UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DISTRICT C

FINAL REPORT OF MAJOR MINE FIRE DISASTER

NO. 22 MINE
ISLAND CREEK COAL COMPANY
PINE CREEK, LOGAN COUNTY, WEST VIRGINIA

March 8, 1960

By

William R. Park
District Supervisor

James T. Whalen
Federal Coal-Mine Inspector

William M. Cordray
Federal Coal-Mine Inspector

Originating Office - Bureau of Mines
Mount Hope, West Virginia
W. R. Park, District Supervisor
Health and Safety District C

CONTENTS

FINAL REPORT OF MAJOR MINE FIRE DISASTER

NO. 22 MINE
ISLAND CREEK COAL COMPANY
PINE CREEK, LOGAN COUNTY, WEST VIRGINIA

March 8, 1960

By

William R. Park
District Supervisor

James T. Whalen
Federal Coal-Mine Inspector

William M. Cordray
Federal Coal-Mine Inspector

INTRODUCTION

A mine fire was discovered at 8:30 a.m., Tuesday, March 8, 1960, immediately inby the 3-left overcast on the west-main haulageway in the No. 22 mine of the Island Creek Coal Company. As a direct result of the fire, 18 men died from asphyxiation and/or carbon monoxide poisoning. Two men escaped from the No. 4 unit section (4 left barrier) 1,600 feet inby the fire area, and 30 other men were in scattered sections of the mine outby the fire area. All men were withdrawn from the sections outby the fire; these men assisted with the recovery and fire-fighting operations. Sixteen men died while traveling inby from the fire area and their working sections in the direction of the Elk Creek slope (See Appendix C). These men had erected a partial brattice-cloth barricade 950 feet inby the junction of 4 left and west main entries and approximately 3,500 feet inby the fire area. Two other men died near the entrance to the No. 7 unit section, 1,700 feet inby the fire area.

A mining-machine operator was killed June 15, 1960, by a fall of roof in a set of three entries being driven in the left barrier to encircle the fire area to permit the installation of permanent seals on the inby end of the fire area; no other person was seriously injured in the fire-fighting and sealing operations. A separate report has been written on the investigation of the roof-fall fatality.

The names of the victims, their ages, marital status, occupations, and the number of their dependents are listed in Appendix D of this report.

Bureau of Mines investigators believe that the fire originated on the west-main haulageway immediately inby the 3-left overcast, when dry wooden crossbars and posts were ignited by electric arcs or flame from the trolley wire.

GENERAL INFORMATION

The No. 22 mine, at Pine Creek, Logan County, West Virginia, is served by the Chesapeake and Ohio Railway. The operating officials of the Island Creek Coal Company on March 8, 1960, were:

R. E. Salvati	President	Huntington, West Virginia
J. L. Hamilton	Executive Vice President	Huntington, West Virginia
N. T. Camicia	Vice President and General Manager of Operations	Holden, West Virginia
R. M. Johnson	Manager of Mines	Holden, West Virginia
D. E. Bayer	Director of Development	Holden, West Virginia
T. H. Strunk	Holden Division Manager	Holden, West Virginia
Claude Smith	Superintendent	Pine Creek, West Virginia
C. E. Linkous	Safety Director	Holden, West Virginia
M. B. Collier	Mine Foreman	Pine Creek, West Virginia

A total of 129 men, 96 underground and 33 on the surface, was employed on 2 shifts a day, 5 days a week, and produced a daily average of 2,300 tons of coal, all loaded mechanically. Production for 1959 was 853,253 tons of coal. The last Federal inspection prior to the disaster was made December 7-11 and 14, 1959. Access into the mine was through a slope and 3 shafts. The slope, (Elk Creek) 525 feet in length on a 16-degree pitch, had been used as an escapeway and intake airway. The 3 shafts were namely, a coal-hoisting shaft, a man-and-material hoisting shaft, and a return air shaft. The return air shaft was 210 feet in depth; the other 2 shafts were approximately 483 feet in depth. Mining was being done in the high-volatile bituminous Cedar Grove coal bed, which averaged 60 inches in thickness in the areas being mined.

The immediate roof was unconsolidated shale that varied from 0 to 42 inches in thickness and contained numerous slips and slickensided formations. Occasionally, the immediate roof was sandstone that contained coal streaks. A "coal rider" ranging from 2 to 4 inches in thickness was present above the shale roof. Main roof was sandstone.

A small fire occurred in this mine November 28, 1958; it was extinguished the same day. The coal and adjacent strata are not subject to spontaneous ignition.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods: A room-and-pillar method of mining was followed. Multiple entries, in sets of 5 to 8 and turned at various intervals, were driven 22 feet wide on 50- to 100-foot centers. Rooms were 20 to 28 feet wide and crosscuts were made at intervals of approximately 80 feet. Pillars had been partially recovered; however, recent mining in the continuous miner sections, 2 right and Nos. 4 and 7 sections, west-main barrier, consisted of developing rooms in the main barrier and then extracting the remaining blocks of coal. The blocks of coal measured

80 feet in length by 80 feet in width, and a step system of mining was employed to recover such coal. Working places were driven 16 feet wide. Two rows of straight posts on 4-foot centers were installed to within 36 inches of the faces of the miner working places. Roof bolts, 5/8-inch in diameter and 30 to 72 inches in length, were installed on 4-foot centers to within 4 feet of the faces. The straight posts were removed after the bolts were installed. This method of roof support was also used to support the roof in the pillar lifts, except that a minimum of 2 rows of breaker posts on 4-foot centers were installed on the open end of the pillar lift, and a minimum of 4 cribs were installed on each side of the push-out before recovering the push-out blocks. In the conventional loading sections, the roof-support plan required roof bolts to be installed on 4- to 5-foot centers to within 4 feet of the faces and a row of permanent posts to be set on 4-foot centers, in the center of the working places, to within 20 feet of the faces, maintaining two 13-foot-wide roadways in the 28-foot-wide rooms. In the face areas, 1 row of posts was required along each side of the working place with at least 3 safety posts to be set near the faces. In the other sections of the mine, the conventional timbering plan required posts or crossbars to be set on 6-foot centers under favorable roof conditions and on closer centers where the roof appeared to be weak. At least two safety posts were required to be used near the faces inby the last permanent posts or roof bolts. Roof bolts were used in all sections of the mine and were supplemented with a row of posts on 6-foot centers along each side of the roadways. These posts were topped with cap pieces. Expansion and wedge-type anchor bolts 30 to 72 inches in length and 5/8 and 1 inch in diameter were installed. The bearing plates were 6 by 6 inches by 1/4 or 3/8 inch. Additional bearing support was provided where the bolted roof was of a "cloddy" or flexible nature; this consisted of a wooden half header 2 by 8 by 30 inches placed above the steel bearing plate. Also, 2 by 8-inch by 16-foot crossbars were used. The holes for roof bolting were drilled dry with percussion drills, equipped with permissible dust collectors. The air for the drills at the faces was supplied by pipe lines from a central compressor station on the surface. A portable compressor was used to provide air for drilling holes for bolting along the haulageways. The west main entries in the vicinity of 3 left entries (fire area) were driven before bolting was begun in the mine; consequently, roof along the west-main haulageway in the fire area had been supported by 7 by 9-inch by 16-foot crossbars installed almost "skin to skin".

Explosives and Blasting: Explosives and detonators were stored on the surface in separate magazines, transported underground in special cars, and stored in suitable section boxes. Explosives were carried from the section boxes to the faces in suitable containers. Blasting was done on shift with permissible explosives, fired with permissible single-shot blasting units. The shot holes were fired singly immediately after charging by authorized shot firers. Molded clay was used for stemming. The shot firers made tests for methane and examined the roof before and after each shot was fired. Searches for fire were made after blasting.

Ventilation and Gases: Ventilation was induced by one electrically driven axial-flow fan, operated exhausting, and circulating through the mine approximately 190,000 cubic feet of air a minute. An additional fan, formerly in use, was provided at the Elk Creek slope. The main fan was operated continuously, installed in a fireproof structure on the surface, offset from its mine opening, provided with explosion doors, a recording pressure gage, and a device to give alarm should the fan slow down or stop. Overcasts and permanent stoppings were constructed of incombustible material, and temporary stoppings were constructed of lumber and/or brattice cloth. Check curtains and line brattice were used to conduct air in the face regions. Ventilation doors were installed in pairs to provide air locks for final mining of the main barriers. The quantities of air reaching the last open entry crosscuts and intake ends of pillar lines during the December 1959 Federal inspection was more than 7,000 cubic feet a minute. The last measured quantity of air passing under the overcast at 3 left entries was 64,500 cubic feet a minute, as the area of the overcast and the area immediately inby the overcast was restricted. As compared with the greater part of the haulageway, a high velocity air current passed through this area. The fast moving air current in the fire area aided considerably in the rapid spreading of the fire.

The mine is classed gassy by the West Virginia Department of Mines and by the Bureau of Mines. During the December 1959 Federal inspection, the mine was liberating methane at a calculated rate of 232,000 cubic feet in 24 hours. Suitable preshift, on shift, and weekly tests for methane and examinations for dangers were made and recorded by certified officials.

General Conditions: The mine ranged from wet to dry. An excessive amount of dust was not raised into the air during mining operations. Water was used to allay dust at the underground dump and during cutting and loading operations with the continuous miners. The mine surfaces, including the haulageways and parallel and back entries, appeared to be rock-dusted adequately, and the applications were within 40 feet of the faces at the time of the December 1959 Federal inspection.

Transportation: Coal was transported from the faces to car-loading elevators by cable-reel shuttle cars and in mine cars to the underground dump at the coal-hoisting shaft, and then hoisted to the surface in 15-ton capacity skips. The cars were hauled by trolley locomotives. The tracks and rolling stock were maintained in good condition, and the clearance space along the haulageways was free of obstructions. Clearance points at sidetracks and turnouts were indicated by "markers". Unobstructed shelter holes were provided along the roadways and ample clearance was provided at the entry switches.

A fire boss making the preshift examination of the mine on March 8, stopped at the 3-left overcast and examined the overcast and the haulage road area immediately inby; he found nothing unusual or hazardous at these locations. The fire boss mentioned that he had

stopped and examined these areas for some time, as the area was "taking weight", which was resulting in heaving bottom and occasionally broken timbers. Height of the haulageway immediately inby the overcast was less than 48 inches; the fire boss stated that there was less height immediately inby the overcast than at any other location along the haulageway. Testimony of haulage crews and others who traveled the main haulageway showed that the trolley-pole harp had been contacting the steel frames of mine cars at this location occasionally for some time previous to the fire of March 8. Several motormen testified that their trolley-pole harps contacted the steel mine cars at the 3-left overcast nearly every time they traveled inby with empty mine cars for several months previous to March 8. A motor crew also testified that on March 3, 1960, their trolley-pole harp contacted the steel mine cars at a point immediately inby the 3-left overcast, and the resultant arcs and sparks ignited an empty paper rock-dust bag and a piece of a timber lying along the haulage road. This material was extinguished by a member of the motor crew with rock dust and water. Management officials stated that this fire was not reported to them and they had no knowledge that such a fire had occurred until the fire of March 8. Standing cars were secured with effective holding devices. The hoist at the man shaft was provided with the required safety devices.

Men were transported underground in special self-propelled man-trip cars and in regular solid-bottom mine cars, and suitable man-trip waiting stations were provided. Special self-propelled cars were provided for transporting a few men at a time, such as officials, inspectors, and repair men. Haulage operations were directed by dispatchers using trolley and standard telephone systems. In addition, switch-operated signal lights were installed at the main-line switches.

Electricity: Electric power, 110, 220, 440, and 2,300 volts alternating current, was used on the surface, and 250 volts direct-current power and 440 volts alternating current was used underground. The direct current was supplied from four 300 KW and one 200 KW rotary converters with overload settings of 1,800 to 2,000 amperes and was used to operate the haulage and face equipment. Three 300 KVA dry-type transformer units were used to reduce the 4,160 volts alternating-current power to 440 volts alternating-current power for operation of three permissible-type continuous miner machines. Two 1,000,000 circular mil positive and two 1,000,000 circular mil negative insulated feeder lines and three 4/o shielded-type single conductor, fire resistant cables entered the mine through 6-inch cased boreholes from the surface. Oil circuit breaker switches for the alternating-current power lines were located at the bottom of the boreholes. Power was then conducted to the transformers by 2/o 3-conductor, fire resistant, shielded-type cables, containing grounding conductors. All of the oil circuit breakers were equipped with ground-tripping arrangement rated from 4 to 7 amperes. The 6/o trolley line, 1,000,000 circular mil feeder lines, and power wires were installed on insulators and sectionalized with cut-out switches, installed at intervals of approximately 2,000 feet. The electric face equipment was of the permissible and nonpermissible types and the

permissible-type equipment was in permissible condition at the close of the December 1959 Federal inspection; the nonpermissible-type equipment was in use prior to July 16, 1952. The trailing cables on the mobile equipment were fire-resistant, and the cables and the mobile equipment were provided with circuit-interrupters and fused "nips" for overload protection.

Tests for methane were made with a permissible flame safety lamp before the electrically driven equipment was taken into or operated in the face regions, and at frequent intervals while such equipment was operated at the working faces.

Illumination and Smoking: All persons used permissible electric cap lamps for portable illumination underground. Smoking was not permitted or observed underground, and searches for smokers' articles were conducted frequently.

Mine Rescue: A mine-rescue team was not maintained at the mine; however, a fully equipped and trained team was maintained at the company's mine rescue station at Holden, West Virginia. Fully equipped and regularly trained mine-rescue teams were also available at the Rock House, Wyoming, Guyan, Bartley, West Virginia, and Evanston, Kentucky, divisions of the company. Several other mine-rescue teams and a fully equipped State mine-rescue truck were within a 25-mile radius of the mine. Self-rescuers were carried by some of the underground employees. Adequate escapeways were not available from two working sections to the surface. As a result of final barrier extraction, caving, and hooved bottom, escapeways, other than haulageways from Nos. 4 and 7 sections, were not in reasonably safe condition for travel. Sufficient direction signs were not posted to indicate the travelable manways and designated escapeways. The check-in and check-out system provided positive identification upon the person of each individual underground. The fire-fighting equipment consisted of supplies of rock dust and fire extinguishers in each section and at strategic points throughout the mine. A track-mounted chemical truck and a 1,000-gallon capacity water car, equipped with a pressure pump, were kept readily available underground.

STORY OF FIRE AND RECOVERY OPERATIONS

Participating Organizations: Officials of the several organizations who took part in the direction of the recovery work include: R. E. Salvati, president, J. L. Hamilton, executive vice president, N. T. Camicia, vice president, R. M. Johnson, manager of mines, D. E. Bayer, director of development, and C. E. Linkous, director of safety and mine inspection of the operating company; Charles A. Neal, vice president of District 17, Jerry Stidman, chief, field representative, District 17, Robert Browning, field representative, District 17, and Louis Schuler, assistant to the safety director, United Mine Workers of America; Crawford L. Wilson, director, and Paul Lingo, deputy director, West Virginia Department of Mines; and James Westfield, assistant director, and W. R. Park, district supervisor, Bureau of Mines.

A State maintained mine-rescue team from Amherstdale, a mine-rescue team made up of State inspectors, and mine-rescue teams from the Bartley, Guyan, Wyoming, Holden, Rock House, and Elkhorn Division of Island Creek Coal Company assisted with the recovery operations.

Activities of Bureau of Mines Personnel: Company officials notified the Logan office of the Bureau of Mines of the fire about 10:15 a.m., March 8, 1960. Inspector Whalen informed the Mount Hope office of the Bureau of Mines of the fire about 10:20 a.m., and then proceeded to the mine. Federal Inspectors William Cordray, Hobart Jarvis, Thomas Gay, and Paul Akers arrived at the mine shortly thereafter; they were briefed as to the location of men and the fire. After briefing, these men entered the mine and assisted with underground activities. As fire-fighting operations, exploration of the affected areas, loading of fire materials, and sealing operations progressed, additional Bureau representatives assisted with the several activities. These men who worked several days to several months were: James Westfield, W. R. Park, Thomas Allamon, R. C. DeWeese, J. A. Woods, Paul Tisdale, Robert Cain, Robert Brown, Anthony Fumich, Frank Furin, Sylvester Gaspersich, Robert Calvert, Maurice Childers, Fred Kemrite, and W. B. Michael. One or more Bureau representatives assisted during each shift with all exploratory work, recovery of the bodies, loading of hot materials, and sealing of the fire area. The fire area was sealed completely July 10, 1960.

A high-expansion "foam plug", formed by spraying a dilute solution of ammonium lauryl sulfate in water on a lace knitted curtain stretched across the No. 4 entry of west mains at the 3-left overcast, was forced into the fire area by air pressure. The equipment for the foam plug was installed and operated by Don Mitchell and Anton Loger of the Bureau of Mines. The foam plug penetrated the tightly caved fire area for a lineal distance of 350 feet. The tightly caved fire area prevented a quick or an adequate evaluation of the effect in the fire area of the foam plug.

Evidence of Activities and Story of Fire: The day-shift crew, (7:30 a.m. to 3:30 p.m.), consisting of 52 employees, left the surface about 7:30 a.m., Tuesday, March 8, 1960, and were lowered by cage through a shaft into the mine. About 7:35 a.m., two production crews, consisting of 15 men, including officials, left the shaft bottom in special self-propelled man cars for No. 4 left barrier and No. 7 right barrier sections. These man-trips were followed about 4 or 5 minutes later by the two section haulage men, each operating a "light" locomotive; a track crew, consisting of 3 men, shortly thereafter followed the "light" locomotives with a locomotive and 3 tool cars enroute to No. 7 section. Twelve of the remaining 32 underground employees were engaged in the production of coal in 2 right section outby the fire area; 20 employees engaged in haulage and maintenance left the man-shaft bottom for their respective work areas shortly after the man-trips.

The Nos. 4 and 7 section locomotives, operated by Clyde White and Garfield Hensley, followed the Nos. 4 and 7 man-trips to No. 4 sidetrack, located just outby 3 left entries. White and Hensley had orders to take 10 empty mine cars from the No. 4 sidetrack to No. 7 section. White and Hensley followed their instructions and had reached their working sections when the fire was discovered at 8:30 a.m. A few minutes after White and Hensley left the shaft bottom with "light" locomotives, a 3-man track crew, consisting of Frank Ardis, Okey Bryant, and Roy Dempsey, followed with a locomotive and 3 tool cars enroute to No. 7 section. The track crew pushed the 3 cars from the shaft to the No. 7 section, and therefore, they did not travel as rapidly as the "light" locomotives. The Nos. 4 and 7 section man-trips reached their respective working sections without incident, and these crews were producing coal when they learned of the fire.

Three mine electricians worked in the No. 7 barrier section during the 12:00 midnight to 8:00 a.m., shift, March 8. These men worked their shift repairing the face electrical equipment and greasing. They were a few minutes later than usual leaving the section on the morning of March 8, and they called the haulage dispatcher and asked for travel instructions about 7:40 a.m. The dispatcher instructed the electricians to travel to 3 left entries and wait in 3 left until the Nos. 4 and 7 section man-trips passed. The three electricians traveled in a locomotive and a mine car. When the man-trips passed the entrance to 3 left, one of the electricians called the dispatcher and asked for clearance to the shaft bottom after advising that the two man-trips had cleared 3 left. The dispatcher instructed the electricians to wait until the two "light" locomotives and the track crew were clear of 3 left and then proceed to 2 right and clear the main haulage road. The 2 section locomotive operators switched 10 empty mine cars from the No. 4 sidetrack and proceeded towards No. 7 section. Motorman Garfield Hensley hauled the 10 empty mine cars and motorman Clyde White followed a short distance back of the last car. Electrician Shelby Wheeler was on the main haulageway at the 3-left switch observing the locomotives and cars as the two motormen traveled inby. As the lead locomotive hauling the mine cars reached the 3-left overcast, a large electric arc or flash occurred that filled the entry from rib to rib. The electric arc and flash appeared to begin on the trolley-wire side of the entry. Motorman Hensley did not stop his trip and motorman White following two or three car lengths behind the trip failed to stop and continued inby the overcast. Although the electricians did not know what caused the large flash of flame and arc, they did not investigate because the two locomotives continued traveling inby without interruption. Examination of the two section locomotives in July 1960 showed that the trolley pole immediately adjacent to the trolley harp on the No. 25 locomotive had been burned and charred. Also, an electrical blister was present on the harp casing. The trolley pole and harp on the No. 27 locomotive did not show evidence of burning or charring. After the two section locomotives and the track crew cleared the 3-left switch, the electricians traveled to 2 right entries where they waited about 10 minutes until the

main-line locomotive passed. Immediately after the main-line locomotive and trip of 85 mine cars cleared the 2-right switch, the three electricians traveled on to the shaft bottom. The dispatcher's record for March 8 shows that the main-line locomotive, operated by Bernie Carter, left the shaft bottom at 8:05 a.m., with 85 mine cars enroute No. 4 sidetrack, which is about 2 miles inby the shaft bottom. Carter arrived at No. 4 sidetrack without mishap, but then had to wait for a locomotive to return to the sidetrack to help clear the main line. While waiting for a locomotive, Carter began filling the sand boxes on his locomotive. During the filling of the sand boxes, Carter saw a locomotive traveling on the main haulageway inby 3 left entries and he then heard a noise which he thought was made by loading or unloading of tools into or out of a mine car. The locomotive appeared to have stopped just inby the 3-left overcast. When the locomotive appeared to have been stopped at the overcast for about 4 or 5 minutes, Carter called the dispatcher and asked if anyone was supposed to be working at the overcast; Carter was advised that no one was to be working at that location. The locomotive after about a 4- or 5-minute stop proceeded inby. About 5 minutes after the locomotive left the overcast area, Carter observed a light or flame in the area. Carter called the dispatcher by phone immediately and informed him that he was going to check the flame or light. Almost immediately thereafter, Carter advised the dispatcher that a fire was burning just inby the 3-left overcast. The fire appeared to have started on the trolley-wire side of the haulageway about 5 feet inby the 3-left overcast. The fire had spread along 4 or 5 wooden crossbars, the supporting legs, and the accumulations of dust on the ribs. The dispatcher instructed Carter to move the trip of empty cars and get the chemical fire truck to the fire.

The locomotive and mine cars that Carter observed at the 3-left overcast were being used by a 3-man track crew. It will never be known why the track crew stopped at the 3-left overcast, and no one will ever know what activities or duties were performed by the track crew at the location. It is possible that the trip or part thereof was derailed at the overcast location, and the noise heard by the main-line motorman was caused by the rerailing of the cars; it is also possible that the crossbars and legs were ignited by arcs or sparks from the trolley wire during the derailment and the noise was made by the crew attempting to extinguish the fire. Examination of the locomotive used by the track crew showed that the trolley pole adjacent to the harp was burned and charred, and the pole cable was in two parts. The locomotive and cable were energized by wrapping several strands of feeder wire cable around the harp casing and then fastening these wires to the pole cable. The cable blow-up, repairs to the cable, and igniting of the roof supports could have caused the trip stop at the overcast. Another possible explanation for the track-crew stop at the overcast is that they observed flame or smoldering fire resulting from the arcs and sparks made by the locomotive crew that preceded them. If the observance of fire was the reason for the track-crew stop, the crew failed to extinguish the fire completely, as it was relatively large when discovered by Carter (main-line motorman) about

5 minutes after the track crew left the location. Mose Collier, mine foreman, who was on the surface, was informed of the fire; Collier immediately instructed the dispatcher to have the doors in 3 left opened and the power disconnected. Immediately after Carter advised the dispatcher of the fire, the dispatcher and Carter were in conversation by trolley phone with Clyde White, motorman, who was inby the fire. The dispatcher instructed White over the trolley phone to travel outby the fire and help Carter procure the fire truck and fight the fire. White replied that he would help Carter immediately but shortly thereafter, he informed the dispatcher that the fire was too large for him to travel through it. White was then advised by the dispatcher to proceed to and take the men from No. 7 section to No. 4 section and get in touch with Bill Donaldson, safety engineer, and go to fresh air. About this time, the electric power was "cut off" and there was no further communication with anyone inby the fire.

Claude Smith, superintendent, and Mose Collier, mine foreman, arrived on the scene and took charge of the fire-fighting operations. An 80-gallon chemical truck and a water-car were moved to the scene of the fire where water and chemicals were applied until the supplies were exhausted. A high-pressure rock-dusting machine was moved up and rock dust applied; however, very little headway was made in controlling the fire along the heavily timbered entry. The roof material fell as the burning crossbars collapsed. A 5-inch compressed air line lying parallel to the haulage track was shut off after it ruptured because of the heat. Smith and Collier arrived at 3 left about 20 to 30 minutes after the fire was discovered. Smith and Collier estimated that the fire had spread along the haulageway for a distance of about 80 feet when they arrived at the scene. The air line was disconnected at 2 right and water was obtained by tapping the 5-inch line and starting a 600 gallon-a-minute pump located at a "sump" in 2 right. Fittings and materials were assembled and a 3-inch diameter water hose was laid to the fire area by 11:00 a.m., the same day. Water was directed on the burning material, which had fallen to a height of about 4 feet and for a distance of about 200 feet. A temporary stopping was erected across the haulageway outby the fire area to exclude as much as possible air from passing over the fire. Later, an additional 3-inch water line was laid to the fire area.

Recovery Operations: About 12:25 p.m., on the day of the fire, Kyle Blair, continuous-miner operator and Willis Carter, ventilation man, each of whom had been working in the No. 4 left barrier section inby the fire, arrived at the junction of the main haulageway and 3 left entries where they met men fighting the mine fire. Carter and Blair learned of the fire while loading coal at the face of a working place in No. 4 section; they traveled to the mouth of the section where they found the men with Donaldson, safety engineer, and Josh Chafin, section foreman. There was much discussion between Carter and Donaldson about the possibility of escaping through the Elk Creek slope. Carter

maintained that it would not be possible to travel to the slope, as the west main entries between the slope and their location was closed. Donaldson listened carefully to Carter's statements concerning escape routes and then instructed Josh Chafin to take his crew and travel towards the Elk Creek slope. Donaldson advised Chafin further that he would travel to No. 7 section and bring the No. 7 section crew towards the slope. Before Donaldson left for No. 7 section, Carter advised Donaldson that he and Blair were going to try to escape through Nos. 1 and 2 entries of the west main entries, that they would travel through a small regulator opening into 4 left entries, and then travel to the mouth of 4 left entries where they would open the large air lock doors; thereby short-circuiting most of the air and the smoke from the fire. Donaldson agreed that "shorting" the air and smoke into 4 left entries would be helpful. Carter and Blair then left Donaldson and the other men and traveled to 4 left entries. Heavy smoke was encountered when the door at the 4-left overcast was opened and considerable smoke was encountered in Nos. 1 and 2 entries of west main entries inby the air-shaft headings, a distance of about 1,200 feet (see Appendix B). After passing the air-shaft headings, Carter and Blair found the air of good quality; however, extensive falls of roof in Nos. 1 and 2 entries made travel slow, difficult, and hazardous. After traveling a distance of about 3,000 feet in several hours, Blair and Carter arrived at the entrance to 3 left entries about 12:25 p.m., without injury. Carter and Blair mentioned that they stopped several times to rest and to determine if possible whether they were outby the fire. None of the other employees, 18 men, entrapped by the fire escaped.

About 1:15 p.m., March 8, a party of State and Federal inspectors and company officials entered the mine through the Elk Creek slope, which had been closed with a stopping fitted with a man-door several months prior to the fire. The door was opened to permit about 47,000 cubic feet of air a minute to enter the mine and enable the crew to explore the area and determine conditions therein. This party traveled about 900 feet along the west main entries, when they were forced to withdraw because of hooved bottom, standing water, and concentrations of carbon monoxide. Before leaving for the surface, changes were made to divert the intake air from west mains to the main fan through 5 left entries. A second trip was made through the Elk Creek slope about 5:00 p.m., of the same day to explore further, but the crew returned to the surface and no further attempts were made to enter the Elk Creek slope opening. During the evening of March 8, tapping sounds were made on the borehole casing from the surface to the underground workings about 2,000 feet from the fire area, but there was no response. The Nos. 1 and 2 entries of the west main entries were originally used as return airways; however, these entries were changed to intake airways previous to the fire and they were to be used as escapeways and travelways. The No. 2 entry was separated from Nos. 3, 4, 5, and 6 entries by cinder-block stoppings. The Nos. 7 and 8 entries of west main entries were used

as return airways and were separated from No. 6 entry by masonry stoppings. Work was started on the evening of March 8 to advance in Nos. 1 and 2 entries of west main entries as far as possible inby the fire located on No. 4 entry; this work was done to permit travel inby the fire and permit the installation of temporary stoppings in Nos. 3, 4, 5, and 6 entries at locations inby the fire. Crews were also engaged in timbering No. 2 entry and in repairing and reinforcing the permanent stoppings in crosscuts between Nos. 2 and 3 entries adjacent to the fire area. A 3-inch plastic water line was connected to the 5-inch water line in No. 4 entry and then extended along the No. 2 entry. Two-inch branch water lines fitted with valves were tapped into the 3-inch water line and placed through the stoppings into the fire area. Test pipes equipped with valves were placed in the stoppings to determine the quality of air in the fire area. A rescue crew equipped with gas masks traveled in Nos. 1 and 2 entries for a distance of about 1,200 feet inby 3 left entries where they encountered difficult traveling because of roof falls, dense smoke, and concentrations of carbon monoxide. A rescue crew also attempted to travel through crosscuts from No. 2 entry to No. 4 entry inby the fire area; dense smoke and fumes prevented the crew from reaching No. 4 entry. A crew of men equipped with gas masks made a trip into the air-shaft headings and explored the area (see Appendix B). During this trip and about 510 feet inby the fire, smoke and heat were encountered when an opening was made in a stopping between Nos. 2 and 3 entries. During this period of exploration, a 2,000-foot section of 3-inch water line that had been originally connected into the 5-inch line outby 3 left entries was replaced with a 5-inch water line to increase the water supply in the fire area.

Because of the difficulty of traveling from 3 left entries through Nos. 1 and 2 entries of west main to the area inby the fire, providing supplies for the erection of checks, temporary stoppings, line curtains, and installing roof supports was slow, difficult, tedious, and hazardous. The absence of open travelable openings at the inby end of the fire made the containing of the fire at the inby end almost impossible. To facilitate the erection of temporary stoppings across the Nos. 3, 4, 5, and 6 entries of west main entries inby the fire, an attempt was made to reverse the direction of air flow through the fire area by directing the intake air to the inby end of the fire through Nos. 1 and 2 entries and returning such air over the fire through Nos. 3, 4, 5, and 6 entries and through a metal tubular overcast into 3 left entries (see Appendix A). The metal overcast and several stoppings near 3 left entries were installed outby the fire area and a regulated quantity of air was permitted to pass over the fire and through the metal tubes into the 3 left return airways. Unfortunately, although this change was beneficial, it failed to permit a complete air reversal through the fire area. While this ventilation change was being made, water was being applied to the fire area at all critical points and temporary stoppings were installed across Nos. 2 and 3 entries inby the fire area to divert the intake air to No. 4 entry. Temporary stoppings were erected in crosscuts between Nos. 4 and 5 entries for a distance of approximately 600 lineal feet in No. 4 entry inby the fire area. This work was accomplished by crews wearing gas masks. A fresh-air base (No. 5 station) was established on the haulageway (No. 4 entry) 500 feet inby the line of temporary stoppings.

Exploratory crews traveled Nos. 7 and 8 entries of 2 west main entries in intake air over heavy falls of roof for a distance of about 1,500 feet; at this location, they found both entries closed by wooden stoppings. Later, a crew returned and opened these stoppings, which permitted intake air to ventilate the active working places in No. 7 section. This crew, in their search of the area for the trapped men, found two full lunch buckets. The crew returned through Nos. 7 and 8 entries to the fresh-air base at 3 left entries. A gas mask crew reached the No. 7 section from No. 5 station on the haulageway at almost the identical time that the men traveling in intake air through Nos. 7 and 8 entries reached No. 7 section. During the same shift, a gas mask crew traveled the haulageway to the 4-left overcast, where 2 locomotives and a man-trip car were found. The working places in 4 left barrier section were explored before the crew returned to the fresh-air base. Shortly after these exploratory trips were made with gas masks, a fresh-air base (No. 6 station) was established on the haulageway (No. 4 entry) inby the entrance to No. 7 section (see Appendix B). Additional exploration trips in the 4 left section, the 4 left storage tracks, and No. 7 section confirmed the belief that the entrapped men had moved from and were not in these areas. Crews wearing gas masks or oxygen breathing apparatus continued making exploratory trips into open areas inby No. 6 station, and about 3:20 p.m., March 15, 1960, the bodies of 14 of the trapped men were located approximately 950 feet inby the junction of 4 left and west main entries, a distance of about 3,550 feet inby the fire area (see Appendix B). Only one of the men (the foreman Josh Chafin) had written a message; his message was to his family and it was attached to his safety lamp.

Recovery of the 14 bodies was begun immediately after the bodies were located; however, recovery was slow and hazardous as the removal of the bodies to No. 6 station was performed by crews wearing gas masks. While the rescue crews were engaged in preparing and carrying the bodies of the victims outby the fire area, other crews continued to explore Nos. 7 and 8 entries of west main entries inby No. 4 section. About 8:35 p.m., on March 16, 2 additional bodies were located in Nos. 6 and 7 entries approximately 120 feet inby the 14 bodies. During the afternoon of March 17, a rescue team probing in the vicinity of No. 7 section located the last two bodies of the trapped men in Nos. 5 and 6 entries of west main entries (see Appendix B). The body of the last victim was brought to the surface about 4:45 p.m., March 17, 1960.

Immediately after the bodies of the victims were brought to the surface, all work consisted of enclosing the fire area with masonry stoppings or seals. Such seals were completed in Nos. 3, 4, 5, and 6 entries inby the fire on March 25, 1960 (see Appendix A). After the final seal was completed in No. 6 entry inby the fire, all men were withdrawn from the mine for a period of 24 hours. On March 27, crews on a 3-shift a day, 7 days a week basis began loading out the burning fire materials at the 3-left overcast on No. 4 entry (haulageway).

Changes were made in the ventilation system in the fire area before loading operations were begun. The air current was reversed in direction and permitted to travel into No. 4 entry (fire area) and return inby the fire directly to the main fan. Air-lock doors were erected outby the 3-left overcast on the haulageway (No. 4 entry). A 24-inch metal pipe 120 feet in length equipped with a control damper was erected in No. 4 entry between the temporary seals and permanent seals at the inby end of the fire area; this provided means of controlling the amount of air over the fire during fire-fighting and loading operations. Loading of the burning material was started with a loading machine discharging into mine cars. The heat generated by the burning material had weakened the roof, which fell to a maximum height of 20 to 22 feet. Intensive heat in the area and fallen material retarded loading operations. A 36-inch metal pipe located near the roof and extended as loading advanced conducted the hot air directly to the new overcast and thence to the return airways (see Appendix A). As loading of the hot materials in No. 4 entry progressed and opened crosscuts off No. 4 entry, masonry dams were erected to contain and divert the water from Nos. 2 and 3 entries toward the burning material.

Hot materials, fire, smoke, and carbon monoxide were present in the loading areas from March 27 until June 9, when loading of the burning materials was discontinued. The fire material was removed from No. 4 entry for a distance of 400 feet (see Appendix B). At this time, it was decided that loading of the fire material should be discontinued, as the fire appeared to be traveling inby in Nos. 3, 4, 5, and 6 entries of west mains entries faster than the fire materials were being loaded. It was further decided that the fire area should be completely sealed as rapidly as possible. As either masonry seals or incombustible stoppings were erected in all entries, except No. 4 entry, outby the fire, between Nos. 2 and 3 entries and between Nos. 6 and 7 entries from 3 left entries to inby the fire, seals were needed only in Nos. 3, 4, 5, and 6 entries inby and in No. 4 entry outby the fire to completely close the fire area. As the only travelways from 3 left entries to inby the fire were restricted to difficult walking and/or crawling, it was decided that seals inby the fire could be installed most rapidly if a tracked haulageway was provided from 3 left entries to the west mains entries inby the fire. Accordingly, conventional loading machine crews began driving three entries through the left barrier pillar adjacent to west main entries from 3 left entries to a point inby the fire (see Appendix B). The driving of the entries was begun June 13 and completed July 10. Seals were completed in Nos. 1, 2, 3, 4, 5, 6, 7, and 8 entries of west main entries outby the fire while the barrier entries were being driven. Seals in Nos. 1, 2, 3, 4, 5, 6, 7, and 8 entries inby the fire were completed July 10, 1960. At the time of this report, work was in progress to recover the electric equipment from the Nos. 4 and 7 sections. Further mining plans for the mine had not been completed when this report was released.

During the recovery work and while the fire of March 8 was being combatted, it was reported by some of the workmen that a fire had occurred at about the same location at 9:30 p.m., on Thursday, March 3, 1960. Reportedly, the fire on March 3 occurred when the trolley-pole harp on a locomotive contacted the steel mine cars and caused an arc and flash which ignited an empty rock-dust bag and a partly broken and deteriorated timber. The fire of March 3 occurred when a locomotive was hauling 48 mine cars from No. 4 sidetrack to the Nos. 4 and 7 working sections. The operator of a locomotive following the 48 cars observed the burning material, and he stopped and extinguished the fire.

INVESTIGATION OF CAUSE OF FIRE

Investigating Committee: The underground investigation of the cause of the fire was begun March 8, 1960, continued intermittently, and completed July 22, 1960. Members of the official investigation committee were:

West Virginia Department of Mines

Crawford L. Wilson	Director
Paul Lingo	Deputy Director
Hobert Rice	Inspector-at-Large

Island Creek Coal Company

N. T. Camicia	Vice President and General Manager of Operations
R. M. Johnson	Manager of Mines
D. E. Bayer	Director of Development
Claude Smith	Superintendent
C. E. Linkous	Safety Director
M. B. Collier	Mine Foreman

United Mine Workers of America

Charles Ferguson	Safety Director
L. W. Schuler	Assistant to the Safety Director
R. O. Lewis	President, District 17
Charles A. Neal	Vice President, District 17
Jerry Stidman	Chief, Field Representative, District 17
Amos Williamson	Chairman - Mine Safety Committee Local Union No. 7063
Ott Linville	Member - Mine Safety Committee Local Union No. 7063
Theodore Cornett	Member - Mine Safety Committee Local Union No. 7063

United States Bureau of Mines

Marling J. Ankeny	Director
James Westfield	Assistant Director, Health and Safety
William R. Park	District Supervisor
James T. Whalen	Coal-Mine Inspector
William M. Cordray	Coal-Mine Inspector

Crawford L. Wilson, Director, West Virginia Department of Mines, conducted an official inquiry and investigation of the fire by interrogating a number of officials and employees of the company in the Recreation Building at Holden, West Virginia, March 22, 1960, and in the mine offices at Pine Creek, West Virginia, May 25, 1960. The purpose of the inquiries was to hear and record all testimony relevant to conditions and practices in the mine prior to and on March 8, 1960, and to determine therefrom if possible, the cause of the fire. Some of the information thus obtained is included in this report. Representatives of the operating company, United Mine Workers of America, West Virginia Department of Mines, and Bureau of Mines questioned the officials and employees during the inquiries. The following men represented the several organizations during the inquiries:

West Virginia Department of Mines

Crawford L. Wilson	Director
Paul Lingo	Deputy Director

Island Creek Coal Company

N. T. Camicia	Vice President and General Manager of Operations
R. M. Johnson	Manager of Mines

United Mine Workers of America

Charles Ferguson	Safety Director
Charles A. Neal	Vice President, District 17

United States Bureau of Mines

William R. Park	District Supervisor

Point of Origin: The consensus of the investigators of the Bureau of Mines is that the fire originated on No. 4 entry of west main entries (main haulageway) about 5 feet inby the 3-left overcast, when dry wooden crossbars and supporting legs were ignited by electric arcs or sparks from the trolley wire at that location.

Summary of Evidence: Conditions observed in the mine during recovery operations and the investigation following the disaster, together with information available from previous Federal coal-mine inspection

reports and that obtained from company officials, workmen and mine records, provided evidence as to the cause and origin of the fire. The evidence from which the conclusions of the Federal investigators are drawn is summarized as follows:

1. Records of the fire-boss examinations of the working sections and the main haulageways list no unusual condition observed during the examination made several hours before the fire.

2. During the December 1959 Federal inspection, the man shaft and the Elk Creek slope were open and accessible for travel. An escapeway was open and in travelable condition to either the slope or man shaft.

3. Previous to November 30, 1959, underground employees entered and left the mine by way of the Elk Creek slope; however, use of the Elk Creek slope as a portal was discontinued on that date, and employees entered and left the mine through the Pine Creek man shaft beginning December 1, 1959.

4. The use of the Elk Creek slope was discontinued because it was planned to remove barrier pillars immediately inby the slope. The extraction of barrier pillars near the slope also necessitated that the use of the slope as an intake airway be discontinued. Accordingly, the use of the Elk Creek slope was discontinued as an intake airway December 27, 1959, and a solid steel door was installed in the slope opening; this door was locked.

5. Company officials and employees advised that the main haulageway was open and travelable from 4 left entries to the slope bottom until the middle of February 1960, when hooving floor material closed the haulage entry completely and prevented travel to the slope bottom.

6. Although some of the company officials and employees knew escape by way of the slope was impossible after February 15, 1960, only a limited amount of work was done to provide a reasonably safe travelable escapeway, other than the main haulageway, from Nos. 4 and 7 working sections to the surface.

7. On the day of the fire, travel from Nos. 4 or 7 working sections to 3 left entries through Nos. 7 and 8 entries would have been extremely difficult and hazardous and practically impossible. Travel from Nos. 4 and 7 working sections to 3 left entries through Nos. 1 and 2 entries of west main entries was also extremely difficult and hazardous, as evidenced by the time escapees Carter and Blair used in traveling this route.

8. Incomplete extraction of coal blocks in the pillar mining of the barrier pillars adjacent west main entries caused the entire area to take "weight", hoove, and break timbers and roof material. The hooving floor material closed the west main entries adjacent to the pillared areas.

9. During development of the west mains entries, roof was supported by 7- by 9-inch by 14-foot wooden crossbars set on wooden legs. At a number of locations along No. 4 entry (haulageway) and inby 3 left entries, hooved floor material and sagging crossbars restricted the vertical clearance between the track rails and the overhead crossbars. Maintaining sufficient vertical clearance in these locations was difficult and required that crossbars be replaced and floor material be lifted occasionally.

10. Officials and employees stated that less vertical clearance was provided along the haulageway immediately inby the 3-left overcast than at any other location along the haulageway. Haulage crews stated that the trolley pole of their locomotives was occasionally forced against the steel mine cars when they pulled empty trips to the Nos. 4 and 7 sections.

11. Immediate use of the chemical fire truck on the fire of March 8 was prevented by poor repair of the track switch at the storage location of the fire truck.

12. A fire occurred about 9:30 p.m., on Thursday, March 3, 1960, at almost the same location as the fire of March 8. The material ignited March 3 was extinguished by the operator of a locomotive trailing the empty car trip.

13. The fire of March 3 occurred when the trolley-pole harp of a locomotive hauling 48 empty mine cars contacted the steel mine cars.

Cause of the Fire: The Federal investigators are of the opinion that the fire was caused when electric arcs or flame from the trolley wire ignited dry wooden crossbars and/or timbers on the haulageway immediately inby the 3-left overcast. The Federal investigators further are of the opinion that the electric arcs or flame were the result of the trolley-pole harp of a locomotive contacting a steel mine car at the location while a trip was being taken to No. 7 section, or the electric arcs and flame were caused when a track crew pushing 3 mine cars with a locomotive reached the location. Exactly how sufficient electric arcing to ignite wooden roof supports might have occurred as the track crew reached the fire area is conjectural; however, such electric arcing could have resulted from the trolley-pole cable blow-up or from a derailment of the trip and one or more of the mine cars being forced into contact with the trolley wire.

RECOMMENDATIONS

The following recommendations are made to prevent similar disasters.

1. At least two separate and distinct travelable escapeways should be provided from each working section to the surface. The

escapeways should be kept in safe condition for travel and reasonably free from falls, standing water, and other obstructions to the extent that men can escape quickly in an emergency.

2. In the developing of multiple entries, consideration should be given to the separating of multiple intake airways with a continuous line of stoppings, so as to provide two separate and distinct escapeways in the event of a fire in intake air.

3. Direction signs should be posted conspicuously at all points of intersections with other passageways to indicate manways and designated escapeways.

4. Underground workmen should be thoroughly trained in fire-fighting procedures, and fire drills should be held regularly. "What to do in case of a fire" should be written instructions containing all pertinent information and procedures and should be posted conspicuously for easy reference by all employees.

5. Consideration should be given to providing auxiliary means of underground communication to be used in an emergency or in case of power failure. Telephone lines could be trenched or placed in conduit, and/or a storage-battery powered trolley-phone system could be provided on the locomotives.

6. Haulage entries should be examined frequently by authorized personnel to assure that ample vertical clearance is provided between moving equipment and power wires. When inadequate vertical clearance is present along haulageways, corrective measures should be taken as rapidly as possible.

7. All underground personnel should be instructed on procedures that should be followed in the event of a disaster underground. These instructions should include information on barricading, especially information on when, where, and how to erect barricades.

8. Plans for pillar mining should strive for complete extraction of coal so as to provide good roof falls and prevent areas from taking "weight". Every effort should be made during pillaring to remove all blocks of coal.

ACKNOWLEDGMENT

The writers acknowledge gratefully the courtesies extended and the help given by officials and employees of the operating company, officials and other members of the United Mine Workers of America, and representatives of the West Virginia Department of Mines and the United States Bureau of Mines.

Respectfully submitted,

/s/ W. R. Park

W. R. Park
District Supervisor

/s/ James T. Whalen

James T. Whalen
Federal Coal-Mine Inspector

/s/ William M. Cordray

William M. Cordray
Federal Coal-Mine Inspector

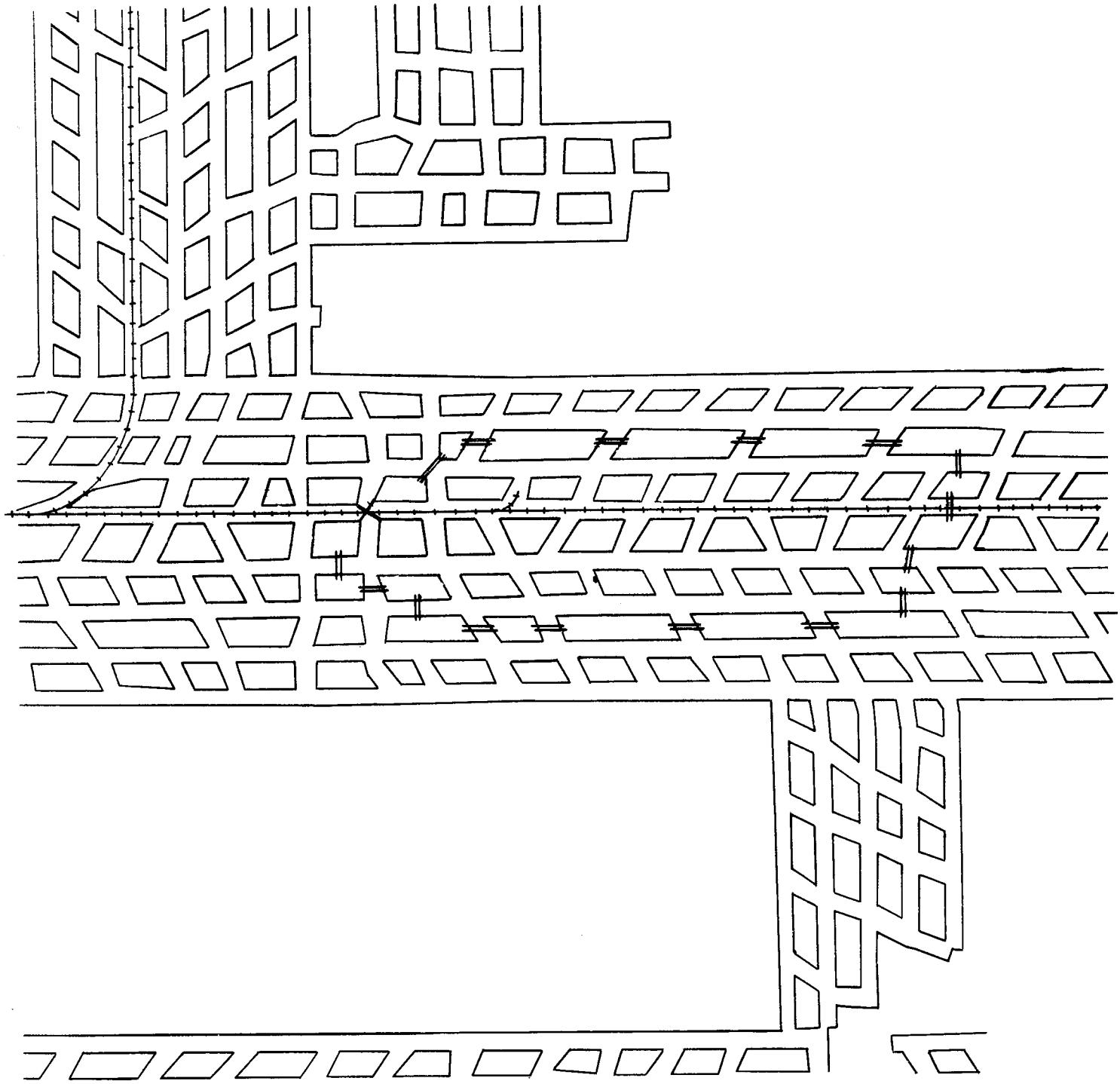
Approved by:

/s/ James Westfield

James Westfield
Assistant Director--Health and Safety

/s/ M. J. Ankeny

M. J. Ankeny
Director



APPENDIX A
FIRST SEALING OF FIRE AREA

APPENDIX B

MAP OF A SECTION OF WEST MAINS NO. 22 MINE, ISLAND CREEK COAL COMPANY,
PINE CREEK, LOGAN COUNTY, WEST VIRGINIA, MARCH 8, 1960 MINE FIRE