REPORT OF COAL MINE FIRE
NEMACOLIN MINE
THE BUCKEYE COAL COMPANY
NEMACOLIN, GREENE COUNTY, PENNSYLVANIA

March 26, 1971

by

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INTRODUCTION

This report is based on an investigation made pursuant to the provisions of the Federal Coal Mine Health and Safety Act of 1969 (83 Stat. 742).

On Friday, March 26, 1971, at approximately 10:20 a.m., a fire occurred in 118 straight mains section in the Nemacolin mine, The Buckeye Coal Company. There were 125 persons underground, 11 of whom were working in 118 straight mains. Of the 11, 9 persons escaped and 2 persons were killed. Also, one person accidentally lost his life on April 16, 1971, during direct fighting of the fire. (See appendix A.)

It is the writers' conjecture that the fire resulted when the end of the trolley wire fell in No. 2 entry (empty track) of 118 straight mains and came in contact with the grounding clamp attached to the track rail.

GENERAL INFORMATION

The Nemacolin mine at Nemacolin, Greene County, Pennsylvania, is operated by The Buckeye Coal Company, a subsidiary of Youngstown Sheet and Tube Company, Youngstown, Ohio.

The names and addresses of the operating officials were:

R. P. Bremner, President, Post Office Box 900, Youngstown, Ohio 44501
F. Aliucci, Manager of Mines, Nemacolin, Pennsylvania 15351
M. M. Fitzwater, Jr., Superintendent, Nemacolin, Pennsylvania 15351
W. P. Hanley, Assistant Superintendent, Nemacolin, Pennsylvania 15351
George J. Cerjanec, Mine Foreman, Nemacolin, Pennsylvania 15351
Alex Kott, Safety Engineer, Nemacolin, Pennsylvania 15351

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APPENDIXES

At the time of the last Federal inspection prior to the fire, employment was provided for 349 persons, of whom 263 worked underground and 86 on the surface, 3 shifts a day, 5 and 6 days a week, to produce an average of 5,846 tons of coal daily.

The mine is opened by one slope and five shafts into the Pittsburgh coalbed, which averages 84 inches in thickness in this area.

The immediate roof consisted of wild coal, laminated shale, and sandstone. The floor was hard shale and fire clay.

The analysis of a coal sample taken from the Pittsburgh coalbed in this vicinity is as follows:

	Percent
Volatile Matter	34.6
Fixed Carbon	52.35
Ash	13.05

Numerous tests by the Bureau of Mines have shown that coal dust having a volatile ratio of 0.12 is explosive. The volatile ratio of the coal in this mine as determined from the aforementioned analysis is 0.39, indicating that the coal dust is explosive.

A regular Federal inspection was in progress at the time of the fire. The last Federal inspection prior to the fire was completed November 19, 1970, and spot-check inspections were made weekly.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods

The mine was developed by the room-and-pillar method. Entries were driven in sets of 4 to 7, 16 feet wide, with crosscuts at suitable intervals. Bureau-approved standards for roof supports utilizing roof bolts or crossbars installed on jacks or posts had been adopted.

Coal was mined by continuous miners, and pillars were recovered by the pocket-and-wing and modified open-end systems.

Ventilation and Gases

The mine was ventilated by three propeller-type fans, operated exhausting, and provided with the required safety devices. At the time of the last Federal inspection, 940,000 cubic feet of air a minute was circulated through various splits in the mine. The mine liberated 950,000 cubic feet of methane in a 24-hour period.

The area where the fire occurred was ventilated by the No. 2 fan. (See appendix C.) In 118 straight mains, a split system of ventilation was employed and provided approximately 46,000 cubic feet of air a minute. Auxiliary fans in conjunction with line brattice were used to ventilate the working faces. Examinations for methane and other hazards were made as required.

General Conditions

The mine surfaces varied from wet to dry, and rock-dust applications were considered to be adequate at the time of the last Federal inspection.

Transportation

Coal was mined by continuous-type mining machines, loaded into shuttle cars, transported to loading ramps, and transferred into steel mine cars. The loaded cars were gathered by section trolley locomotives and placed in sidetracks for further transportation by tandem locomotives to the rotary dumps at No. 1 shaft bottom. Coal was hoisted from a bin at the bottom to the surface preparation plant by 15-ton-capacity skips, thence loaded into barges on the river.

Electricity

Electric power was purchased from the West Penn Power Company at 26,000 and 28,000 volts alternating current and transformed to 7,200, 3,300, 440, 220, and 110 volts alternating current for use on the surface and underground.

Direct-current power at 290 volts was provided for underground use by 11 conversion units which were installed with the required safety devices.

The direct-current power circuit in 118 straight mains and 118 mains left was supplied with 290 volts direct current by two 750-kw. silicon diode rectifiers. (See A and B, appendix C.) These rectifiers were located along the 118 road haulageway approximately 2,500 feet and 3,500 feet outby the working faces in 118 straight mains. The circuit breaker on the inby rectifier (see A, appendix C) was set at 3,500 amps and the circuit breaker on the outby rectifier (see B, appendix C) was set at 3,300 amps. The direct-current power was transmitted over a 400 MCM (9 section) copper trolley wire along the No. 4 entry to the working section in 118 straight mains. The 400 MCM (9 section) copper trolley wire used in the No. 2 entry (empty track) was energized from the trolley wire in No. 4 entry through Nos. 7 and 13 crosscuts. The negative circuit consisted of 70-pound rail track, bonded as required, extended along the 118 road haulageway to the junction of the 118 mains left. This track was parallel to a negative 1,000 MCM copper cable that extended to the working section. Inby this point, single-bonded 40-pound rail track was used in the No. 4 (loaded track) entry, crossover tracks, and the No. 2 (empty track) entry.

A 7,200-volt a.c. power cable supported by a messenger cable suspended from the roof in the No. 5 entry supplied the power centers and portable rectifiers which provided 550 volts a.c. and 250 volts d.c. for use by the face equipment.

Illumination and Smoking

Permissible cap lamps were used underground for portable illumination. Smoking was prohibited.

Mine Rescue Personnel and Equipment

A trained and fully equipped mine rescue team was available at the mine. During the first weeks of the mine fire, three additional mine rescue teams were trained and thereafter participated in the sealing and recovery operations. Self-rescue devices were stored at the loading ramps on all the working sections for use by the underground personnel. However, the personnel working in the affected area did not attempt to obtain the self-rescue devices. It is doubtful that they could have acquired these devices due to the smoke in the storage area. (See C, appendix C.)

Firefighting Equipment

Waterlines, fire hose, high-pressure rock-dusting machines, and 2,000-gallon-capacity water cars, properly equipped, were available underground. Supplies of emergency firefighting equipment and materials were provided at strategic locations.

STORY OF THE FIRE AND RECOVERY OPERATIONS

Assisting Organizations

The following organizations participated in fighting the fire, sealing operations, recovery of the mine, and investigation.

The Buckeye Coal Company
United Mine Workers of America
Pennsylvania Department of Environmental Resources
U.S. Bureau of Mines

Activities of Bureau of Mines Personnel

At approximately 11:30 a.m., March 26, 1971, Donald W. Huntley, Acting Subdistrict Manager, Pittsburgh, Pennsylvania, was notified of a mine fire in the Nemacolin mine, The Buckeye Coal Company, by Earle M. Rudolph, Federal Coal Mine Inspector, who was conducting an inspection at the mine. After notifying the Subdistrict office of the occurrence, Rudolph; William L. Groves, State Deep Mine Inspector; George J. Cerjanec, Mine Foreman; and George Bizub, afternoon shift foreman, proceeded to the fire area to offer aid and advice in fighting the fire. Personnel from the Pittsburgh office assembled emergency equipment and proceeded to the mine. Upon arrival at the mine, they met James B. Shannon, Federal Coal Mine Inspection Supervisor, Waynesburg, Pennsylvania.

Shannon remained on the surface and the Pittsburgh personnel entered the mine. T. J. McDonald, District Manager--Coal Mine Health and Safety District A; Donald W. Huntley; and R. J. Kirk, Federal Coal Mine Inspector, arrived at the mine at approximately 2:40 p.m. and proceeded underground to the scene of the fire. Donald P. Schlick, Assistant Director--Coal Mine Health and Safety; John W. Crawford, Mining Engineer, Washington, D.C.; and Bruce Grant, Research Manager, Washington, D.C., arrived at the mine at approximately 10:00 p.m. James Westfield, Special Assistant for Mine Investigation and Rescue, Office of Deputy Director--Health and Safety, arrived at the mine at approximately 2:00 a.m., March 27. The Westinghouse Mine Rescue and Survival System apparatus arrived March 27.

Bureau personnel established sampling stations and initiated procedures to sample the mine atmosphere through boreholes as soon as the boreholes penetrated the underground workings of the mine. Sampling of the mine atmosphere through boreholes and at the mine ventilating fans was conducted continuously during the direct fighting of the fire, construction of the bulkheads, flooding of the fire area, and recovery operations of the mine. After the fire area was sealed and flooded, Bureau personnel continuously patrolled the bulkheads. In addition to the Bureau personnel conducting instruction and training classes at the mine site for additional mine rescue teams, they directed and aided rescue teams in the recovery operations.

Personnel from the Technical Support Group, Bruceton, Pennsylvania, provided technical assistance, as needed.

Evidence of Activities and Story of Fire

The 118 straight mains day-shift crew consisting of 11 men, including the foreman and a mine tool-bit company representative, entered the mine on March 26, 1971, at 7 a.m., and arrived on the section about 7:30 a.m. Normal mining operations were in progress until approximately 10:10 a.m., when Wayne Bair, stoper operator, complained to John Horvat, section foreman, that fumes from the stoper were burning his eyes. Horvat instructed him to install two more roof bolts and the Galis roof-bolting machine would complete the job. Horvat left No. 5 entry and went to No. 6 entry where Richard K. Randolph and John Latsnic, roof bolters, and William Keyser, Carmet Tool-Bit Company representatives, were installing roof bolts.

Bair, while assembling the bolts, noticed the failure of air pressure to the stoper. To ascertain the cause he traveled through "0" crosscut to a canvas check installed in No. 2 entry. Upon opening the check in No. 2 entry, he observed yellow smoke, closed the check, and went for Horvat. Bair located Horvat in No. 6 entry and informed him of the smoke. Both men then traveled out No. 6 entry and crossed through No. 1 crosscut out No. 5 entry to No. 2 crosscut where they met Frank Zorasky, shuttle-car operator, looking across No. 4 entry at dense smoke in No. 3 entry. Due to the dense smoke, Horvat instructed Bair and Zorasky to notify the crew to leave the section. Horvat proceeded out No. 4 entry to the loading loop and through the No. 3 crosscut to the ramp on No. 3 entry where he encountered dense smoke.

In an attempt to locate the source of the smoke he traveled out No. 3 entry to the next outby (No. 4) crosscut, but the smoke forced him to cross over to clear air on No. 4 (loaded track) entry. He continued along No. 4 entry to the crossover in No. 7 crosscut where he opened the trolley switch in the crossover, which was one of the power sources to the trolley wire in No. 2 entry (empty track). He then ran to the mine phone located at the junction of 118 straight mains and 118 mains left to summon aid and to notify the dispatcher, mine officials, and the crew in 118 mains left. He instructed Ken Parrish, motorman, to open the trolley switch in No. 13 crossover, which was another source of power to the trolley wire in No. 2 entry, and to obtain firefighting equipment from 7 south.

Meanwhile, Bair and Zorasky notified John Kingora, the utility man in No. 5 entry, and the men in Nos. 6 and 7 entries that evidently there was a fire in the section and that everyone was to leave through the left returns. The men assembled outby the check curtain in No. 6 entry. Phillip Ferrutti, continuous-miner operator, decided to go back into No. 7 entry to retrieve his safety lamp. Randolph also decided to return to No. 6 entry for his safety lamp. When Ferrutti returned to the group, he was told that Randolph had gone after his safety lamp and had not returned. Ferrutti went into No. 6 entry as far as the last open crosscut to where he could see the bolting machine. He called Randolph several times; not receiving any response and observing dense smoke in the crosscut, he returned to the assembled group.

The group then proceeded out No. 6 (return) entry to the first mandoor (in No. 4 crosscut) between Nos. 5 and 6 entries where they crossed into No. 5 entry (intake escapeway). Smoke was observed approximately 70 feet inby this crosscut. They continued out No. 5 entry to the junction of 118 straight mains and 118 mains left where they met Horvat and informed him that Randolph was still in the section. Charles Gibson, Sr., mason, who was installing a stopping on the right side in 118 straight mains, was not accounted for at this time. (See D, appendix C.)

Raul Vicinelly, section foreman of 118 mains left, arrived at the junction of the two sections. Vicinelly and Horvat started to erect checks across Nos. 3 and 4 entries between Nos. 12 and 13 crosscuts to force fresh air through Nos. 2 and 5 entries (see E and F, appendix C). These efforts proved futile as rolling clouds of black smoke billowed out No. 2 entry and filled No. 5 entry.

Arriving at the scene, W. P. Hanley, Assistant Superintendent, made a decision to withdraw all personnel from the immediate area and to evaluate the situation. Hanley then issued orders to evacuate all other areas of the mine and to short circuit the ventilation at No. 19 crosscut. Checks were erected across the intake entries inby this point. (See G, appendix C). A mandoor was opened into the left return, and a hole was made in the stopping in the right return. (See H, appendix C.)

Hanley and Vernon Phillips, General Assistant Mine Foreman, entered the right return to look for evidence that might indicate if Gibson had passed outby this point. There was no evidence of Gibson's passing by this point, and an increase in the density of smoke in that area forced them to retreat.

At approximately 12:45 p.m., William L. Groves, State Deep Mine Inspector; Earle M. Rudolph, Federal Coal Mine Inspector; George J. Cerjanec, Mine Foreman; and George Bizub, afternoon shift foreman, arrived on the scene.

At this time the first sign of an active fire was observed when the plastic check across No. 2 entry melted. A waterline paralleling the haulage road was broken allowing the water to flow into the fire area, and the quantity of air passing over the fire was further reduced by opening additional outby mandoors into the left return. At about 2 p.m., a 2,000-gallon-capacity water car arrived at the scene and the fire was attacked directly.

At approximately 2:30 p.m., J. D. Breedon, Federal Coal Mine Inspection Supervisor, and several Federal inspectors arrived on the scene and, with the assistance of mine rescue personnel, established a sampling station to monitor the air returning from the fire area in the left return. (See I, appendix C.)

T. J. McDonald, District Manager--Coal Mine Health and Safety District A, Pittsburgh, Pennsylvania; Donald W. Huntley, Acting Subdistrict Manager, Pittsburgh, Pennsylvania; and R. J. Kirk, Federal Coal Mine Inspector, arrived on the scene about 3 p.m. About 3:30 p.m., the results of the samples of the air from the left return and No. 2 fan disclosed that combustibles had reached a dangerous point. All persons were withdrawn from the mine.

Officials of The Buckeye Coal Company, United Mine Workers of America, Pennsylvania Department of Environmental Resources, and the U.S. Bureau of Mines met to formulate procedures to rescue the two missing men.

It was decided that boreholes would have to be drilled from the surface into the face area of 118 straight mains in an attempt to contact and rescue the trapped men. The drilling was started on March 26. On March 27, about 3:45 p.m., the first borehole, No. 1 (see appendix C), was drilled through into the face area. Additional holes were also being drilled in the face area, and as these holes penetrated the mine workings efforts were made to contact the entrapped men by lowering phone communications. Geo-phones were also used to detect sound vibrations underground; however, these efforts were futile. Throughout the entire recovery operations, approximately 90 boreholes had been drilled into the mine workings in and around the fire area. Various materials were induced via these boreholes into the mine in an effort to control the fire.

Based on the **results** of samples of the mine atmosphere collected at the boreholes and fan openings, a decision was made on March 30 to enter the mine and reevaluate the fire situation. The fire was found burning at the same location as last seen on March 26.

On March 31, it was decided that the entrapped men could not have survived the gases produced by the fire. Since direct attack was ineffective, it was agreed to flood the fire area with water to the highest water level obtainable and that all persons would be withdrawn from the mine during the flooding operation. Water was pumped from the surface through Nos. 1, 2, and 36 boreholes into the face areas. On April 8, at 3:15 p.m., expansion foam was induced from the surface through Nos. 51, 52, and 53 boreholes (see appendix C) into the intake airways outby the fire area.

The maximum high-water level (587'6") as determined by the underground topography was reached on April 13. It was then decided to reenter the mine to determine if the partial flooding had enough effect to make a direct attack on the fire possible. An examination on April 14 indicated this was possible and it was decided to fight the fire directly.

On April 15, mine rescue teams entered the area and direct firefighting was resumed; however, the fire had spread beyond its last known location to Nos. 0 and 00 entries (return entries) at No. 19 crosscut.

On April 16, at about 1:30 p.m., William L. Groves, State Deep Mine Inspector, Pennsylvania Department of Environmental Resources, was accidentally drowned during the firefighting operations. (See appendix A.)

Analyses of air samples taken on April 17 at No. 39 borehole indicated increased concentrations of combustibles, and all persons were again withdrawn from the mine.

The conditions were discussed and the next course of action was determined. It was agreed to remotely build underground dams from the surface via boreholes to raise the underground pool of water. Concrete mixtures were piped from the surface through Nos. 49, 50, 59, and 60 boreholes to confine the water. (See appendix C.) Fly ash, ash slurries, aqua gel, and high-expansion foam were also piped through boreholes at various locations to contain the fire.

On April 26 and 27, an inquiry was held by the U.S. Bureau of Mines at which all four agencies participated. Testimony was received from witnesses who had knowledge of the fire. (See appendix E.)

On May 14, it was decided to systematically inject nitrogen from the surface through boreholes at strategic locations to aid in containing the fire. Nitrogen was induced into the fire area on a prearranged schedule to minimize possible explosion hazards and to reduce the fire to a dormant state.

The remotely constructed dams were not completely effective and a decision was made on May 29 to return underground to seal the fire area. An examination of the entire mine was initiated at 3:45 p.m. the same day. Work toward installing bulkheads was to commence on June 2. The bulkheads were to be constructed to design specifications of 50 p.s.i. using concrete having a compression strength of approximately 4,000 p.s.i. and a tensile strength of 40,000 p.s.i. and were to retain a maximum waterhead of 41 feet. This waterhead would exert a pressure of 17.8 p.s.i. on the bulkheads. The maximum waterhead attained during the flooding operation was approximately 29 feet (12.6 p.s.i.). (See appendix I.)

The mine roof was reinforced on both sides of the bulkhead sites, and the bulkheads were trenched no less than 12 inches into the bottom and roof and no less than 2 feet into solid coal in the rib. Where adequate trenching could not be done in the roof or bottom, high-tensile strength 5/8-inch by 4-foot roof bolts were installed 30 inches into the roof on 12-inch centers and 18 inches in the mine bottom on 18-inch centers. (See appendix F).

A total of 25 bulkheads was erected. Twenty-three were installed by personnel underground, and two, Nos. 24 and 25, from the surface via boreholes.

Rearranging of the nitrogen induction schedule on May 31 resulted in high CH_4 levels and all persons were withdrawn from the mine. Nitrogen induction was restored to the previous schedule, and when the mine atmosphere became stable on June 1, persons were permitted to reenter and the preparation toward building the bulkheads was resumed.

The bulkheads were completed on August 10, 1971, and after allowing sufficient curing time the bulkheads were inspected on August 26 by the four agencies, after which pumping of water was initiated to fill the area behind the bulkheads to the maximum waterhead attainable. On August 28, water pumping was halted and excessive seepage around several of the bulkheads was stopped by chemical and cement grouting. A reinspection of the bulkheads was made on September 1, and the bulkheads were found to have minimum leakage. The highest water elevation level attained was about 603 feet.

Having reached the highest water level, the management of The Buckeye Coal Company requested that the mine be permitted to resume normal mining operations.

However, some of the working sections were at a lower level than the impounded water, and it was decided that the following devices would be installed to detect bulkhead failure or excessive water leakage:

1. A sensing device in No. 53 borehole to detect a drop in the water level.

2. A pressure monitoring device in No. 6 bulkhead to detect a drop in water pressure.

3. Mercury switches mounted on suspended flaps to detect an additional flow of water outby each bulkhead.

After the installation, these devices were periodically activated and inspected. These devices were connected to actuate a recorded taped warning via loudspeakers (Pagers) located at strategic locations throughout the mine and on the surface. In addition, certified persons constantly patrolled the bulkheads until recovery of the fire area was initiated.

After an inspection made at the company's request on September 9, 1971, the 104(a) Withdrawal Order dated March 26, 1971, was modified to permit rehabilitation work in 8, 9, 10, and 11 right and 3 left sections off 2 north.

The 10 right section was projected as the established route for recovery of the entombed men and was to be driven without interruption until the recovery was complete. This work took precedence over any other work conducted.

On September 15, 16, and 17 an inspection was made of the entire mine. On September 20, a reinspection was made to determine if all the deficiencies found September 15, 16, and 17 had been corrected. The 104(a) Withdrawal Order was then modified as follows:

September 20, 1971, 10 right 2 north section, the south empty, the south loaded, and 2 north haulage roads were released for production and transportation of coal. The 1 south, 10 south, and 8 road sections were released to permit rehabilitation work.

The Withdrawal Order was then further modified as follows:

1. September 27, 1971, 9 right was released for production of coal.

2. September 30, 1971, 8 right was released for production of coal.

3. November 7, 1971, 844 haulage road was released for rehabilitation work.

4. November 17, 1971, 3 left section was released for production of coal.

5. April 11, 1972, 843 road section was released for production.

After all available information indicated the fire was extinguished, a conference was held on January 3, 1972, and it was decided to dewater the area behind the bulkheads.

Approximately fifty million gallons of water was impounded behind these bulkheads.

Dewatering of the sealed area continued until September 12 at which time recovery operations were initiated.

Recovery Operations

Initially 10 right section was projected to intersect No. 7 entry of 118 straight mains and to establish a means to ventilate the sealed area; a crosscut (No. 2 room) was to be driven from No. 1 entry (return entry) in the 10 right section to No. 1 entry in the 118 mains left. Due to adverse conditions encountered in 10 right section, it was decided to initiate an additional route by driving 12 right section off 10 right section for recovery purposes and to penetrate the faces of Nos. 5 and 6 rooms of 118 straight mains, establishing Nos. 5 and 6 rooms as intake airways and No. 2 room in 10 right section as a return airway.

After the area had been flooded for a 17-month period, a meeting was held on September 11, 1972, and a decision was made whereby all normal production was to cease and 118 straight mains (sealed area) was to be recovered. Samples of the atmosphere were collected through boreholes into the sealed area. The results of these samples showed the atmosphere would not create an imminent danger upon opening this area.

On September 12, 1972, two crosscuts were started from 12 right toward the faces of 118 straight mains to intersect Nos. 5 and 6 entries.

At 5:15 a.m., September 15, 1972, mine rescue teams wearing McCaa breathing apparatus and using hand tools penetrated 118 mains left from 10 right through No. 2 room. The No. 2 room had been previously driven to within 4 feet of 118 mains left. A sampling station was established in this return to continuously monitor the gases from the sealed area. After a 3-hour stabilization period, the same procedure was followed in 12 right, and at 2:50 p.m. an opening 12 inches by 18 inches was made into the face of No. 6 room, 118 straight mains. Upon encountering positive pressure, the right return of 12 right was converted to an intake entry by closing the right return regulator and opening a man door inby this regulator. This caused the air to reverse in No. 6 room, 118 straight mains. At 9:55 p.m. No. 5 room was opened into the area from 12 right. The openings in Nos. 5 and 6 were later enlarged to an 80-square-foot area.

At 11:50 p.m., an object was sighted floating in about 3 feet of water in No. 6 room, 118 straight mains. (See A, appendix G.) Upon entering No. 6 room, it was determined the the object was a body, later identified as that of Richard K. Randolph. The body was recovered at 3:10 a.m., September 16.

At a meeting held on September 16, procedures were established for further recovery operations. To provide more ventilation from 12 right into 118 straight mains, changes and adjustments were made in the ventilation system. The recovery procedure was to establish ventilation on the right side of 118 straight mains and also to locate the body of Charles Gibson, Sr., suspected to be in No. 1 (return) entry. (See B, appendix G.) This was accomplished by erecting checks in the entries outby the last crosscuts and coursing the air from Nos. 5 and 6 entries to and through No. 1 (return) entry.

On September 21, the body of Charles Gibson, Sr., was found in the No. 10 crosscut on the return side of a stopping between Nos. 1 and 2 entries. (See C, appendix G.)

Recovery operations were continued until September 25 when low oxygen was encountered and recovery work was stopped. It was ascertained that, in order to improve ventilation to this area, the No. 2 fan would have to be utilized. This was accomplished by mining through the pillar between Nos. 14 and 15 bulkheads and establishing a return to the No. 2 fan. This work was completed September 29 and it significantly increased the quantity of air passing through the sealed area. While this work was in progress, an inspection of all the active workings of the mine was made on September 26 and 27 to determine if coal production could be resumed. On September 30, adjustments were made in the ventilating system and the air current was reversed in 118 mains left. Exploration of the fire area was resumed and was completed on October 1.

On October 2 the mine, with the exception of 12 right section, was released for production of coal. Coal production was resumed on October 3.

Inquiries were held by the Pennsylvania Department of Environmental Resources on October 24 and 25. (See appendix E.)

INVESTIGATION OF CAUSE OF FIRE

Investigation Committee

An investigation of the fire area was started on October 4, 1972. Additional technical personnel assisted in the technical aspects of the investigation. (See appendix H.)

The investigation was impeded due to an accumulation of 3 to 6 inches of "yellow boy" deposited on the mine surface and equipment as a result of the inundation of the area.

Probable Point of Origin

In all probability the fire resulted when the end of the trolley wire fell in No. 2 entry (empty track) of the 118 straight mains section and came in contact with the grounding clamp attached to the track rail.

Summary of Evidence

All indications were that the fire was generally confined to the roof areas. (See appendix G for evidence of fire.) Coke varied from 1 inch to a depth of about 2 feet on the mine floor in No. 3 entry from No. 3 crosscut to No. 12 crosscut.

Miners' garments (jackets) suspended near the roof inby No. 3 crosscut were not scorched or burned.

Several metal containers (5-gallon capacity) filled with hydraulic oil near the compressor and in No. 3 entry inby No. 3 crosscut were intact. A hydraulic oil storage tank car in No. 9 crosscut between Nos. 2 and 3 entries did not show signs of being on fire.

Machinery and equipment in the fire area did not reveal any signs of being on fire; however, several sections of trailing cables and power cables suspended from the roof were partially consumed by heat or flame. Sections of cables on or within 3 to 4 feet from the mine floor showed no evidence of heat or flame.

A trip of cars being loaded at the loading ramp had moved four and one-half car lengths and stopped approximately 4 feet outby the car spotter indicating that possibly the control system for the car spotter had developed a short circuit in the control cables due to the destruction of the insulation on the cables by heat or flame. At No. 5 crosscut, the trolley wire in No. 4 entry (loaded) track had made contact with the mine cars. Evidence of electrical arcing between the trolley wire and the mine cars indicated that the trolley wire in No. 4 entry was still energized after the trip had moved. Numerous trolley wire hanger insulators were completely melted at various locations along No. 2 (empty) and No. 4 entries, thus allowing the trolley wire to drop to the mine floor and onto the mine cars.

The investigation in the vicinity of the probable origin of the fire indicated the following:

1. The 90-horsepower electric motor on the portable track-mounted Acme Rotary Compressor (Model 325R-T) was protected by an internal 400-ampere overload device. The compressor showed no evidence of having been on fire.

2. The insulation on the trailing cable suspended on the inby end of the compressor that was exposed to the ventilating current was consumed; however, none of the trailing cable lying on the floor showed evidence of heat. Hydraulic hoses on the compressor that were not protected from the ventilating air current were charred and blistered on the outby side; however, the inby sides of the hoses were not charred or blistered. Sections of the hoses that were protected from the air current by components of the compressor were not damaged by heat. It is assumed that the charred and blistered portions of these hoses and cables were the results of extreme heat being channeled over the damaged areas.

3. Two No. 2 Bureau of Mines approved-type cables were used in parallel from the nipping station and were spliced to a 2/0 cable approximately 6 feet from the cable entrance to the compressor. Reportedly, approximately 4 to 5 months before the fire the 250-amp fuse protecting a single 2/0 cable had been overheating, melting the solder connections on the fuse which resulted in repeated fuse failure. To eliminate fuse failure, the two No. 2 cables, each protected by a 200-amp fuse, were spliced to the 2/0 cable to more readily dissipate the heat.

4. The positive lead in one of the No. 2 cables was found completely severed as the result of an electrical short circuit about 12 feet outby the compressor. James Rutosky, stoper operator, testified that while using the compressor on the 12 to 8 a.m. shift, March 25, 1971, one of the two fuses (200-amp capacity) had three consecutive failures resulting in the stopping of the compressor after each failure. On each occurrence, the fuse failed in the same trolley tap. After the third fuse failure, a 300-amp fuse was installed. The compressor was operated for the balance of the shift without fuse failure. Testimony from other users of the compressor after March 25, 1971, indicated no fuse failures. From evidence found and testimony given, it is assumed that one of the cables had been severed prior to the fire and the compressor was operating on one No. 2 cable protected by a 300-amp fuse.

5. The two trolley taps were found attached to the trolley wire. One fuse was blown and the lead from this nip was found to be separated by an electrical short circuit 4-1/2 inches from the nip. The second fuse was intact.

Probable Cause of Fire

The trolley wire and insulating anchor were found lying on the mine floor at the compressor nipping station. Examination of the trolley wire and the attached anchor indicated that the clamp attaching the hanger to the trolley wire was partially consumed by electrical short circuit. Evidence indicated that the vinyl-type insulation in the hanger bell used to anchor the trolley wire had softened due to heat. The trolley wire and the softened insulation then pulled free from the hanger bell allowing the end of the trolley wire to drop to the mine floor, striking one of the compressor ground clamps. This resulted in the partial destruction of the anchor and the ground clamps. The second ground clamp with a negative and frame ground conductor was intact.

Analyses of samples of coal and coke collected in the area of the compressor nipping station indicated high heat in the roof area and low heat near the bottom. After removing the trolley wire anchor bolt assembly, samples were collected from the inside of the hole and at the roof line. The analyses of these samples indicated more heat inside the hole, rather than at the roof line outside the hole. This indicated the probability of the hanger being grounded and generating heat, which resulted in the softening of the insulation in the bell thereby allowing the trolley wire to drop to the mine floor striking the negative ground clamp which was the origin of the fire.

VIOLATIONS

Imminent Danger - Section 104(a)

A mine fire occurred in 118 sections.

Action taken

Order of Withdrawal No. 1, E.M.R., was issued on March 26, 1971, requiring that all persons, except persons referred to in Section 104(d) of the Act, be withdrawn from and prohibited from entering the mine. The Order was modified to release areas of the mine, as recovered, and the entire mine was released on November 4, 1972.

REQUIREMENTS

1. In addition to the anchoring device, an insulated hanger should be provided at the ends of the trolley wires and trolley feeder wires to prevent the wires from making contact with the mine floor or mine track rails upon failure of the anchoring device.

2. Circuit breaker short-circuit trip settings should be maintained to be consistent with the power transmission system. The power transmission system should be evaluated periodically to determine if adequate short-circuit protection is provided during normal mining and idle periods.

3. Upon the presence of any smoke or abnormal amounts of fumes, a thorough search should be made and continued until the source is determined and eliminated.

Respectifully submitted,

Alex O'Rourke

Willis E. Cupp

Joseph S. Bochna

Approved by:

Robert E. Barrett
District Manager--Coal Mine
Health and Safety District 2

Appendix A.--Memorandum report on accidental death of William L. Groves

COPY

United States Department of the Interior

BUREAU OF MINES

4800 FORBES AVENUE

PITTSBURGH, PENNSYLVANIA 15213

Health and Safety
Technical Support Center

June 2, 1971

Memorandum

To : Henry P. Wheeler, Jr., Deputy Director--
Health and Safety, Washington Office

Through: Donald S. Kingery, Chief
Technical Support Center, Pittsburgh

From : James V. Luxner, Mining Engineer

Subject : Report of accidental death of William L. Groves, State Deep Mine Inspector, Pennsylvania Department of Environmental Resources, in Nemacolin Mine, The Buckeye Coal Co., Nemacolin, Greene County, Penna., April 16, 1971.

The Technical Support Center was directed to conduct an independent investigation and prepare a limited report on the death of William L. Groves.

William L. Groves, age 57, had 38 years of mining experience. For the past 14 years, Mr. Groves was a State Deep Mine Inspector. Surviving are his widow, Jane Burnette Groves, and one son, William C. Groves, of Carmichaels, Pennsylvania.

On Friday, March 26, 1971, a fire occurred in the Nemacolin Mine, Entry 118, in which two men were killed. From this date the fire was fought from the surface through boreholes with water, fly ash, foam, etc. On Wednesday, April 14, a decision was made by Federal, State, Union and Company officials to fight the fire directly. Crews were organized and the first crew entered the mine on the afternoon shift, April 14, 1971.

On Friday, April 16, 1971, William L. Groves, State Deep Mine Inspector, Donald W. Huntley, Subdistrict Manager, Health and Safety District A, Bureau of Mines, and M. M. Fitzwater, Jr., Mine Superintendent, Nemacolin mine, discussed the fire-fighting methods being used in the Nemacolin Mine and decided to get a first-hand look at the situation. The group entered the mine at approximately 12:00

cc:
D. P. Schlick, WO
J. Westfield, WO
T. J. McDonald, Pgh.
J. V. Luxner w/originals

noon and proceeded to Entry 118 (Appendix D). On reaching the Section they inspected the right side and then proceeded to enter the entry designated as No. 3 (fresh air intake). Three crosscuts outby Borehole No. 51 in No. 3 Entry, water was encountered. The water level rose as they proceeded inby. The group were wearing waders and walking was difficult because of slippery conditions and hidden obstacles in the water. After traveling 100 feet inby (one crosscut), they passed a Joy loading machine and, at this location, foam was encountered. As they proceeded inby in Entry No. 3, the water and foam increased in depth until they reached the intersection outby No. 51 Borehole. At this intersection the water was about two feet deep with about three feet of foam floating on top of the water. At this point the foam was about shoulder high.

Messrs. Fitzwater and Huntley removed the brattice check cloth which was diagonally across the intersection. They then proceeded inby toward Borehole No. 51 with Fitzwater in the lead, Huntley second, and Groves bringing up the rear. After traveling a short distance further toward Borehole No. 51, it was decided that they could do no good until the foam was beaten down. They (Fitzwater, Huntley, and Groves) discussed the fire and the conditions that they observed. Not being able to see very much in the crosscut just outby Borehole No. 51, Mr. Huntley called out to have a hose and fognozzle brought up; he then decided to go out until the equipment arrived. Huntley worked his way past Groves and proceeded outby. Groves suggested that he and Fitzwater stay until Mr. Huntley notify them that the equipment had arrived and they (Groves and Fitzwater) would come out. Fitzwater was just a short distance inby Groves when he (Fitzwater) heard a faint call for help in back of him. When he looked around he could not see Groves. Fitzwater called that Groves was down in the foam and water.

Huntley, who had traveled outby Borehole No. 51 about 30 to 40 feet, returned to help Fitzwater. Edward Urbany, Mine Safety Coordinator, Department of Mines, Walter J. Balitski, Federal Coal Mine Inspector, Supervisor, U. S. Bureau of Mines, Kittanning, Pennsylvania, and Harvey Lewis, Chief Engineer, a short distance outby Huntley, also came up to find Groves. This group using feet and hands attempted to find Groves. After a short while Mr. Huntley called to have the water hose with fognozzle brought up. Mr. Balitski went to get it. Mr. Walter T. Magera, Federal Mine Inspector, who was 200 feet away in 0 entry sampling for CO, CO_2, and oxygen deficiency, arrived in the area. The hose and fognozzle were brought up and played on the foam where Groves was last seen.

Groves was actually found by Magera, face down and spread eagle. Groves' boots were floating with the heels sticking out of the water. He was in the intersection outby Borehole No. 51.

Messrs. Magera and Urbany with the help of others carried Groves outby one crosscut (100 feet), placed him on the 11BU Joy loading machine and immediately started mouth-to-mouth resuscitation. No pulse could be found. Ted Bioni, Federal Mine Inspector, who was sampling for CO in the -0 entry, arrived in the area just as Groves was being carried back. Bioni and others administered mouth-to-mouth resuscitation and continued doing so until Mr. Groves was pronounced dead by the doctor. (Appendix C)

The time elapse from Fitzwater's call that Groves was down until he was found was estimated to be from 5 to 10 minutes.

In searching for Groves, the foam got stirred up and even increased to ear-depth due to the group (Fitzwater, Huntley, Lewis, Urbany, Balitski, and Magera) searching for him. The one-inch bubbles that were on the top were created by stirring action and fresh air current going inby over top the foam. The foam was a mixture of 150-1 and the majority of the bubbles were real small (dense solution). In searching for Groves, several of the group got their heads under the foam, lost their sense of direction, started coughing, and were nauseated by the foam. The foam had mixtures numbers of 39335 and 39333 which indicates that the detergent was the same but one number is for a five-gallon can and one for a 55-gallon drum. The foam had a tendency to stick to their faces and had to be wiped off so they could breathe. According to the National Fire Protection Association (N.F.P.A.) - code number 11A by definition - high expansion foams are those having expansion ratios from 100-1 to 1000-1. The detergent was supplied by the Mine Safety Appliances Company, Pittsburgh, Pennsylvania, Phone: 412-241-5900. Their (MSA) statement - "the high expansion foam used in combatting the fire at the Nemacolin Mine presents no hazard to health." The composition given by MSA was a 25 percent solution of ammonium lauryl sulfate in water plus chemical additives, which determine the fire fighting capability of the foam, are proprietary information. Borehole No. 51, where the foam was pumped down, had a diameter of approximately 6 inches and a depth of 405 feet. High expansion foams greater than 150-1 would have created problems due to such a small pipe.

On Wednesday, April 28, 1971, Walter Vicinelly, State Deep Mine Inspector, performed an experiment in a 20-foot diameter swimming pool with 30-inches of water in it. The water temperature was 46°F, and the outside temperature was 56°F.

Mr. Vicinelly dressed as William L. Groves had been dressed - with waders, miner's belt around the outside of his waders, hard hat, cap lamp and battery (left hip), and with his self-rescuer on his right hip. Mr. Vicinelly also wore a jacket.

It was decided with Federal, State, Union and Company officials present, that Walter Vicinelly would enter the swimming pool, take a couple of steps and then fall forward. Mr. Vicinelly did this. He struggled to get his feet down but could only paddle "doggie-fashion" until he reached the side of the pool where he pulled himself up. He was completely exhausted and had been in the water for only 20 seconds. His rubber waders kept his feet afloat and he was unable to get his feet down on the bottom. All those present observed his waders floating. This, it is believed, is what happened to William L. Groves. No one saw Groves fall.

As a result of this experiment, the State recommended that when waders are worn a life jacket must also be worn. Walter Vicinelly was questioned as to how long he thought he was in the pool. He said - a minute to a minute-and-a-half. Those present who had observed the incident told Mr. Vicinelly that he had been in the pool only 20 seconds. Movies were taken by one of the State officials.

The Coroner's Certificate of Death, the Death Certificate, and attending physician's report, all put accidental death by suffocation due to drowning as the cause of William L. Groves' death. (Appendices A, B, and C).

No autopsy was performed. (Greene County Coroner, Frank J. Behm, Jefferson, Pa., 15344, Phone 412-883-5001; Pathologist, Dr. W. F. Baird, R. D. #3, Waynesburg, Pa., 15370, Phone 412-627-5822; attending Physician, Dr. Roy C. Jack, 201 W. South Street, Carmichaels, Pa., 15320, Phone: 412-966-2000).

This investigation (hearings) took place at the No. 4 Portal of the Nemacolin Mine, The Buckeye Coal Company, May 3, 1971. The final deposition was received May 17, 1971. (Appendix E)

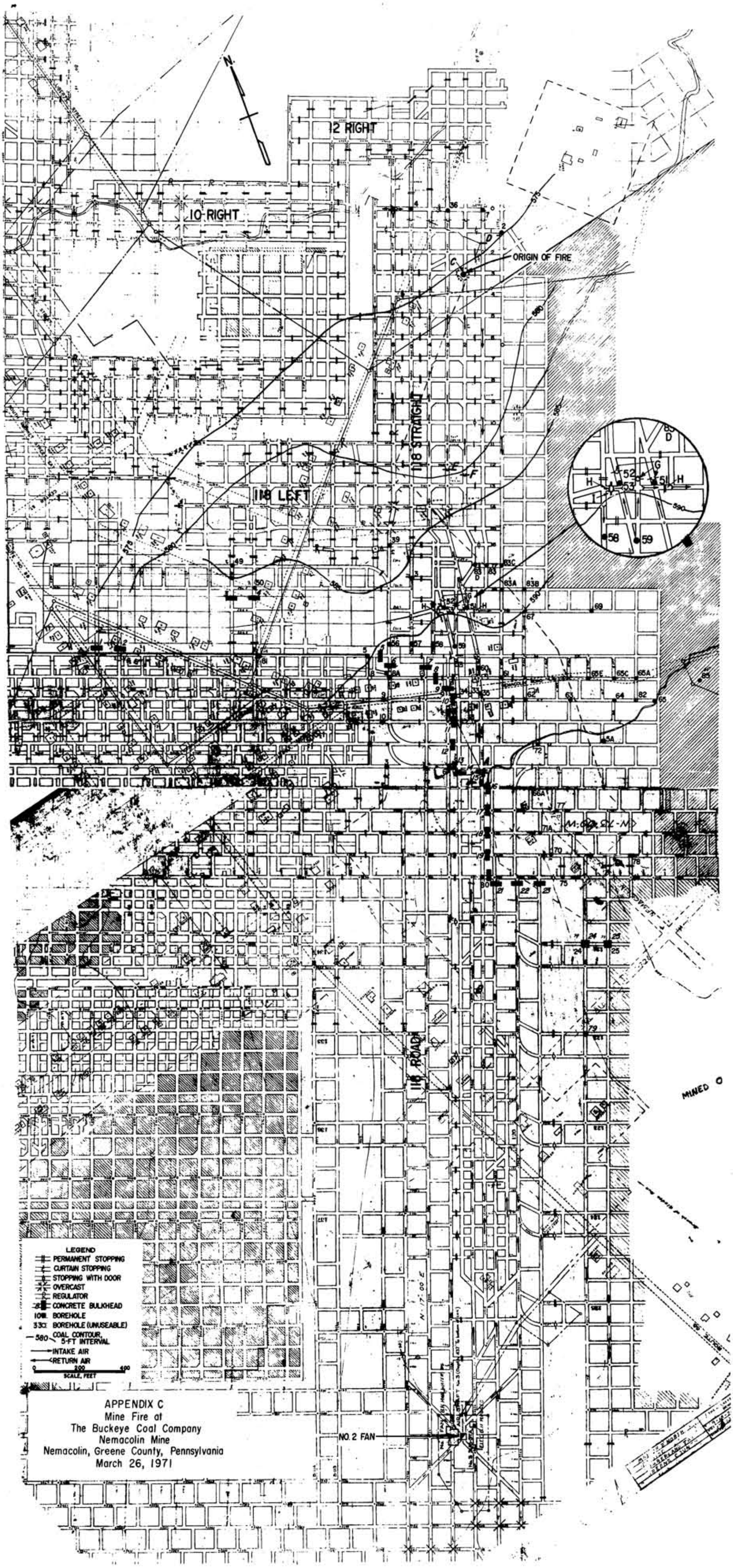
/s/ James V. Luxner

James V. Luxner

Enclosures: 5

Appendix B.--Victims of Fire

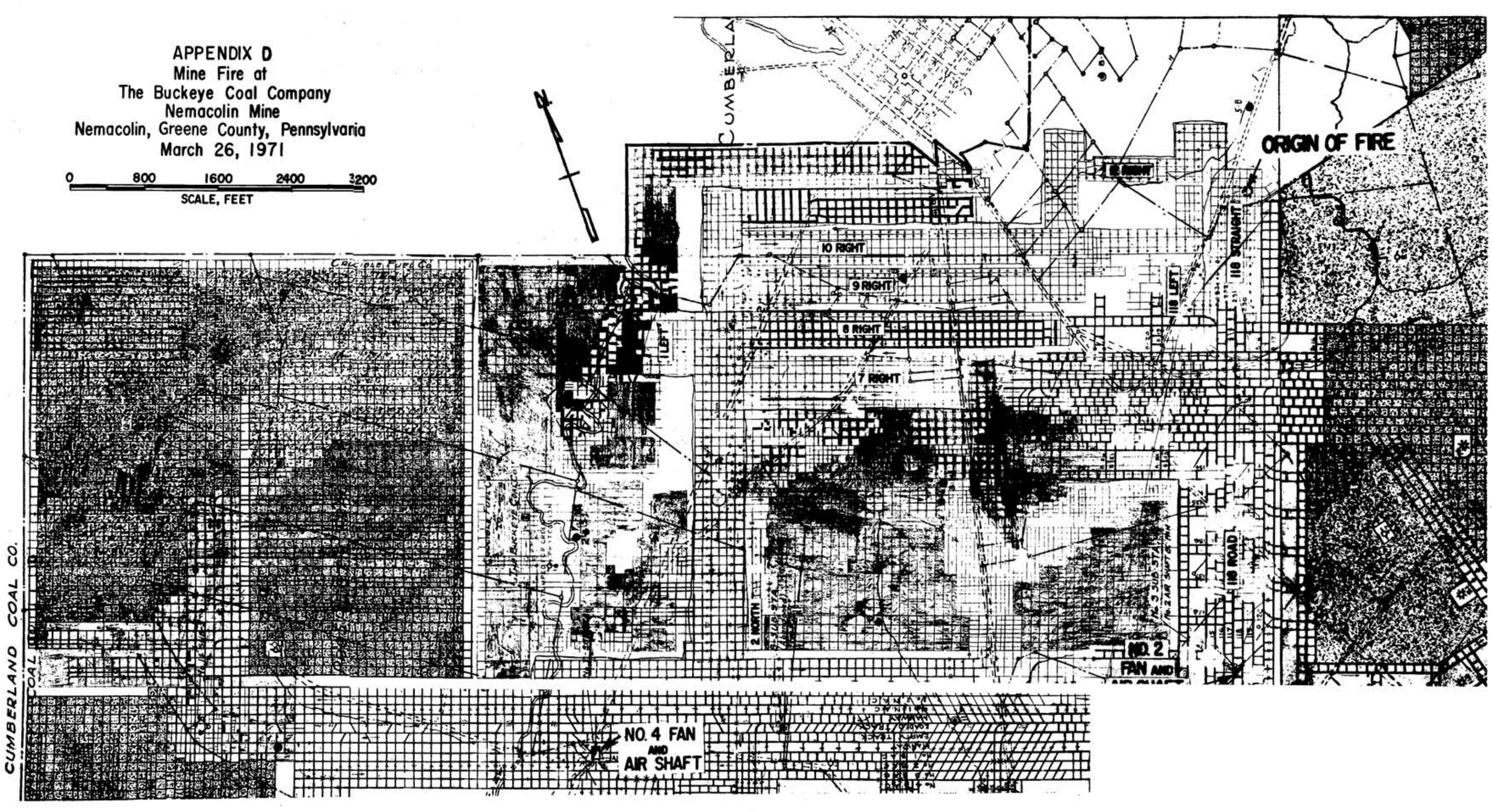
Name and Social Security No.	Age	Occupation	Total mining experience	Experience this mine	Experience this occupation	No. of dependents
Richard K. Randolph 190-10-9284	63	Roof bolter	40 years	37 years	5 years	1
Charles Gibson, Sr. 211-07-9425	64	Mason	31-1/2 years	31-1/2 years	31 years	1



APPENDIX C
Mine Fire at
The Buckeye Coal Company
Nemacolin Mine
Nemacolin, Greene County, Pennsylvania
March 26, 1971

APPENDIX D
Mine Fire at
The Buckeye Coal Company
Nemacolin Mine
Nemacolin, Greene County, Pennsylvania
March 26, 1971

0 800 1600 2400 3200
SCALE, FEET



Phillip Ferruti	Continuous-miner operator
Frank Zorasky	Shuttle-car operator
Frank Jurczak	Chief electrician
M. M. Fitzwater, Jr.	Superintendent
James Rutosky	Acme compressor and stoper operator on the 12 to 8 a.m. shift, March 25, 1971
George J. Cerjanec	Mine Foreman, Nemacolin mine
Thomas Walters	Shuttle-car operator
Walter F. Tomchik	Maintenance foreman
John Morris	Construction foreman
Ben Mancini	Assistant Mine Foreman
George Bizub	Mine Foreman, 4 to 12 p.m. shift

Pennsylvania Department of Environmental Resources

Interrogation held October 24 and 25, 1972

Interrogators

S. A. Fredrick	Chairman of the Commission, Pennsylvania Department of Environmental Resources
J. J. Hunter	Member of the Commission, Pennsylvania Department of Environmental Resources
Joseph Reggianni	Member of the Commission, Pennsylvania Department of Environmental Resources

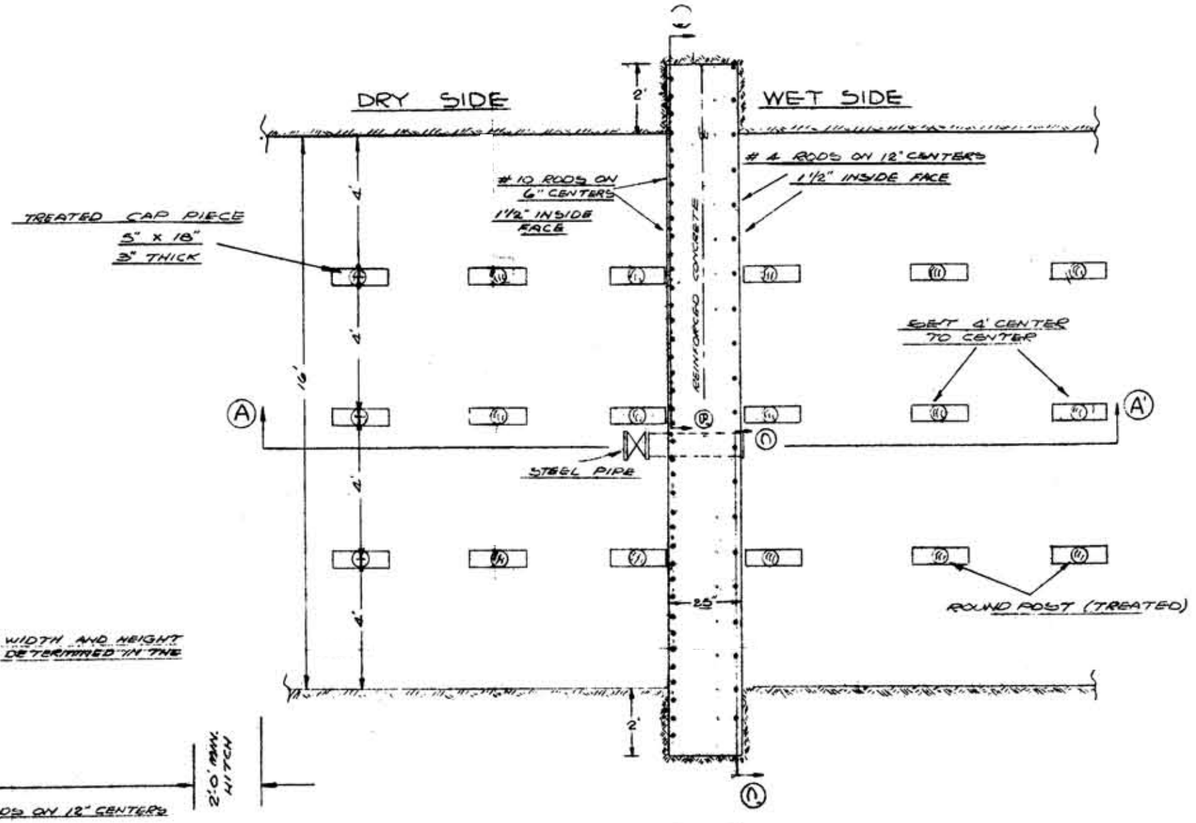
Witnesses

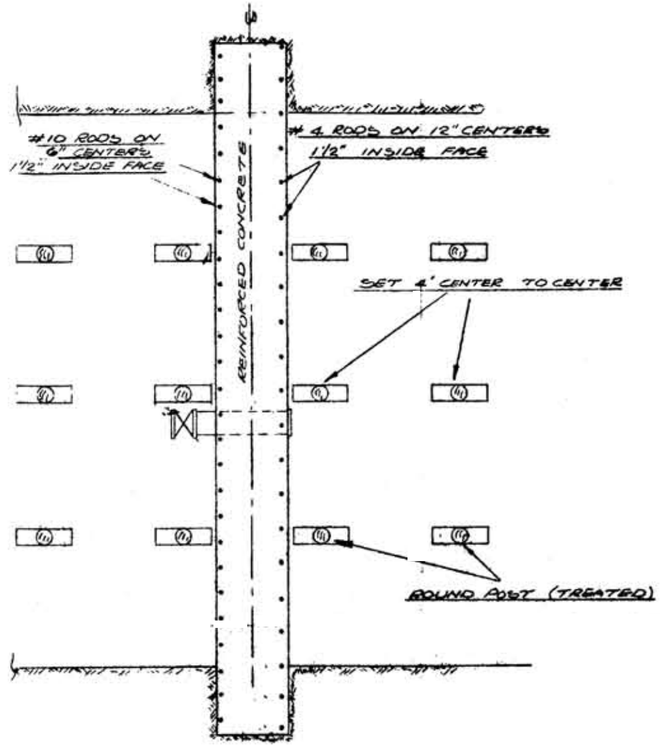
Lloyd Robinson	Locomotive operator
Kenneth Parrish	Locomotive operator
George Wilson	Locomotive operator
William Atchinson	Locomotive operator
Joseph Obradovich	Locomotive operator
George Kotch	Locomotive operator

Persons present during interrogation

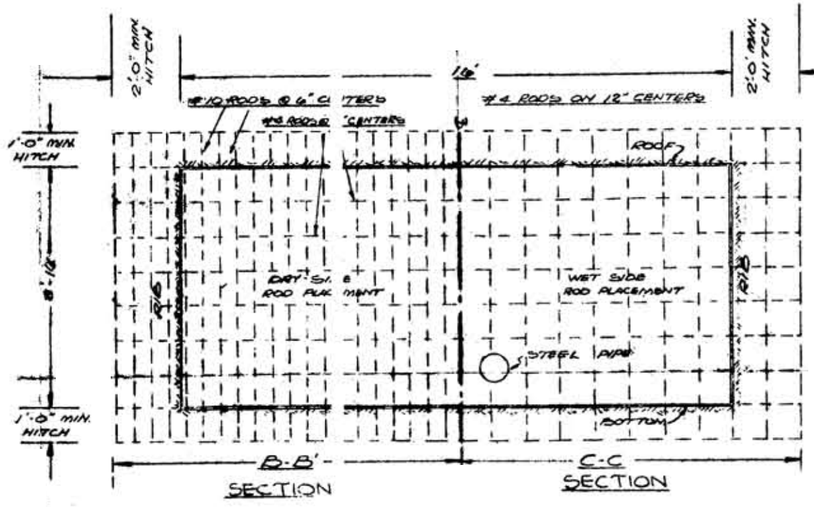
F. Aliucci	Manager of Mines, The Buckeye Coal Company
M. M. Fitzwater, Jr.	Superintendent, Nemacolin mine
W. P. Hanley	Assistant Superintendent, Nemacolin mine
D. Leroy Waggett	Resident Engineer, The Buckeye Coal Company
Dan Stickler	Attorney-at-Law, appearing on behalf of The Buckeye Coal Company

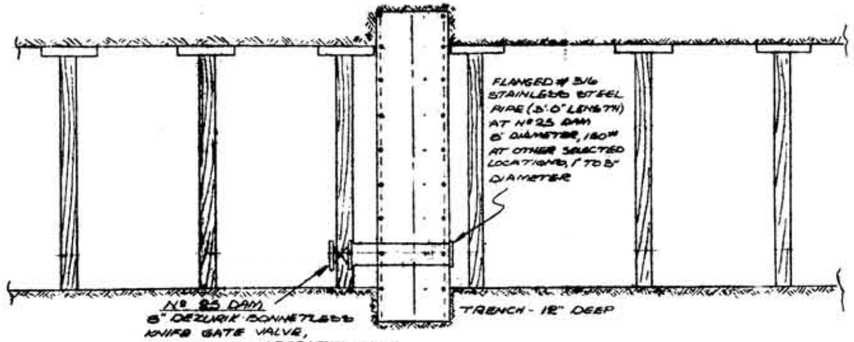
Anthony Stock	Safety Coordinator, District 4, United Mine Workers of America
Frank Bialko	Chairman, Safety Committee, United Mine Workers of America
Thomas Walters	Member, Safety Committee, United Mine Workers of America
Joseph Sokol	Member, Safety Committee, United Mine Workers of America
Joseph S. Bochna	Coal Mine Inspection Supervisor, U.S. Bureau of Mines
Willis E. Cupp	Coal Mine Inspection Supervisor, U.S. Bureau of Mines





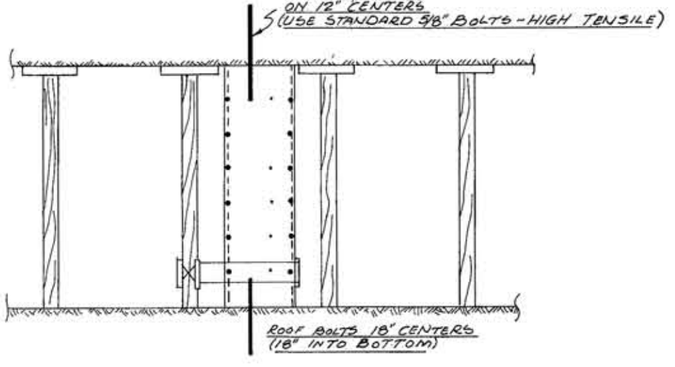
LENGTH OF RODS WILL DEPEND ON THE WIDTH AND HEIGHT OF ENTRY AND DEPTH OF HITCHES AS DETERMINED IN THE FIELD BY THE ENGINEER.





No 25 DAM
8" DEZURIK BONNETLESS KNIFE GATE VALVE, HANDWHEEL OPERATED WITH TYPE 316 VALVE BODY OR APPROVED EQUAL.-

OTHERWISE 1" TO 3" DEZURIK BONNETLESS KNIFE GATE VALVE (OR APPROVED EQUAL) WILL BE USED AT SELECTED LOCATIONS. - EVERY 5TH DAM.



SECTION A-A'

APPENDIX F

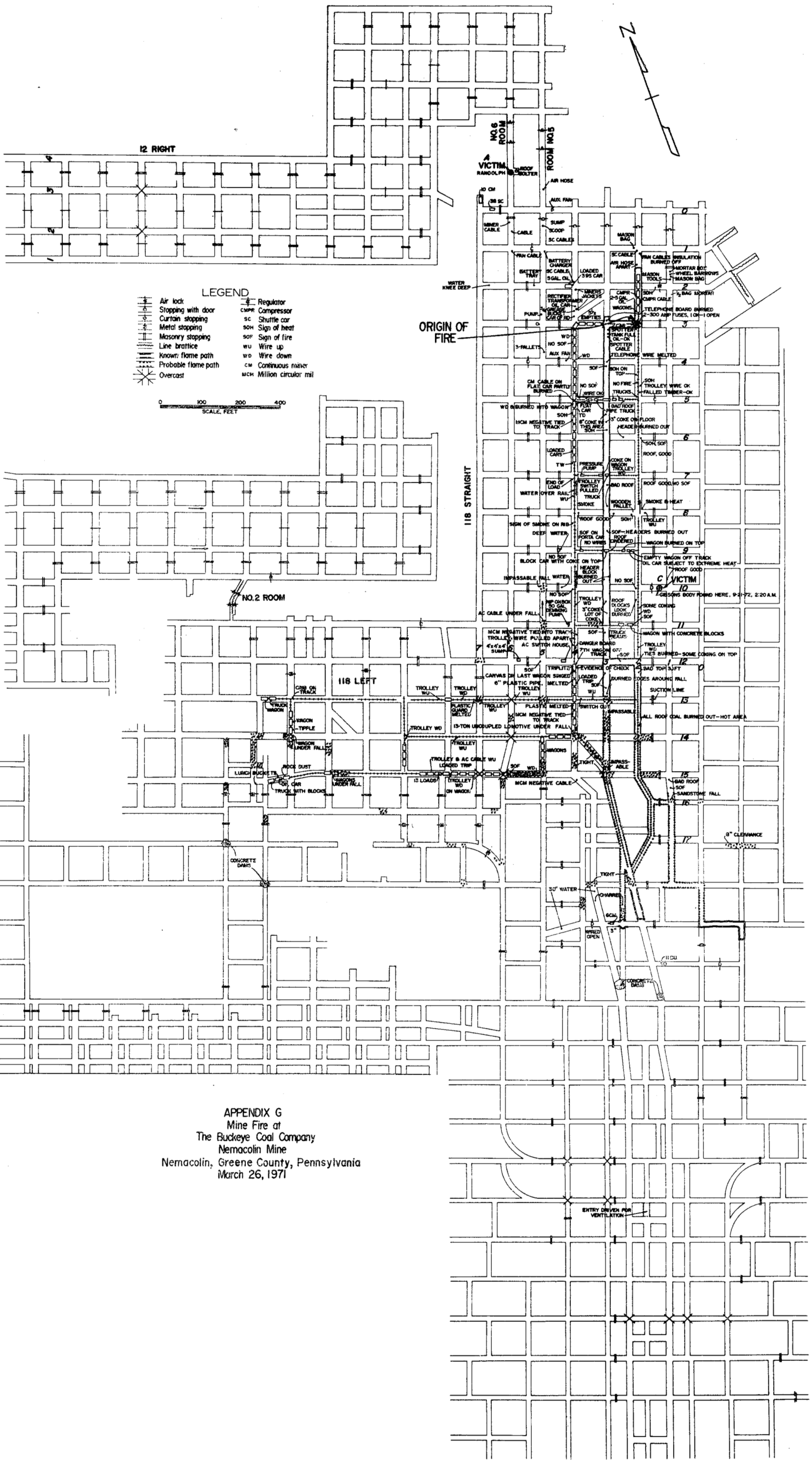
PROPOSED DAM DESIGN
NEMACOLIN MINE
THE BUCKEYE COAL COMPANY

SCALE 1" = 2 FT

JULY 1971

JOHN T. BOYD COMPANY
MINING ENGINEERS

EXHIBIT 2 (ALTERNATE)



APPENDIX G
Mine Fire at
The Buckeye Coal Company
Nemacolin Mine
Nemacolin, Greene County, Pennsylvania
March 26, 1971

Appendix H.--Investigating Committee

The investigation was conducted by the "Four Agencies" and those present during the investigation were:

The Buckeye Coal Company

M. M. Fitzwater, Jr.	Superintendent
W. P. Hanley	Assistant Superintendent
Frank Jurczak	Maintenance Supervisor

United Mine Workers of America

Anthony Stock	Safety Coordinator, District 4
Frank Bialko	Mine Safety Committeeman
Thomas Walters	Mine Safety Committeeman
Joseph Sokol	Mine Safety Committeeman

Pennsylvania Department of Environmental Resources

S. A. Fredrick	Mine Fire Commission
J. J. Hunter	Mine Fire Commission
Joseph Reggianni	Mine Fire Commission
P. H. Hyatt	State Deep Mine Inspector
Stephen Marsinek	State Deep Mine Inspector (Electrical)

U.S. Bureau of Mines

Alex O'Rourke	Supervisory Mining Engineer
Joseph S. Bochna	Coal Mine Inspection Supervisor
Willis E. Cupp	Coal Mine Inspection Supervisor
Ralph I. Krek	Coal Mine Inspector (Electrical)
Gerald E. Davis	Coal Mine Inspector (Electrical)
Charles Daruda	Coal Mine Inspector (Electrical)
Kenneth D. Brady	Coal Mine Inspector (Electrical)
Edward M. Kawenski	Chief, Industrial Safety Group, PTSC
George A. Price	Mining Engineer, PTSC

Appendix I.--Maximum Waterhead (Feet) and Pressure (p.s.i.) on Dams, 118 Fire Area

Dam No.	Elevation bottom of seam (feet)	Maximum[1] H_2O head (feet)	Maximum[2] pressure p.s.i.
1	596	21	9.1
2	592	25	10.9
3	588	29	12.6
4	586	31	13.5
5	585	32	13.9
6	585	32	13.9
7	586	31	13.5
8	588	29	12.6
9	590	27	11.7
10	592	25	10.9
11	593	24	10.4
12	595	22	9.6
13	594	23	10.0
14	593	23	10.0
15	593	23	10.0
16	593	23	10.0
17	593	23	10.0
18	591	26	11.3
19	591	26	11.3
20	591	26	11.3
21	590	27	11.7
22	588	29	12.6
23	588	29	12.6
24	578	39	16.9
25	576	41	17.8

1/Maximum elevation = 604 bottom of seam, plus 7 feet (seam height) plus 6 feet. Possible fall = 617 feet.

2/Maximum H_2O head = maximum head feet x $\frac{62.434}{144}$ (.434) = p.s.i. (pressure)