
Mine #1, Mine Index No. 11427AA  
Duty, Dickenson County, Virginia

December 26, 1987

Location where  
Ted C. Street, Victim,  
was found.



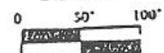
FATAL EXPLOSION ACCIDENT  
DOUBLE R COAL COMPANY, INC.  
Mine #1, Mine Index No. 11427AA

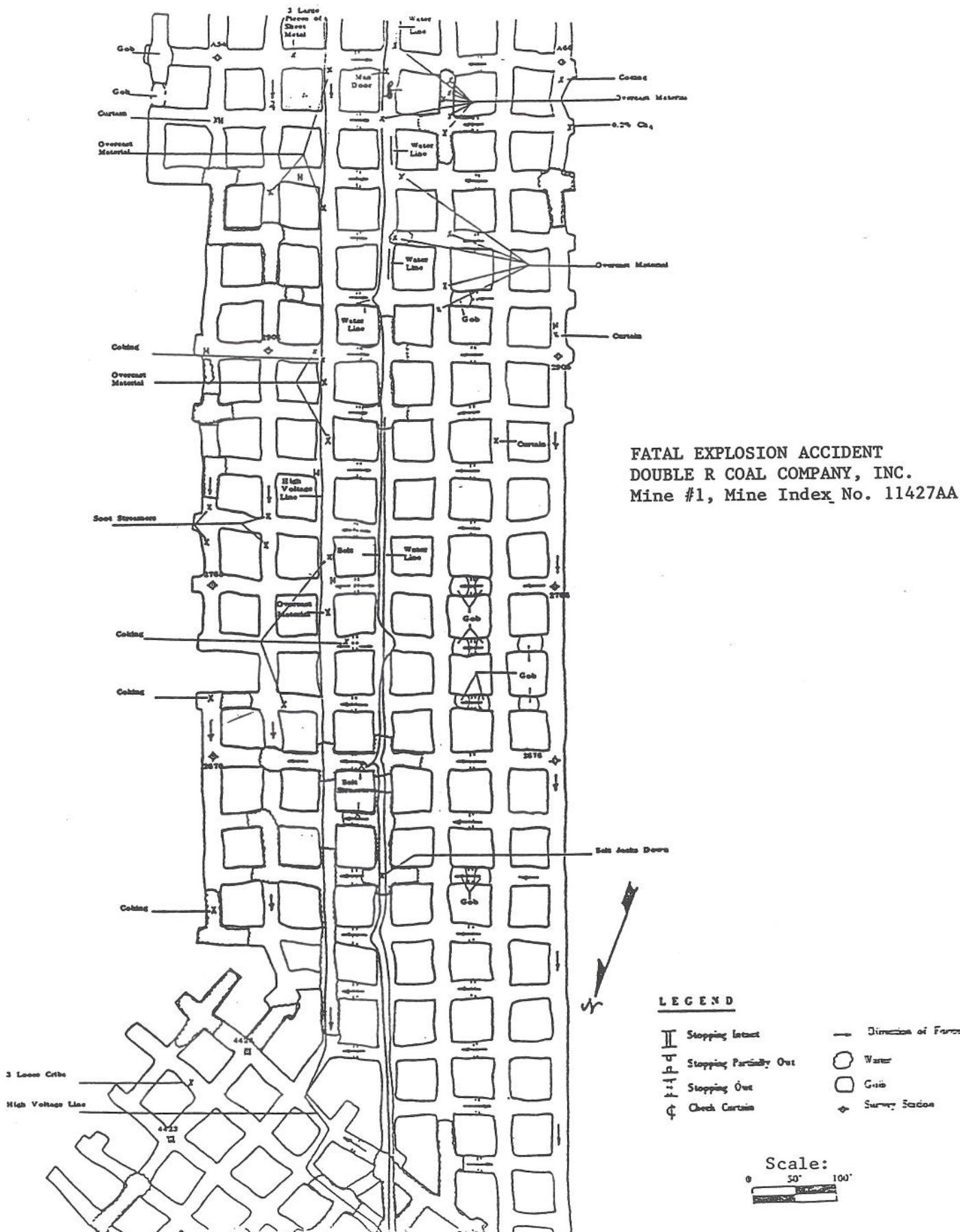


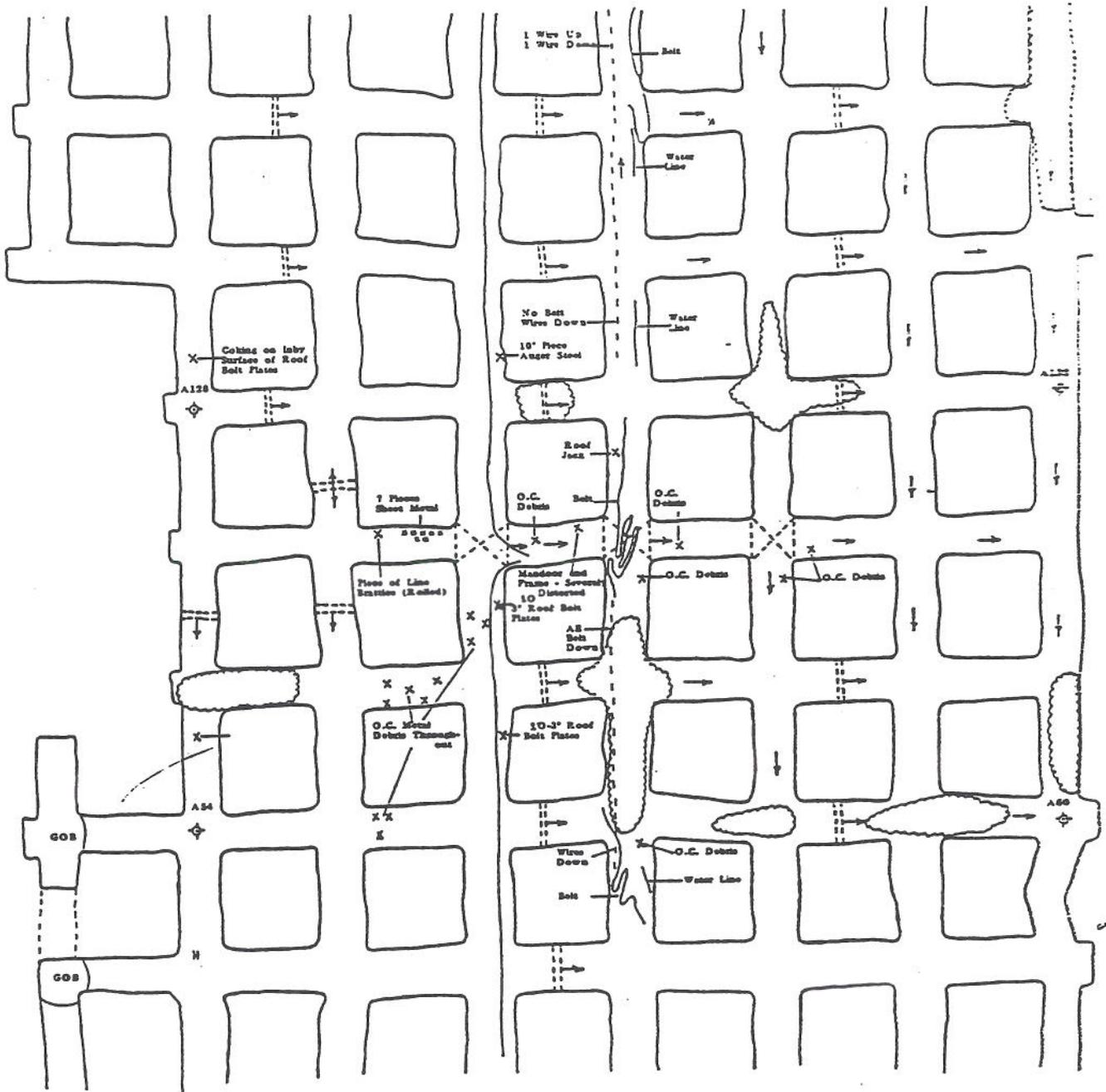
LEGEND

- |  |                        |  |                    |
|--|------------------------|--|--------------------|
|  | Stopping Intact        |  | Direction of Force |
|  | Stopping Partially Out |  | Water              |
|  | Stopping Out           |  | Gob                |
|  | Check Curtain          |  | Survey Station     |

Scale





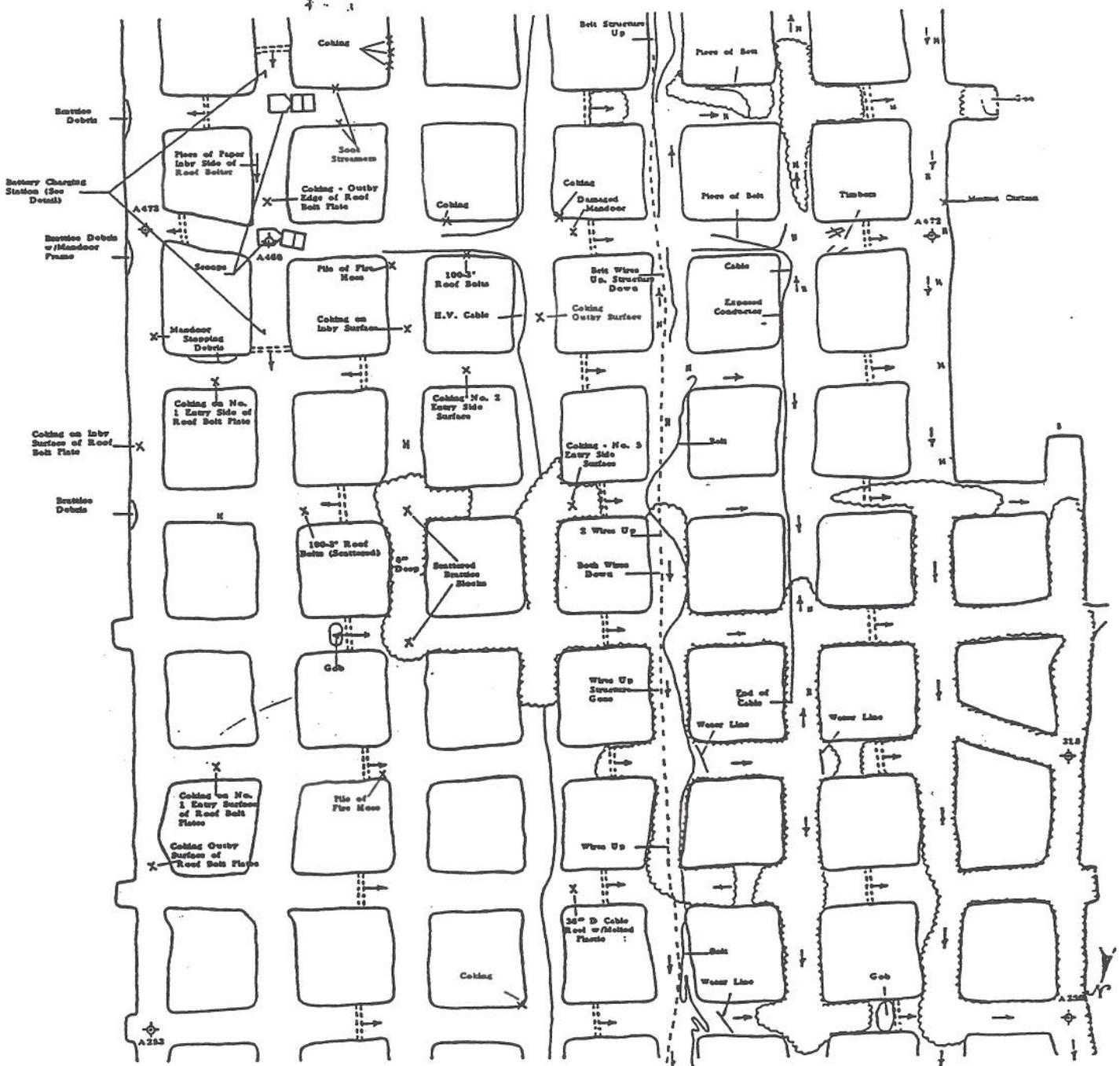


**LEGEND**

- |  |                        |  |                  |
|--|------------------------|--|------------------|
|  | Stopping Intact        |  | Evidence of Heat |
|  | Stopping Partially Out |  | Water            |
|  | Stopping Out           |  | Gob              |
|  | Direction of Force     |  | Survey Station   |
|  | Overcast Out           |  |                  |

Scale:

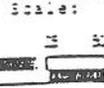
FATAL EXPLOSION ACCIDENT  
DOUBLE R COAL COMPANY, INC.  
Mine #1, Mine Index No. 11427AA



LEGEND

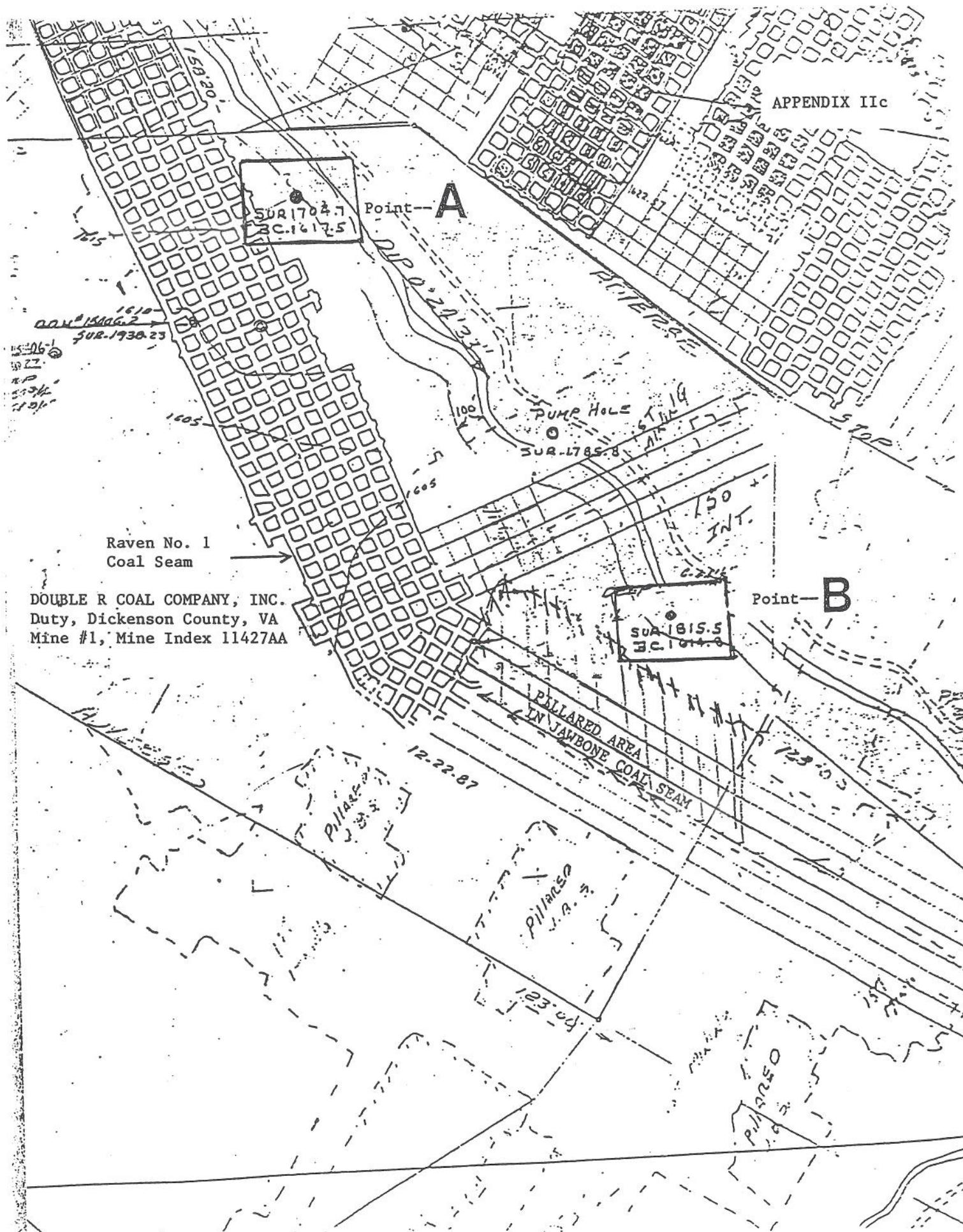
- |  |                        |  |                   |
|--|------------------------|--|-------------------|
|  | Stopping Inlet         |  | Entrance of Hoist |
|  | Stopping Partially Out |  | Water             |
|  | Stopping Out           |  | Gob               |
|  | Direction of Force     |  | Survey Station    |

FATAL EXPLOSION ACCIDENT  
DOUBLE R COAL COMPANY, INC.  
Mine #1, Mine Index No. 11427AA



- Stopping Intact
- Stopping Partially Out
- Stopping Out
- Direction of Force
- Evidence of Heat
- Water
- Gas
- Survey Station





Point A

SUR 1704.7  
SC. 1617.5

Point B

SUR 1815.5  
SC. 1614.0

Raven No. 1  
Coal Seam

DOUBLE R COAL COMPANY, INC.  
Duty, Dickenson County, VA  
Mine #1, Mine Index 11427AA

PILLARED AREA  
IN JAWBONE COAL SEAM

Pillars  
J.A. 3

Pillars  
J.A. 3

Pillars  
J.A. 3

12-22-87

1610  
SUR-1930.23  
1605

PUMP HOLE  
SUR-1785.8

150  
INT.

158.20

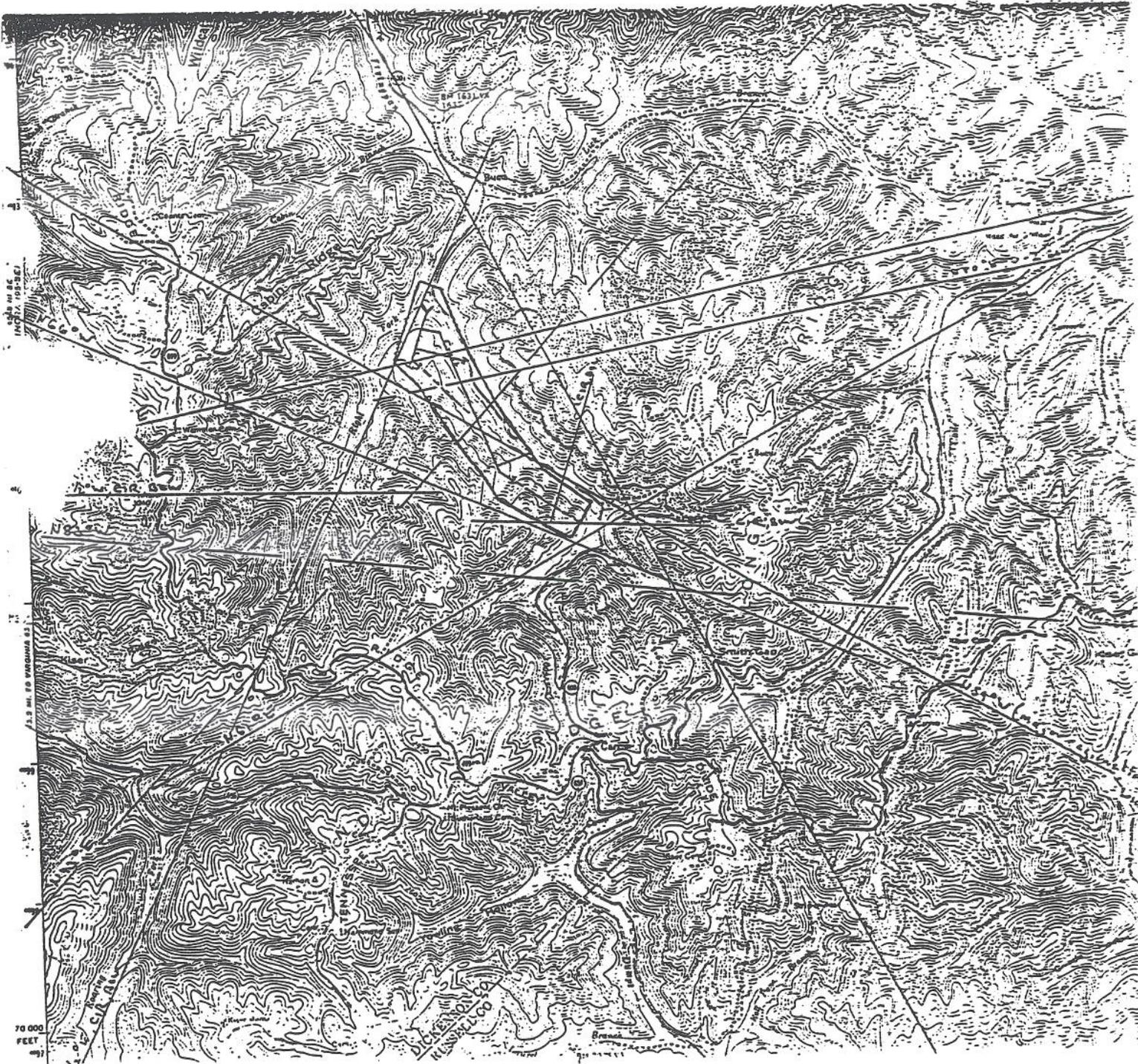
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100

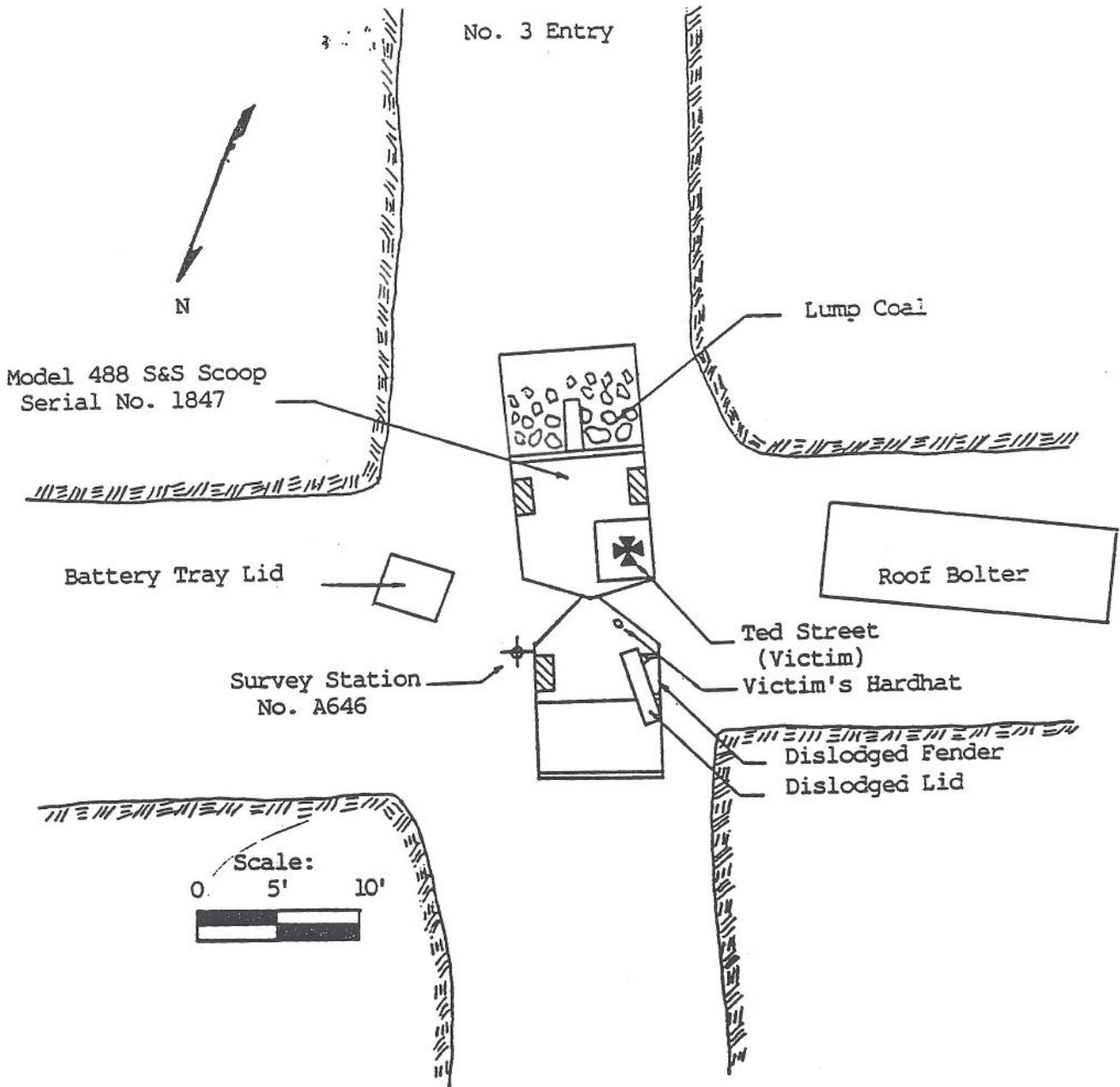
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123-03

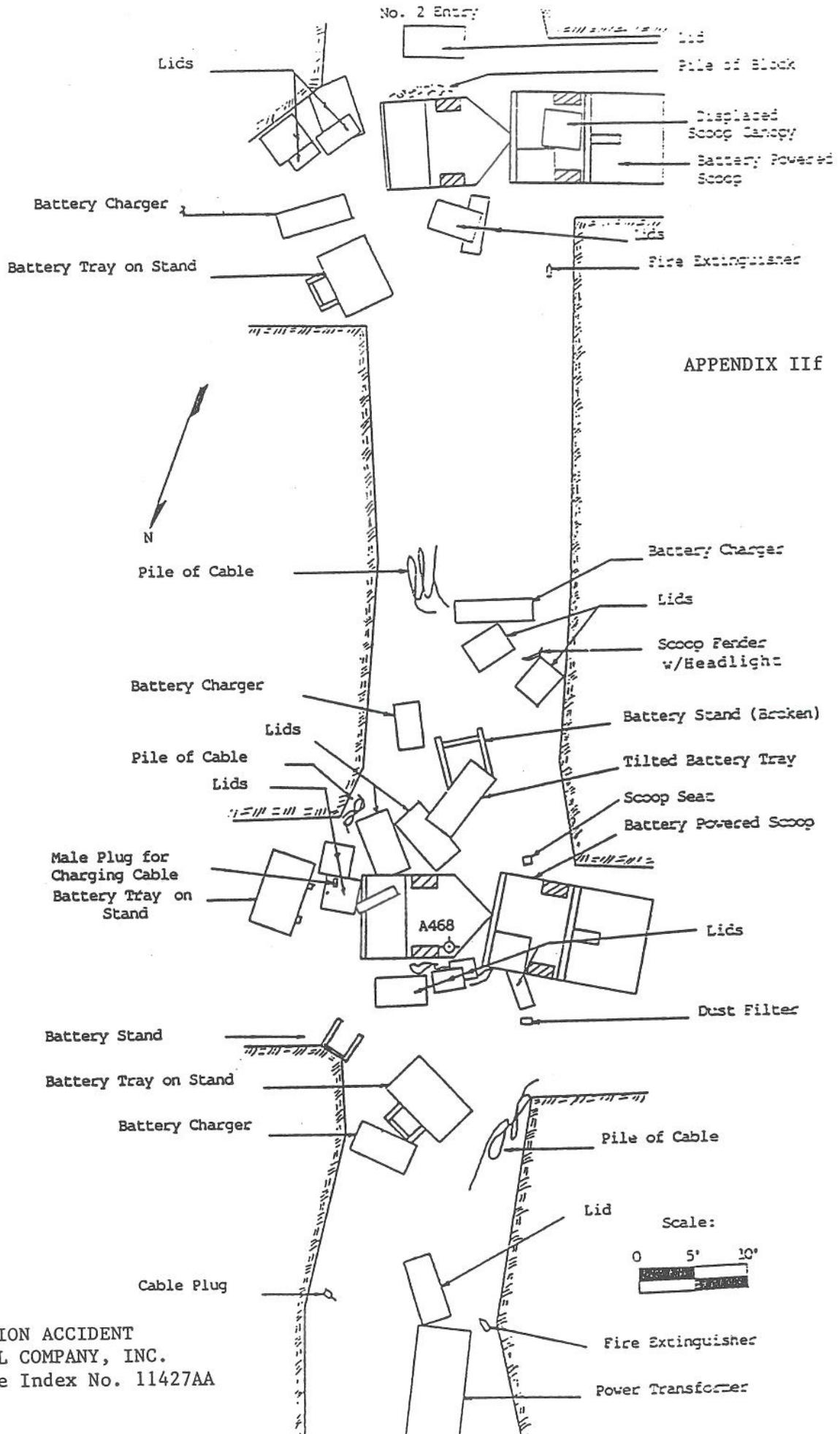
123-03



LINEAR/FRACTURE ZONE PROJECTIONS  
DOUBLE R COAL COMPANY, INC.  
Mine #1, Mine Index No. 11427AA  
Duty, Dickenson County, Virginia

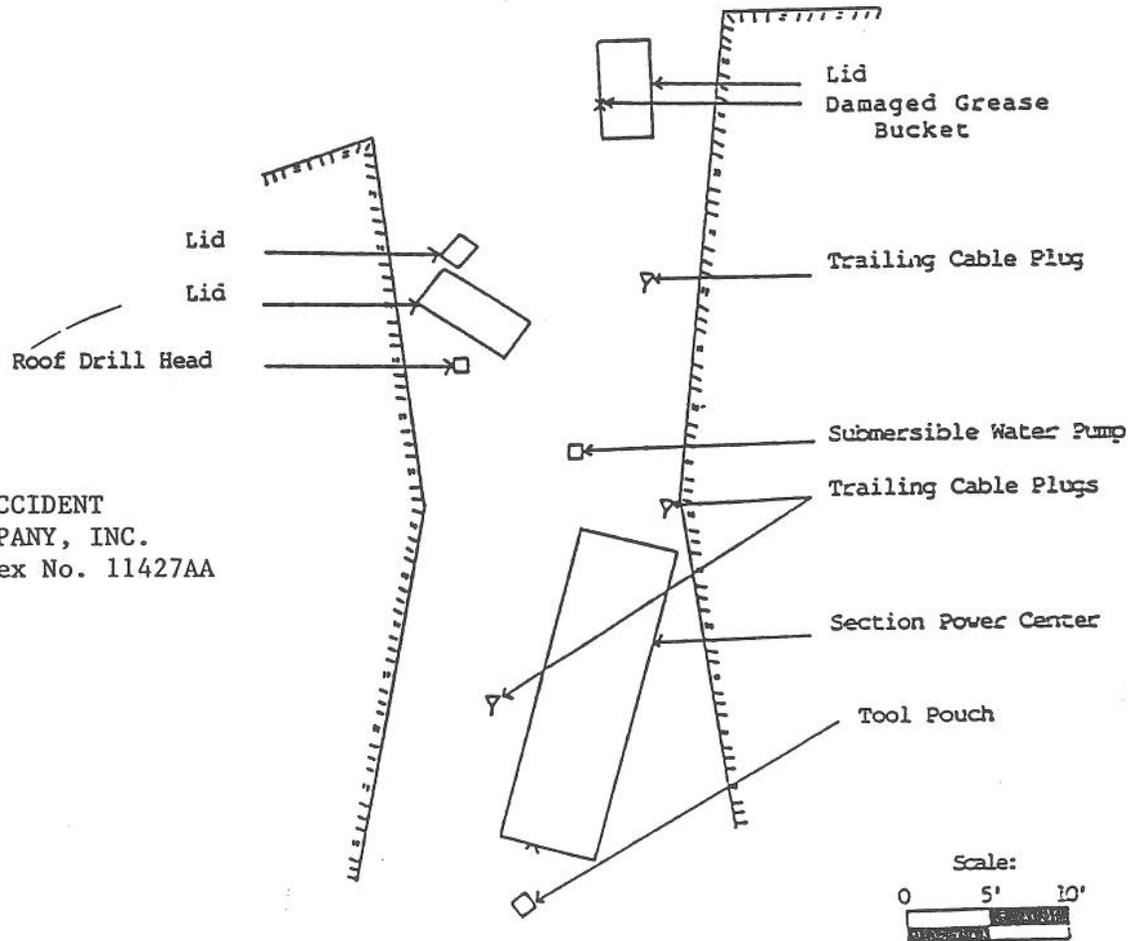
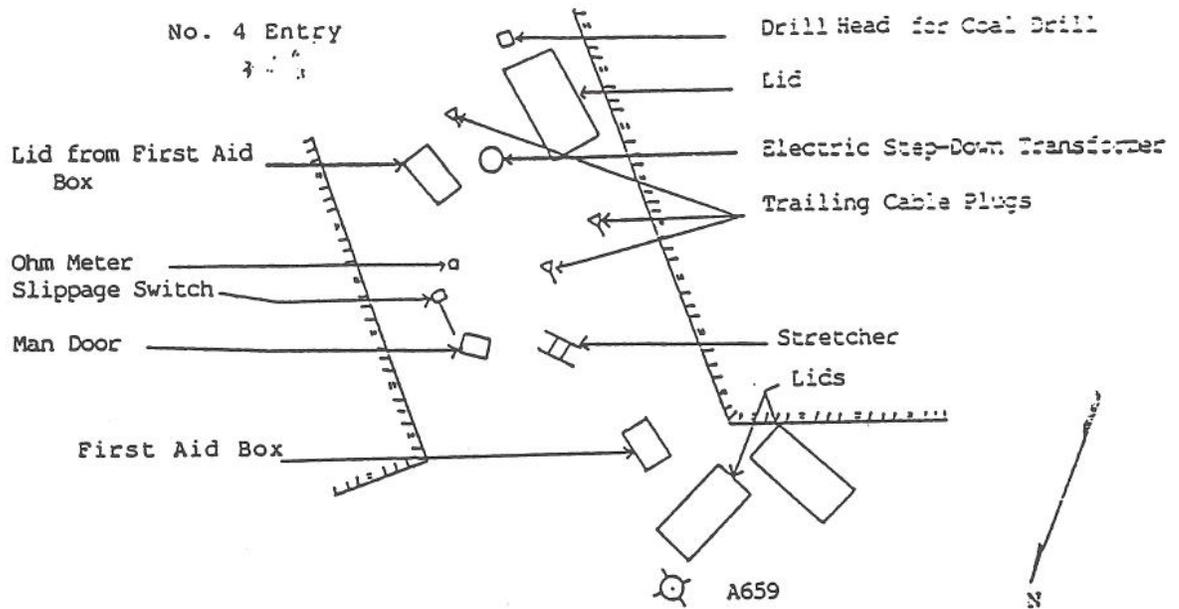


FATAL EXPLOSION ACCIDENT  
DOUBLE R COAL COMPANY, INC.  
Mine #1, Mine Index No. 11427AA



APPENDIX IIF

FATAL EXPLOSION ACCIDENT  
 DOUBLE R COAL COMPANY, INC.  
 Mine #1, Mine Index No. 11427AA



FATAL EXPLOSION ACCIDENT  
 DOUBLE R COAL COMPANY, INC.  
 Mine #1, Mine Index No. 11427AA

The following is a list of persons furnishing information and/or present during the investigation.

Double R Coal Company, Incorporated

Bill Ratliff	Owner
John Ratliff	Day Shift Foreman
Kenneth Brooks	Second Shift Foreman
Robert Simpson	Third Shift Foreman
James Bostic	General Laborer
Robert Joseph Howard	Cutting Machine Operator
Junior Lester	Mechanic
Kenneth Dorton	Second Shift Outside man and Night Watchman
Harold Lee	Electrician
Robert Lee	Electrician
Gregory Ratliff	Shot Fireman
Gary Johnson	Scoop Operator

Clinchfield Coal Company

Thomas Asbury	Safety Director/Mine Rescue Trainer
---------------	--

United Mine Workers of America

J. C. Lambert	Electrical
Harold Hartsock	International Representative
Leonard Fleming	Safety Coordinator

Mine Safety and Health Administration

Richard Vasicek	Coal Mine Safety and Health Specialist
Ronald Costlow	Coal Mine Inspector
Joseph Yudasz	Coal Mine Inspector
Lincoln Selfe	Mine Inspector
Roy Davidson	Electrical Engineer
Wayne Fetty	Coal Mine Inspector,
	Electrical
Dale Cavanaugh	Mechanical Engineer

Virginia Division of Mines

Lewis F. Wheatley  
Lloyd Robinette  
Beauford Ray

Dwight Miller

Charles Jessee

Wayne Davis

Deputy Director  
Mine Safety Engineer  
Technical Specialist,  
Electrical  
Technical Specialist,  
Electrical  
Technical Specialist,  
Ventilation  
Technical Specialist,  
Ventilation

Others

Janice Street  
Ted C. Street, Jr.

Victim's wife  
Victim's son

REPORT SUBMITTED BY:

LEWIS F. WHEATLEY  
Deputy Director

WAYNE DAVIS  
Technical Specialist

DWIGHT MILLER  
Technical Specialist

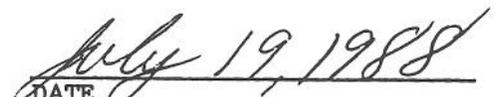
LLOYD ROBINETTE, JR.  
Mine Inspector Supervisor

CHARLES JESSEE  
Technical Specialist

BEAUFORD RAY  
Technical Specialist

REPORT APPROVED BY:

  
HARRY D. CHILDRESS, Chief

  
DATE

/lje

Attachments

p. c.