FINAL REPORT OF MINE EXPLOSION
EDGEWATER MINE
TENNESSEE COAL, IRON AND RAILROAD COMPANY
R.F.D. 14, BIRMINGHAM, JEFFERSON COUNTY, ALABAMA

JULY 30, 1948

By

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Supervising Engineer

H. N. Smith
Coal-Mine Inspector

and

Arthur Guthrie
Coal-Mine Inspector

Originating office, Birmingham, Alabama
M. C. McCall, Supervising Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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INTRODUCTION

An explosion occurred in the Edgewater mine of the Tennessee Coal, Iron and Railroad Company at Edgewater, Jefferson County, Alabama, at 9:00 a.m., July 30, 1948. Three hundred ten men were in the mine at the time of the explosion, and 4 men were in a rock slope driven from the surface to intersect the coal bed in the explosion area. This new slope was driven by Salmon and Cowin Company, Incorporated, to provide an escapeway and an air intake for future development. It had connected to the mine, Wednesday night, July 28, through a small opening which was being enlarged at the time of the explosion. Two hundred ninety-seven men escaped from the mine in organized man-trips; one man was injured, rescued, hospitalized, and has recovered; six men were killed by violence; and 10 men, 8 of whom were burned, escaped through the escapeway being connected to the mine. Five of these burned men later died in hospitals.

The explosion was probably caused by a damaged flame safety lamp igniting methane in 11 south slope right air course at a masonry seal near the bottom of the new 11 south slope escapeway. It was a local explosion confined to the 11 south slope entries; however, effects of the violence were evident in 10 south slope entries, main west entries, and at the 10 south slope fan. Flame issued from the 11 south escapeway slope and withered the leaves on trees for a distance of about 150 feet.

The explosion area was dry except for bodies of water in three of the four 11 south slope entries. The mine was rock-dusted.

The Bureau of Mines office at Birmingham, Alabama was notified by telephone of the explosion at 9:30 a.m., July 30, 1948 by Mr. Percy Cowin, owner of a contracting firm Salmon and Cowin Company, Incorporated. This firm was sinking the 11 south slope escapeway, and Mr. Cowin believed the explosion had occurred in this slope. Mr. R. H. Bumgardner, manager, Safety and Casualty Bureau, Tennessee Coal, Iron and Railroad Company, phoned immediately after Mr. Cowin and advised that an explosion had occurred at the Edgewater mine at the 11 south slope escapeway. Four Bureau of Mines employees and the Bureau of Mines rescue truck arrived at the portal of the 11 south slope escapeway at 10:30 a.m., and learned that the 4 men employed by the contracting firm and some employees from the mine had escaped through this new slope and had been sent to hospitals for treatment. One man who had escaped from the mine was still at the slope portal awaiting an ambulance. The Bureau of Mines employees and the rescue truck left immediately for the main slope entrance of the Edgewater mine. A total of 5 representatives of the Bureau of Mines participated in either the rescue and recovery operations, the investigation, or both.

GENERAL INFORMATION

Location and Ownership

The Edgewater mine of the Tennessee Coal, Iron and Railroad Company is at Edgewater, Jefferson County, Alabama, and is served by the company-owned railroad. The post office address of the mine is Birmingham, R.F.D. 14.

Operating Officials

Robert Gregg	President	Brown-Marx Building, Birmingham, Alabama
Ralph E. Kirk	Manager of Raw Materials	do.
James C. Gray	General Superintendent	Pratt City, Ala.
R. H. Bumgardner	Manager, Safety and Casualty Bureau	Brown-Marx Building, Birmingham, Ala.
S. D. Michaelson	Chief Engineer	Pratt City, Ala.
P. S. McCrorie	Superintendent	R.F.D. 14, Birmingham, Alabama
Frank P. Locke	Mine Foreman	do.

This company owns and operates, in addition to Edgewater mine, Docena, Hamilton, Wylam No. 8, Short Creek No. 19, and Concord No. 1 mines, all of which are in Alabama.

Employees and Production

Employees at this mine numbered 821, of which number 677 worked underground on 3 shifts and produced 6,800 tons of coal daily. Coal was loaded by mobile machines either in shuttle cars or on shaking conveyors. Electric locomotives hauled the coal in steel cars from the loading points to the underground rotary dump.

Opening and Nature of Coal Bed

This mine is opened by 3 shafts and 6 slopes and is developed in the Pratt coal bed which averages about 66 inches in thickness in the present working areas.

The concrete-lined coal-hoisting shaft is 236 feet deep. The No. 3 return fan shaft is not lined and is 230 feet deep. The No. 5 fan shaft is 360 feet deep.

The man-and-material slope extends from the surface a distance of 529 feet on a pitch of 26 degrees 30 minutes. The other slopes are on a pitch of 30 degrees; 3 of them serve as intake airways, 2 as returns, and all of them as escapeways.

Coal from the Pratt bed is medium-volatile bituminous. The proximate analysis on a "dry basis", as furnished by the company in August 1943, show the following.

	Percent
Volatile matter	27.85
Fixed carbon	66.34
Ash	5.81
	100.00

The volatile ratio of the coal from this bed is 0.296 as calculated from the formula $\frac{V.M.}{V.M. + F.C.}$ Exhaustive tests have shown that dust from coals having a volatile ratio in excess of 0.12 is explosive and will propagate flame when suspended in a dense cloud in air.

The immediate roof is shale in some places, sandstone in some places, and a combination of these rocks in the other areas. Some "pots" are found in the immediate roof. The main roof is massive sandstone.

The floor is smooth, hard shale.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Methods of Mining

A room-and-pillar method of mining is used; pillars are extracted, and about 90 percent of the coal is recovered.

Entries were driven in sets of 3, 4, or 6 and were 20 feet wide with 40-foot pillars, as were the rooms.

Coal was undercut by permissible caterpillar- or rubber-tired-wheel-mounted mining machines to a depth of about 7 feet. It was loaded by 8 Joy machines onto 16 shuttle cars and 8 shaking conveyors which transported the coal to loading points where it was transferred into steel mine cars.

A systematic method, which includes the use of safety posts, is followed in the timbering of rooms and entry faces. Entry timbering is standard throughout the mine.

Ventilation and Gases

Air is induced into the mine by 4 fans operated exhausting and installed on the surface in brick and concrete housings. The fans are installed at least 20 feet from the nearest sides of the mine openings. They are constantly attended, and stand-by automatically starting internal-combustion engines are available at each fan for emergency use. More than 6,000 cubic feet of air a minute was passing through the last crosscuts of each set of entries. Overcasts and stoppings were constructed of either concrete or slagtex blocks. Doors were not used in the coursing of air, and each section of the mine was on a separate split of air. Well-constructed line brattices were used to conduct air to the working faces. Neither blowers nor booster fans were used underground.

During the time of the last Federal inspection, March 2-11, 1948, the fans were exhausting 542,000 cubic feet of air a minute from the mine.

The mine is classed gassy by the State of Alabama, Department of Industrial Relations, Division of Safety and Inspection. Two men were employed regularly as ventilation inspectors. These men used methane indicators and permissible flame safety lamps to make tests for methane in abandoned works and pillar lines. These men also take air measurements and air samples. Records of their findings were posted in a book on the surface. Permissible flame safety lamps were carried by all supervisors, and shot firers, loading-machine, and mining-machine operators make frequent examinations of the air for methane in all face workings where electrically driven equipment is operated. Preshift examinations were made in active working faces, and old workings were inspected continuously.

The quantity of methane liberated from the mine at the time of the last Federal inspection, March 2-11, 1948, was 1,743,840 cubic feet in 24 hours. (See Appendix B for ventilation map.)

Drainage

The mine was reasonably dry; however, some gathering pumps were used to deliver water to permanent pump station sumps. Much of the water in the mine was reused to allay coal dust. Haulage roads were free of standing water, but some water had collected in local "dips" in some of the air courses.

Dust

This mine was generally dry throughout, and all active workings were rock-dusted to within 30 feet of the faces. Haulage entries and airways were rock-dusted; however, it was evident, during recovery operations, that sufficient rock dust had not been applied in some of the back air courses or that the applied rock-dust effectiveness in these back air courses had been lowered by a later deposit of coal dust.

Cars were not topped excessively and coal spillage was not permitted to accumulate along roadways or conveyor pan lines.

Water was used to allay coal dust at working faces. Water sprays were used on mining machines, loading machines, at loading points, at various places along the haulageways, and at the rotary dump at the shaft bottom.

During the investigation 28 samples of the mine dust were collected in the section affected by the explosion and sent to the Coal Analysis Section of the United States Bureau of Mines, Pittsburgh, Pennsylvania. The analyses of these samples and alcohol coke tests are shown in tables Nos. 3 and 4, respectively.

The analytical results indicate that coke was not present in 18 of the 28 samples collected.

Floor samples contained incombustible matter ranging between 37.1 and 86.7 percent (can Nos. T-502 and T-939), and the incombustible content of rib samples (can Nos. U-403 and M-299) ranged between 47.8 percent and 96.7 percent. Respective samples (can Nos. W-546 and K-971) from the ribs and floor, collected 40 feet from the face of 9 west left air course, off 11 south, contained coke in large and very large quantities. During the investigation, streamers of soot were observed throughout the entry in which these samples were collected indicating slow burning of the gas and dust.

Six samples collected in the 11 south entries between 9 west and 14 west contained coke in quantities ranging between small and large.

Sample can No. K-700 collected from props and ribs in 11 south No. 2 right air course inby 14 west at the point where a seal was being removed and where a flame safety lamp (found following the explosion with a broken chimney) had been hanging from a wedge over a prop did not contain coke; however, samples can Nos. U-449 and L-810 collected from timbers and the floor 60' inby this point contained coke in small quantities.

Haulage

Haulage from the shuttle car and conveyor loading points to the underground rotary dump was by trolley locomotives. All locomotives haulage was in intake air. Mine cars were constructed of steel and were equipped with automatic couplings. Twelve 8-ton, 2 10-ton, 1 15-ton, 8 6-ton, and 12 13-ton locomotives were used. Haulage was controlled by dispatchers and block signals.

Coal was handled by a double-drum, steam-driven hoist and a 1-1/2 inch rope. The man-and-material hoist is a cylindrical-drum type, gear driven by a 450-horsepower, 440 volts alternating-current motor. Both hoists were equipped with the necessary safety devices. Coal was hoisted in one 6-ton and one 7-ton self-dumping skips.

Written records indicated that the hoisting equipment was inspected daily.

Lighting

Fixed incandescent lights operated from the mine electric circuit were installed at the coal hoisting shaft bottom, the foot of the man-and-material slope, track switches, sidetracks, and at intervals along main haulageways.

Permissible electric cap lamps were used exclusively for individual illumination underground. Flame safety lamps are of permissible type, cleaned, filled, and assembled by the lamp-house attendants. They are checked before being taken underground by the individuals using them.

Smoking was not permitted underground, nor at various places on the surfaces.

Electrical Equipment Underground

Machinery underground was operated by 275 volts direct-current electricity. The transmission lines enter the mine through the man-and-material slope, the hoisting shaft, return air slopes, and boreholes. The conductors are in armored cables. Underground substations are in well-ventilated, fireproof rooms. Main pumps are operated on 220 and 440 volts alternating current.

Underground electrical face equipment consisted of 8 Joy loaders, 16 shuttle cars, 31 mining machines, 14 shaker conveyors, and electric drills. All electrical face equipment is of permissible type and was kept in permissible condition. Other electrical equipment included pumps, rock-dusting machines, 35 trolley and trolley cable-reel locomotives, and several air compressors.

Cut-out switches were installed at proper intervals in all trolley and feeder lines. These lines were properly installed on insulators.

Temporary cable splices were made underground and were replaced by permanent splices made on the surface.

Electric equipment was inspected regularly, and records of the inspections were kept.

Explosives

Coal and rock were blasted on shift with permissible explosives handled and fired in permissible manner by competent shot firers. Tests for methane were made immediately before and immediately after the firing of shots.

Explosives were taken into the mine in specially constructed explosives cars and were stored in fireproof magazines properly located in each active section. None was stored at working places.

Mine Rescue

Two teams of 6 men each at this mine receive mine rescue training monthly. Numerous men other than those on the 2 teams have received such training. Trained mine rescue teams are maintained at each mine operated by the company. Training is conducted in a modern well-equipped mine rescue station at the Docena mine. The equipment includes 19 self-contained oxygen breathing apparatus, 19 All-Service gas masks, 33 self rescuers, oxygen pump, gas detecting equipment, a supply of repair and replacement parts, an inhalator, first-aid kit, 23 stretchers, 2 W.E. telephone sets, 4 U. S. Army field telephones, 15 permissible flash lights, wool and rubber blankets, identification badges, telephone wire, life line, goggles, and tools. The equipment was in very good condition.

Mine rescue teams from this and nearby mines that participated in the rescue and recovery operations or were available for immediate duty at the mine were:

Company	Mine	Number of Teams
Tennessee Coal, Iron & Railroad Company	Hamilton	2
do.	Wylam No. 8	1
do.	Docena	2
do.	Edgewater	1
do.	Short Creek No. 19	1
Woodward Iron Company	Mulga	2
do.	Dolomite No. 3	1
Alabama By-Products Corporation	Praco	2
Sloss-Sheffield Steel and Iron Company	Bessie	1
do.	Flat Top	1

Fire Fighting

A fire-fighting organization was maintained in the mine, and another was maintained on the surface; however, fire-fighting drills were not held. Underground fire-fighting equipment consisted of water lines in all working faces, water line outlets along haulageways, fire hose, fire extinguishers in each active section and at all permanent electrical installations, tools, lumber, and brattice cloth.

PREVIOUS EXPLOSIONS IN NEARBY MINES

Some previous major mine disasters in mines in the Birmingham district and their probable cause are listed as follows:

Table 1

Date	Mine	Flame Violence	Killed: Gas	Killed: Total	Type	Origin
1905	Virginia	--	--	108	Gas and dust	Blown-out shot
1909	Short Creek	--	--	18	Dust explosion	do.
1910	Mulga	--	--	40	Gas and dust	Open light
1910	Palos No. 3	--	--	90	Gas and dust	Blown-out shot
1914	Mulga	1	16	17	Gas explosion	Open light
1921	Docena	3	2	5	Gas explosion	do.
1922	Dolomite No. 3	60	30	90	Dust explosion	Electric arc
1925	Overton No. 2	24	29	53	Gas and dust	Open light
1937	Mulga	--	--	34	Gas and dust	Open flame safety lamp
1943	Praco No. 10	12	--	12	Gas and dust	Electric arc
*1943	Sayreton No. 2	28	--	28	Gas and dust	Electric arc and fire*

*Second explosion occurred about two and one-half hours later.

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Employees at this mine numbered 821, of which number 677 worked underground on 3 shifts and produced 6,800 tons of coal daily. Coal was loaded by mobile machines either in shuttle cars or on shaking conveyors. Electric locomotives hauled the coal in steel cars from the loading points to the underground rotary dump.

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*Second explosion occurred about two and one-half hours later.

MINE CONDITIONS IMMEDIATELY PRIOR TO DISASTER

The mine was being operated normally at the time of the explosion, and the only unusual condition was that air was being added to the ventilation of the faces of the 11 south slope entries at the bottom of the 11 south slope escapeway. This new escapeway had connected with the mine on Wednesday night, July 28, 1948, when a round of shots was fired in the escapeway. The opening was found by the mucking crew in the escapeway on Thursday, July 29, 1948.

The weather was warm and clear. The United States Weather Bureau records at Birmingham show the following temperatures and barometric pressures: The barometric pressure from 3:00 p.m., July 29, 1948, to 9:00 a.m., July 30, 1948, varied, in inches of mercury, from 29.320 to 29.370. The temperature for this same period varied from 72.0 degrees to 89.5 degrees. Barometric pressure is believed to have had no bearing on this explosion.

The 11 south slope had not produced any coal since about the middle of February 1948. It was, therefore, considered a temporarily abandoned area. An "old works" fire boss had inspected the 11 south slope entries Thursday, July 29, and reported them free of standing gas at noon on that day.

A head-rockman inspected for methane with a permissible flame safety lamp at the beginning of the July 30 shift in the pump room, at the dam in west barrier headings, at the control room, and presumably at the seal which was removed, and the one being removed immediately prior to the explosion.

STORY OF EXPLOSION AND RECOVERY OPERATIONS

The explosion occurred at 9:00 a.m., July 30, 1948. Various men and officials in areas near the explosion area were affected by concussion from the explosion and advised the car distributor underground of the occurrence. The car distributor advised the mine office on the surface that an explosion had occurred in 11 south slope entries. The mine office notified the company offices at Pratt City, Alabama and Birmingham, Alabama.

The district office of the Federal Bureau of Mines at Birmingham, Alabama, was notified at 9:30 a.m. by Percy Cowin, owner, Salmon and Cowin Company, Incorporated. This company was sinking a slope from the surface to intersect the Edgewater mine in 11 south slope entries at a point between 14 and 15 west entries off 11 south slope entries. Mr. Cowin advised that an explosion had occurred in this slope being driven and that 4 men were involved. R. H. Bumgardner, manager, Safety and Casualty Bureau, Tennessee Coal, Iron and Railroad Company, telephoned immediately after completion of Mr. Cowin's call and advised that an explosion had occurred in the 11 south slope escapeway being driven to the Edgewater mine. M. C. McCall, supervising engineer, H. N. Smith and Arthur Guthrie, coal-mine inspectors, and G. C. Farren

safety instructor, traveled by automobiles and a mine rescue truck to the portal of the new slope. Messrs. McCall, Smith, and Farren arrived at the 11 south slope escapeway portal at 10:30 a.m. and learned that the 4 men working in the escapeway slope and some men from the Edgewater mine had escaped through the new opening. These men, except one, hadalready been sent in ambulances to hospitals in Birmingham, Arthur Guthrie had arrived about 10:15 a.m. and had already entered the escapeway slope; a fact that Messrs. McCall, Smith, and Farren did not learn until some time later. The remaining man was also sent in an ambulance to the hospital shortly after the arrival of the Bureau representatives.

The Bureau of Mines men, except Guthrie, left the escapeway slope portal immediately after the last man was placed in the ambulance and arrived at the Edgewater mine man-and-material slope portal at 11:00 a.m. Mr. Walter Kirkwood, chief inspector, of the company was contacted after which Messrs. McCall and Smith entered the mine about 11:30 a.m. accompanied by 2 mine rescue teams and some company officials. The steps in the slope were filled with a single file of men who were leaving the mine in a calm orderly manner. A man-trip was made up at the main slope bottom in which the 2 mine rescue teams and other persons participating in the exploration of the explosion area and recovery of the bodies rode to the 8 west sidetrack on 10 south slope entries. Some officials and supervisors who had preceded the rescue teams were met at this point. These men had been in 11 south slope to a point inby 2 west where they had found the body of a "rock man" and recovered the injured "rock man's" helper. Smoke and gases from the explosion prevented further movement into the 11 south slope entries, and it was decided to attempt access to the 11 south slope entries through 11 west off 10 south slope. A mine rescue team wearing oxygen breathing apparatus entered the 11 west off 10 south slope and crossed to the 11 south slope, and thence to the pump room in the crosscut between the 11 south slope entry and the left air course at the barrier heading. They returned with the information that 11 south slope entries were clear from the intersection of 11 south slope and 11 west entries off 10 south slope. This team, the reserve team, and other persons in 10 south slope then traveled through 11 west off 10 south slope to 11 south slope and the pump room.

A mine rescue team accompanied by Arthur Guthrie was encountered in 11 south slope entries. Mr. Guthrie had followed Messrs. McCall and Smith to the Edgewater main slope opening from the portal of the new 11 south slope escapeway, and finding that they had already entered the mine he, upon instructions, returned to the 11 south slope escapeway with a mine rescue team and entered Edgewater mine from that point. This party reported the finding of 3 bodies and the extinguishing of a small fire in some brattice cloth. Smoke began moving into the 11 south slope from the west, and on an exploration trip two small fires were found and extinguished. Coal and wood were burning in both fires. The smoke entering the 11 south slope from the west did not noticeably move either to the north or the south. At this time a decision was made to close the portal of the 11 south slope

escapeway in an effort to clear the smoke from the 11 south slope entries. All of the men in 11 south slope returned to the 10 south slope through the west barrier heading and traveled through 10 south slope and main west entries to 11 south slope. Air began to travel the 11 south slope toward the faces of the entries after the 11 south slope escapeway was closed and a brattice was erected in the crosscut in the barrier pillar between 11 south slope and 10 south slope back air courses outby 6 west, and the recovery crew followed this fresh air to the pump room. En-route this party found the bodies of 2 men and a 6-ton trolley locomotive on the 11 south slope inby 6 west.

The recovered bodies were carried on stretchers to 5 west 11 south slope where they were loaded into mine cars that were pushed to main west. These mine cars were then hauled by locomotive and rope to the surface and were outside at 9:00 p.m.

The recovery parties reached the surface with all equipment at 9:30 p.m.

G. C. Farren remained on the surface to assist rescue teams preparing to enter the mine and to care for mine rescue apparatus brought out of the mine. H. Marstrander arrived at the mine after the rescue parties had entered. He remained on the surface to furnish liaison with the Bureau of Mines office, Birmingham, Alabama.

Survivors from the explosion area and men and officials from nearby areas supplied considerable evidence regarding the conditions in the 11 south slope entries prior to the explosion.

The new 11 south slope escapeway was driven in anticipation of future development to the west, and was not needed for ventilation at this time because normally 37,000 cubic feet of air was coursed to the faces of the inactive 11 south slope entries. Three concrete-block stoppings were erected to enclose the foot of the escapeway so as to prevent it from becoming an intake when it connected with the mine. One or two concrete blocks, 8 inches by 16 inches in size, were left out of each stopping. These openings were made so that the sealed area would be ventilated, and also provide protection to the stoppings from concussion from blasting in the escapeway. Two days before the escapeway connected with the mine it was evident the connection would be outside of the sealed area, so two more seals were erected inby the first 3. These latter 2 seals had larger openings over them than the openings left in the first 3 erected. (See Appendix C attached to this report.)

Thursday, July 29, the mucking crew in the new escapeway slope opened a hole about 3 feet in diameter into the 11 south slope 2 right air course. Officials at the mine were informed of the connection. Thursday night the opening was enlarged, by blasting, to an area of about 50 square feet. A mine official inspected the seals Thursday night immediately after blasting was completed and found them undamaged. He traveled into 11 south slope on a locomotive to about 12 west and completed the trip afoot. He testified that the ventilation was reversed in 11 south slope from 2 west to the point where he began walking. He was not definite as to the direction of air flow from the 12 west to the seals at the foot of the new escapeway.

On the morning of the explosion, a ventilation inspector measured the volume of air at the 1 west off 11 south slope regulator and also determined the methane present by a methane indicator. The record of these readings was found in his record book and showed the volume of air to be about 2,000 cubic feet a minute in excess of former measurements. The methane had also increased from .35 percent to 0.6 percent. Soon after taking these readings he warned the foreman in 2 west off 11 south slope to keep a close watch on line brattices and ventilation because he had found the methane content in the face crosscuts to be 0.55 percent. The assistant mine foreman came into the 2 west at this time. The foreman in 2 west was assisting in the rerailing of some wrecked cars. The assistant mine foreman remarked that he did not have time to help because he also had trouble. The ventilation inspector and the assistant mine foreman left 2 west together about an estimated 10 minutes before the explosion occurred.

At the time of the ignition 2 men were scaling roof in 11 south slope between 2 and 3 west; two men were traveling toward the face of the slope at about 6 west. Four men were removing a seal in the 11 south slope 2 right air course about 70 feet outby the opening to the new escapeway; one man was at the new pump station control room; 4 men were in the pump room, and 4 men were working at the face of the new escapeway.

INVESTIGATION OF CAUSE OF EXPLOSION

An investigation to determine the cause of the explosion was conducted jointly by the State of Alabama, Department of Industrial Relations, Division of Safety and Inspection; the Tennessee Coal, Iron and Railroad Company; The United Mine Workers of America; and the Bureau of Mines, on August 1, 1948.

Investigators for the State of Alabama, Department of Industrial Relations, Division of Safety and Inspection were: T. L. Ball, Division Chief; E. J. Gentry, Chief Mine Inspector; O. H. Youngblood, A. G. Crane, H. T. Williams, J. H. Chapman, F. L. Weston and J. A. Ivie, Mine Inspectors.

Investigators for the Tennessee Coal, Iron and Railroad Company were: James C. Gray, general superintendent, E. B. Nelson, Assistant General Superintendent; Walter R. Kirkwood, Chief Inspector; R. H. Bumgardner, Manager, Safety and Casualty Bureau, and J. M. Sponsler, Mining Engineer.

United Mine Workers of America investigators were: C. E. Pierson, G. O. Smith and Richard Cannon, Edgewater mine safety committeemen.

Investigators for the Bureau of Mines were: H. N. Smith and Arthur Guthrie, coal mine inspectors, and M. C. McCall, Supervising Engineer.

Hearings were held at the Edgewater mine office July 31, August 3, 4, 5, 7 and 8; at Pratt City, Alabama, August 9 and 10, and patients from the explosion area were questioned in the Jefferson-Hillman and the T.C.I. hospitals on August 3, 1948, and T.C.I. hospital, August 17, 1948.

Property Damage

Damage caused by the explosion consisted of stoppings blown out in 11 south slope in the barrier pillar between 11 south slope and 10 south slope back air courses at 11 west off 10 south slope and inby 6 west off 11 south slope, stoppings blown out at the new 11 south slope escapeway and in the 11 south slope between the first and second entry from 11 west to 13 west, and several regulators were damaged. The covers were blown off the 6-ton locomotive inby 6 west 11 south slope and a wall was blown out of the pump room at 11 south slope and the west barrier heading. Pressure from the explosion blew the explosion doors of the 10 south fan open.

The mine was ready for normal operation the evening of August 1, 1948.

Forces

Forces of the explosion are indicated on a map of the explosion area, attached to this report. (See Appendix D)

A study of the movement of materials from underground structures including stoppings, the bending of trolley-wire hangars, and the deposits of coke, indicate that a division of forces occurred near the foot of the new 11 south slope escapeway; that forces traveled from this point on 11 south slope to the main west left air courses and along the main west left air courses outby to 10 south slope, and inby 3 crosscuts beyond the regulator in main west left air courses. Forces were evident in almost all of the 10 south slope back air courses, all of 11 west off 10 south slope and for some distance north and south in rooms driven off 11 west. Forces were also evident at the faces of 11 south slope and for several hundred feet in the west barrier heading. There was little evidence of violence in the area at the 11 south slope escapeway and in the area between the slope bottom and the pump room. The blower fan tubing in the new escapeway was blown out at the slope portal and some of it lodged in trees about 100 feet from the portal. Coke was deposited, in almost every instance, on the north side of crosscut corners, in the area outby the new slope bottom. It was deposited on the south side in the area inby the new slope bottom.

Evidence of Heat or Flame

Deposits of coke, burned wood splinters, and charred posts, as well as the burned bodies of the men killed and the survivors, were used to determine the limits of flame. Evidence of flame was apparent in 11 south slope entries from a point just inby 2 west to a point just inby the pump room. Flame also traveled through the crosscut in the barrier pillar between 11 south slope and the 10 south slope back air courses outby 6 west and extended north and south in these back air courses for about 200 feet. Flame also entered the 10 south slope back air courses at the intersection of 11 west off 10 south slope and 11 south slope. It traveled in the west barrier headings to a point about 300 feet inby the 10 south slope back air courses, and out of the new escapeway portal where it withered leaves on trees for a distance of about 150 feet from the portal. Four of the 6 men killed were burned, and 8 of the 10 men who escaped through the 11 south slope escapeway were badly burned. Posts near the foot of the new escapeway were charred as were some of the posts in 9 and 10 west off 11 south slope. The surface of a stack of rock dust in paper bags at the crosscut outby the control room in 11 south slope was so burned that the paper exposed on the top of the stack was completely consumed. The rock dust so exposed was not disturbed.

FACTORS THAT PREVENTED SPREAD OF THE EXPLOSION

Spread of the flame was limited by rock dust that had been applied in the entire area. Some coal dust entered into the explosion. This dust may have been deposited on the rock dust or it may have been picked up in the 11 south slope 2 right air course which visually appeared to have received less rock dust than had the other three, 11 south slope entries. This slope had been temporarily abandoned since about the middle of February, 1948. Violence from the explosion was reduced by expansion into the openings surrounding the affected area.

ACTIVITIES IN THE AFFECTED SECTIONS AT THE TIME OF THE EXPLOSION

Seventeen men were in the explosion area at the time of the ignition. Two men were "scaling" roof in 11 south slope just outby 3 west. Neither of them was burned. The injured man was rescued without the use of respiratory protective equipment. He was discharged from a hospital 10 days after the explosion.

The ventilation inspector and the assistant mine foreman had just left the 2 west off 11 south slope entries and were traveling in the 11 south slope toward the face. Their bodies were found about 6 feet and 150 feet respectively outby a 6-ton trolley locomotive that was about 30 feet inby the "turnout" to 6 west. One of these men had ridden the locomotive to this point from the 1 west off 11 south slope and was apparently waiting for the other man who had walked the 1 or 2 right air course of 11 south slope from the 2 west. That the second man had walked through the air courses was substantiated by the fact that his shoes and trousers half way to the knees were wet from wading through water at a point just inby 3 west. Both of these men suffered much violence and both were burned.

A record made by the ventilation inspector Friday morning, July 30, showed that 23,714 cubic feet of air a minute was passing through the regulator for the 1 and 2 wests off 11 south slope. The record also shows that 0.60 percent of methane was found using a permissible methane indicator. The last previous record at this regulator showed 21,300 cubic feet of air a minute and a methane content of 0.35 percent. Some investigators believe the difference in air volume was caused by air flow reversed in 11 south slope entries. This belief is strengthened by the increase in methane in the split. Other investigators believe that the increase in air volume in the 1 and 2 west split is due to the fact that the opening at the foot of the new escapeway provided a short path from the intake to the fan with a corresponding decrease in air resistance, and that the 1 and 2 west split, being the shortest in the ventilating system being serviced by the fan, benefited the difference in the air volumes. Some investigators think air tended to be pulled both directions from a neutral point in the 11 south slope entries, and that this accounted for the increase in the methane in the 1 and 2 west split. This could also account for the presence of methane at the seal being removed near the foot of the new 11 south slope escapeway.

Testimony of witnesses and the record of the ventilation inspector indicates that the inspector and the assistant mine foreman were aware of unusual conditions in the 11 south slope entries from 10 to 20 minutes before the ignition occurred. All investigators agree that these men left 2 west 11 south slope together; that the assistant mine foreman operated the locomotive from the 1 west off 11 south slope to the point where it was found after the explosion; that he was waiting at that point for the ventilation inspector who was walking and inspecting in the 2 right air course 11 south slope entries. These are supported by the fact that the ventilation inspector's trouser legs were wet halfway to the knees and his shoes were wet. The locomotive was found with the brakes taken up, the controller in "off" position, the trolley pole was off the wire in a normal position outside the trolley wire guard-boards, and toward the center of the track. The locomotive headlight switch was in "on" position.

Testimony established the fact that the ventilation inspector wore eye glasses only while taking air measurements, methane readings, and when reading and writing. His glasses were found near his body and out of their case. His anemometer and methane indicator were on his person after the explosion. His record book was found in the 10 south slope back air courses near 6 west, where it had been carried by the explosion. This man's body had suffered much violence, was burned, and was found about 150 feet outby the locomotive.

The assistant mine foreman suffered burns and considerable violence which struck him from the rear. A dent about 3 inches long and about 3/4-inch deep was noted in the back of his head and below the crown. This injury could have been caused by the covers from the locomotive which were found more than 150 feet outby his body. Some investigators believe the assistant mine foreman was looking at the ventilation inspector when they were struck by the force of the explosion.

Other investigators who think the locomotive was the ignition agent, believe the assistant mine foreman was removing the trolley pole harp from the trolley wire, and because the headlights were burning an arc resulted and ignited methane. Federal investigators do not concur with the belief that the locomotive was the ignition agent because more definite evidence indicated the explosion originated elsewhere.

Physical evidence at and near the seal being removed in the 2 right air course indicated the ignition originated at that point. Evidence of force radiated from this point, charred posts indicated the presence of extreme heat and the absence of violence in the area is further evidence of the point of origin. The fact that 8 men in the vicinity suffered injuries confined to burns is further evidence of a point of ignition. Two men in the vicinity suffered contusions that were not serious, and the fact that another burned man suffered crushing injures to the face that could have resulted after the explosion are additional indications of a point of origin. Failure to disturb rock dust from which the containers were burned, and the fact that none of the stoppings between 11 south slope and the left air course was destroyed from 13 west to the faces of the entries also attests lack of violence in the area near the foot of the 11 south slope escapeway.

Coke deposits on 2 sides of posts in areas of violence are readily explained by the fact that the explosion traveled most rapidly in the 2 right air course of 11 south slope entries and expanded in both directions when it traveled through crosscuts.

The survivor among the 4 men at the stopping in the 11 south slope 2 right air course near the foot of the escapeway stated that flame burned there for "quite a bit." He also stated that flame came from toward the 10 south and 11 south. This would also seem to be the case if methane had been ignited at the stopping, because the methane accumulation would have been outby the stopping. He further stated that he heard the noise and saw the flame about the same time. In a later interview he stated that he took the flame safety lamp off the cap piece where it was hanging; that the lamp was out; that he turned the wheel (igniter) once and then it happened; the whole world exploded; that there wasn't time to turn it again. He also stated that he and another man laid down; that fire burned there a long time; that their clothing caught fire, and they could not stay there any longer; that he got up to run and the other man caught his legs and asked that he wait for him. He further stated that he guessed his hat, lamp and belt were found where the explosion started. In subsequent statements he denied that the igniter had been turned. Two other survivors, one at the control room and the other in the pump room, heard the noise but did not see any flame. One other survivor in the pump room who suffered only a contusion stated that he "heard a noise, felt a cyclone" saw flame pass over him, and that the flame was followed by some things that looked like "tracer bullets."

A permissible-type flame safety lamp was found, on its side, on the floor near the bottom of a post that was within 2 feet of the seal being removed. It was also about 10 inches from a loose concrete block. This lamp had a cracked glass chimney and a small hole 3/64-inch to 4/64-inch wide and 20/64-inch long extended through the glass. (See Appendix G). Examination of the lamp disclosed chips of glass inside the lamp, the wick was turned down to a height required for testing with a capping flame. The bonnet of the lamp had received a blow near its top, but the resulting damage was on the side of the lamp opposite from the hole in the glass chimney. The fact that none of the men in the same location with the lamp suffered any cuts or abrasions is evidence that the lamp was not struck with any object driven by the explosion, and it is therefore believed that the lamp must have been damaged prior to the explosion.

The Bureau of Mines investigators believe the glass chimney of the lamp was accidentally broken prior to the ignition. It could have been struck by the sledge hammer that was used to start the hole in the seal being removed, or it may have been struck by a bar being used to pry cement blocks out of the seal, or the lamp may have been dropped and the glass broken.

Cause of Explosion

Bureau of Mines investigators are of the opinion that the explosion was caused by an accumulation of methane which resulted when a new escapeway slope opening cut through to the underground workings of the mine and interrupted the ventilation by creating a short circuit of the air current in the 11 south slope entries. The investigators are further of the opinion that the gas was ignited by a damaged flame safety lamp near the bottom of the 11 south slope escapeway.

Recommendations

1. When a new opening that could effect the regular ventilation in a mine is made, doors should be installed in such opening, and these doors should be closed when the connection is made.

2. Temporarily abandoned workings should be examined by certified officials for methane and other hazards before workmen are permitted to enter.

ACKNOWLEDGMENT

The writers acknowledge the courtesies extended and the help given by representatives of the State of Alabama, Department of Industrial Relations, Division of Safety and Inspection; United Mine Workers of America; and officials and employees of the Tennessee Coal, Iron and Railroad Company. Information was supplied and exchanged without reservation.

Respectfully submitted,

M. C. McCall
Supervising Engineer

H. N. Smith
Coal-Mine Inspector

Arthur Guthrie
Coal-Mine Inspector

Mine Supervisory crew consists of:

1 - General Mine Foreman.

11 - Face Bosses (who fire-boss for succeeding shift).

3 - Old Works Inspectors.

2 - Ventilation Engineers

1 - Safety Inspector

At the time of the explosion 9:00 A.M. Friday, July 30th, there were 315 men in the mine. Two hundred and forty-nine (249) miners came to the surface without any trouble and very little confusion. Sixty-seven (67) men were in the area affected by either flame, violence, smoke, or minor air concussion. Fifty (50) of whom came to the surface without aid.

Of the seventeen (17) men on the 11th South Slope, ten (10) men escaped through the new air shaft that had broken through to the mine; six (6) were killed by violence and burns, and one (1) injured man was taken out of the mine at manway.

The sixty-seven (67) men in the affected area were working in the following places.

R. W. Shook, Foreman, and 17 men were in 8th Left West- 10th South Slope driving four (4) air rooms towards Main West, parallel to the 10th South Slope. All escaped uninjured through lots of dust--slight air blast.

R. E. Reach, Foreman, and 15 men, Section #38 - 11th West- 10th South Slope, driving four (4) air rooms parallel to 10th South Slope. All escaped uninjured. Sudden gust of wind - lots of dust.

W. C. Grammer, Foreman and Seventeen (17) men, Section #31, 1st West- 11th South, driving four (4) air rooms South parallel to 11th South Slope on separate air split. All escaped uninjured through lots of smoke and dust.

Brattice Crew, consisting of four (4) men: R. R. Matthews, white, Alvin Kenneth McGaha, white, Willie John Hartley, white, A. E. Romine, white, who were working on taking down two (2) old brattices near new air shaft between 14th and 15th West, 11th South Slope.

Mechanic Crew of three (3) men: Who were working in pump room and control room in cross cuts on 11th South Slope near 17th West off 10th South. P. P. Penny, white, Morris W. Noles, white, Robert O. Bailey, white.

Building Concrete Block Wall in Pump Room: Two (2) men, Sandy Gary, colored, Eddie Jones, colored.

Scaling 11th South Slope between 2nd and 3rd West on 11th South Slope: Two (2) men, Willie Gragg, colored, and Abraham Maxwell, colored.

On motor on 11th South Slope between 5th and 6th West: Two (2) men, Simon Pentz, white, John Thomas Starnes, white.

Salmon and Cowin, Shaft Contractors: Four (4) men, who were working in air shaft that had broken through to mine between 14th and 15th West, 11th South Slope, James Corbett, white, Ernest Franks, white, James Jordan, colored, Walter Wilson, colored.

The following men were killed by the methane explosion either by violence and/or flame.

Name	Occupation	Color	Age	Married or Single	Number of Dependents Under 18 yrs.
Simon William Pentz	Asst. Mine Foreman	White	61	Married	0
John Thomas Starnes	Ventilation Inspr.	White	62	Married	0
Alvin Kenneth McGaha	Rock Helper	White	25	Single	0
William Gragg	Head Rockman	Colored	54	Married	2
Eddie Jones	Rock Helper	Colored	18	Single	0
Sandy Gary	Rockman	Colored	42	Married	8
	Killed by Explosion - 6				

The following men died later from burns:

James Jordan Died Friday night, 7-30-48	Mucker	Colored	33	Married	4
Willie John Hartley Died Saturday morning, 7-31-48	Rockman Helper	White	41	Married	2
Ernest Franks Died Saturday afternoon, 7-31-48	Drag Hoist Engineer	White	28	Married	1
Audrey Esdell Romine Died Sunday morning, 8-1-48	Rockman Helper	White	24	Single	0
Walter Wilson Died Saturday night, 7-31-48	Mucker	Colored	44	Single	0
	Died later ----- 5				
	Total ----- 11				

Edgewater mine is rated gassy by the Division of Safety and Inspection, Department of Industrial Relations, State of Alabama, liberating 1,813,000 cu. ft. of methane gas each twenty-four (24) hours.

Inspections of Edgewater mine were made by Mine Inspectors of the Division of Safety and Inspection during 1948, as follows:

February 24th and 25th, Inspectors J. A. Ivie; H. T. Williams and F. L. Weston.

May 10th and 11th, Inspectors J. H. Chapman, J. A. Ivie and F. L. Weston.

July 26 and 27th, Inspectors H. T. Williams, J. H. Chapman and J. A. Ivie.

At the times of all three inspections the mine received a clear report, there were no violations of the State Mining Laws and no exceptions were taken. Rock dust is applied by high pressure rock dusting machines and by hand, all haulageways, air courses and working sections to within 30 ft. of faces, were well rock-dusted.

That the explosion was confined to the section of the mine in which the accumulation of methane gas was ignited and localized because of the fact that the mine was well rock dusted. Coal dust played but a minor part in the propagation of the explosion. The systematic and generous use of rock dust, which is general throughout the mine, was directly instrumental in saving many lives as there were 315 men in the mine at the time.

Due to good housekeeping and use of concrete block stoppings, instead of wooden stoppings, there were no accumulations of inflammable material which may have held fire and started more or less serious fires after the explosion. There were only three (3) small ones, a piece of brattice cloth, small piece of plank and the end of one displaced timber found on fire -- all quickly extinguished.

That the violence of the explosion did not extend further into the mine on other entries and cause greater destruction is due in part to the new air shaft that acted as a safety valve releasing the built up flame and pressure direct to surface -- four (4) 20 ft. wide air courses and haulageway on 10th South and a block of coal with but few openings between the 10th South and 11th South entries.

Anticipating the future needs of an increased volume of intake air while mining the undeveloped virgin coal west of the 11th South Entry and ahead of Main West Entry; the company had employed the firm of Salmon and Cowin; Mining Engineers and Contractors; to drive a rock slope for ventilation and escapeway. During the time the mine was idle the last of June and first part of July they built three concrete block stoppings to enclose the area where rock slope would break into the mine, later it was determined that the break-through would be inby the stoppings and two more stoppings were built to enclose the area.

On Wednesday night, July 28th, 1948, a hole 3 ft. in diameter was broken through to the mine. About 8:30 P.M., Thursday night, July 29, this hole was enlarged to about 10 ft. by 5 ft. This allowed a large volume of intake air to enter the mine over the stoppings where blocks had been left out to take care of the concussion of blasting. This additional air entered the air current near the bottom of the 11th Slope. When the capacity of the regulators controlling the normal travel of air was reached, it disrupted the air travel down 11th South, allowing a large body of methane to collect in the right hand air courses and haulageway of the 11th South Slope.

This area was not fire-bossed or inspected for methane from the time the interruption to normal air flow at 8:30 P.M., Thursday night until the time of the explosion at 9:00 A.M. Friday morning.

The foreman in charge of the night or middle shift was requested to examine the brattices near air shaft after shooting was completed in the air shaft. He reported that they (brattices) were apparently O.K. but he did not report any interference to the normal flow of ventilation although he stated he did notice a change.

There were six (6) possible sources of ignition of the body of gas, namely:

1. Smoking
2. Spark from hammer of bratticeman
3. Cutting torch in pump room
4. Light line attached to trolley wire near pump room
5. A defective flame safety lamp or,
6. Trolley locomotive on haulageway between 5th and 6th West. 11th South.

We were able to eliminate the smoking theory -- because the clothing of the men in the explosion area were searched at the hospital and found completely free of matches or smoking materials.

2nd- Spark from the bratticeman's hammer is remote, as brattice was very nearly demolished at time of explosion and he probably wasn't using hammer at this stage of tearing down the brattice.

3rd- We have evidence from the men connecting up the cutting torch that it had not been turned on or put in service.

4th- The lights were burning at time of explosion from evidence presented by men working in pump room.

This brings us to the two (2) most probable sources of ignition, the flame safety lamp; found in the mine near the bottom of the 11th South escapeway at the inby; probable; edge of the body of gas, and the trolley locomotive on the Main Haulage at the outby probable edge of this body of gas.

The flame safety lamp upon examination showed the chimney or glass to have a "V" shaped crack through glass and a hole about the size of a match and 3/8" long; upon opening chips of glass as well as fine coke particles were found inside -- blown inwards by the explosion -- the two gauzes of the lamp showed no evidence of undue internal heat. All other parts of the lamp were in good normal condition of a flame safety lamp in service. The broken glass may have resulted from striking nearby concrete blocks as a result of a fall or blow against them by the explosion.

We have evidence from the brattiçeman that he "was fixing to examine for gas again before I left there; before I could get my lamp it exploded somewhere--whether further up the line I do not know. All I know is, I met fire." He also stated that it appeared to come "from the 11th South as he saw a flame as it got right about nearly to him."

The two (2) men near the locomotive on 11th South Haulage between the 5th W. and 6th W. were both killed by the violence of the explosion. Brakes had been set up on the locomotive, controller was in off position and reverse lever in a forward position. Trolley pole was off the trolley wire, but this could have been done after the other things have been done and in disengaging the trolley pole from the wire it could have caused an arc, igniting the gas.

The investigators could not arrive at a definite conclusion as to the source of ignition, however, the inability of the investigators to definitely determine the igniting agent does not change the fact that an explosive mixture of methane was permitted to accumulate. And this was the cause of an explosion that should not have occured.

Following is a brief account of the Rescue and Recovery work and violence caused by the explosion:

RESCUE AND RECOVERY

When the exploration party reached the 11th South, it was decided to make entrance to the explosion area through the 10th South.

They traveled in 10 South to 11th West in 11th West to main door in stopping. From the main door a rescue team from Docena mine, captained by Jack Robinson, went through door and was instructed to travel to the intersection of 11th West and 11th South. When they failed to return after what was considered a reasonable time another team was making preparation to follow to see what was wrong; when they returned stating that they had traveled on into 11th South inby 11th West to pump room. They had located one body, McGaha on 11th South, outby pump room, reported there was plenty of fresh air on 11th South.

A party then went into 11th South through man door without respiratory protective equipment, traveled inby 11th West to pump room 11th South, found two men inby pump room. At this time they met a rescue team and a Federal Inspector (Guthrie) that had come down the escapeway slope. A piece of burning brattice cloth was extinguished near where McGaha was found.

Strong smoke was observed issuing from cross cut to 11th South Right A.C. A rescue team was sent into 11th South Right A.C. and found two small fires, one was end of timber and the other was a small piece of plank.

The rescue parties were then told to return to the main door in the 11th West and wait. They were there waiting when State Mine Inspectors Youngblood and Crane arrived.

After waiting for approximately one hour, the party had not returned, State Inspectors came back to 10th South to use telephone, where they encountered the exploration party who had returned out the 17th West to 10th South. At this time R. B. Jones, Safety Inspector, reported that the ventilation was again being coursed into 11th South from Main West. This having been accomplished by obstructing the flow of air entering the New escapeway by a brattice cloth stopping erected near the portal.

All recovery activities were then transferred to the 11th South off Main West proceeding the 11th South to a point 2,318 ft. from Main West, they found two (2) bodies and a 6-ton locomotive, light smoke was encountered just inby locomotive. A rescue team then explored the area between there and the 11th West looking for fire and examining for Carbon Monoxide and Methane Gas.

They returned after traveling inby to 11th West and outby through the West Heading that was turned off 11th South, reporting that smoke had cleared and no fire had been found. There was approximately 2% of methane gas found in the 10th West 11th South Heading but not of sufficient volume to cause concern. A temporary stopping was then erected in cross cut to 10th South Back A. C. to course the ventilation into the 11th South. After this three (3) bodies were recovered and carried by stretcher to 5th West where they were loaded into mine car and pushed to 11th South turnout, thence by locomotive and rope haulage to surface.

The last of the bodies reached the outside at 9:00 P.M.

The rescue party reached the outside with all equipment at 9:30 P.M.

VIOLENCE

The violence consisted of the following: Trolley wire and guard boards torn down along the 11th South.

14th permanent stoppings constructed of concrete blocks.

3 temporary stoppings constructed of concrete blocks and new escapeway.

A 6-ton trolley locomotive standing on 11th South between 5th and 6th West was stripped of the top covers except one left near the control end.

Regulators in 1st West and 11th West, 11th South were completely destroyed also curtain regulator behind pump room. The regulator in Main West A.C. was slightly damaged. A concrete block wall built behind pump room as a dam for sump was destroyed.

A W-8 Methane detector and an anemometer badly damaged was outby locomotive.

Other investigators who think the locomotive was the ignition agent, believe the assistant mine foreman was removing the trolley pole harp from the trolley wire, and because the headlights were burning an arc resulted and ignited methane. Federal investigators do not concur with the belief that the locomotive was the ignition agent because more definite evidence indicated the explosion originated elsewhere.

Physical evidence at and near the seal being removed in the 2 right air course indicated the ignition originated at that point. Evidence of force radiated from this point, charred posts indicated the presence of extreme heat and the absence of violence in the area is further evidence of the point of origin. The fact that 8 men in the vicinity suffered injuries confined to burns is further evidence of a point of ignition. Two men in the vicinity suffered contusions that were not serious, and the fact that another burned man suffered crushing injures to the face that could have resulted after the explosion are additional indications of a point of origin. Failure to disturb rock dust from which the containers were burned, and the fact that none of the stoppings between 11 south slope and the left air course was destroyed from 13 west to the faces of the entries also attests lack of violence in the area near the foot of the 11 south slope escapeway.

Coke deposits on 2 sides of posts in areas of violence are readily explained by the fact that the explosion traveled most rapidly in the 2 right air course of 11 south slope entries and expanded in both directions when it traveled through crosscuts.

The survivor among the 4 men at the stopping in the 11 south slope 2 right air course near the foot of the escapeway stated that flame burned there for "quite a bit." He also stated that flame came from toward the 10 south and 11 south. This would also seem to be the case if methane had been ignited at the stopping, because the methane accumulation would have been outby the stopping. He further stated that he heard the noise and saw the flame about the same time. In a later interview he stated that he took the flame safety lamp off the cap piece where it was hanging; that the lamp was out; that he turned the wheel (igniter) once and then it happened; the whole world exploded: that there wasn't time to turn it again. He also stated that he and another man laid down; that fire burned there a long time; that their clothing caught fire, and they could not stay there any longer; that he got up to run and the other man caught his legs and asked that he wait for him. He further stated that he guessed his hat, lamp and belt were found where the explosion started. In subsequent statements he denied that the igniter had been turned. Two other survivors, one at the control room and the other in the pump room, heard the noise but did not see any flame. One other survivor in the pump room who suffered only a contusion stated that he "heard a noise, felt a cyclone" saw flame pass over him, and that the flame was followed by some things that looked like "tracer bullets."

A record made by the ventilation inspector Friday morning, July 30, showed that 23,714 cubic feet of air a minute was passing through the regulator for the 1 and 2 wests off 11 south slope. The record also shows that 0.60 percent of methane was found using a permissible methane indicator. The last previous record at this regulator showed 21,300 cubic feet of air a minute and a methane content of 0.35 percent. Some investigators believe the difference in air volume was caused by air flow reversed in 11 south slope entries. This belief is strengthened by the increase in methane in the split. Other investigators believe that the increase in air volume in the 1 and 2 west split is due to the fact that the opening at the foot of the new escapeway provided a short path from the intake to the fan with a corresponding decrease in air resistance, and that the 1 and 2 west split, being the shortest in the ventilating system being serviced by the fan, benefited the difference in the air volumes. Some investigators think air tended to be pulled both directions from a neutral point in the 11 south slope entries, and that this accounted for the increase in the methane in the 1 and 2 west split. This could also account for the presence of methane at the seal being removed near the foot of the new 11 south slope escapeway.

Testimony of witnesses and the record of the ventilation inspector indicates that the inspector and the assistant mine foreman were aware of unusual conditions in the 11 south slope entries from 10 to 20 minutes before the ignition occurred. All investigators agree that these men left 2 west 11 south slope together; that the assistant mine foreman operated the locomotive from the 1 west off 11 south slope to the point where it was found after the explosion; that he was waiting at that point for the ventilation inspector who was walking and inspecting in the 2 right air course 11 south slope entries. These are supported by the fact that the ventilation inspector's trouser legs were wet halfway to the knees and his shoes were wet. The locomotive was found with the brakes taken up, the controller in "off" position, the trolley pole was off the wire in a normal position outside the trolley wire guard-boards, and toward the center of the track. The locomotive headlight switch was in "on" position.

Testimony established the fact that the ventilation inspector wore eye glasses only while taking air measurements, methane readings, and when reading and writing. His glasses were found near his body and out of their case. His anemometer and methane indicator were on his person after the explosion. His record book was found in the 10 south slope back air courses near 6 west, where it had been carried by the explosion. This man's body had suffered much violence, was burned, and was found about 150 feet outby the locomotive.

The assistant mine foreman suffered burns and considerable violence which struck him from the rear. A dent about 3 inches long and about 3/4-inch deep was noted in the back of his head and below the crown. This injury could have been caused by the covers from the locomotive which were found more than 150 feet outby his body. Some investigators believe the assistant mine foreman was looking at the ventilation inspector when they were struck by the force of the explosion.

TABLE 2 ANALYSES OF AIR SAMPLES. COLLECTED August 1948

MINE Edgewater COMPANY Tennessee Coal Iron & Railroad Co. COLLECTED BY A. Guthrie & H. N. Smith

Bottle No.	Laboratory No.	Location in Mine	PERCENT IN VOLUME					Cubic feet air per min.	Cubic feet, methane in 24 hours
			Carbon Dioxide	Oxygen	Methane	Carbon Monoxide	Nitrogen		
0260	164395	5 No. 20 west left aircourse face	0.09	20.82	0.20		78.89		
4984	164396	10 south 11 west return	0.05	20.88	0.05		79.02	14,550	10,476
5255	164397	Return, 5 No. 20 west right aircourse return	0.09	20.84	0.08		78.99	9,700	11,174
5555	164398	6 north 15 west left aircourse	0.03	20.87	0.00		79.10	5,725	
5566	164399	Return first west 11 south regulator	0.05	20.73	0.37		78.85	22,010	117,269
5675	164400	9 south 10 west regulator	0.05	20.84	0.07		79.04	38,000	38,304
5915	164401	Main return 8 west off 10 south	0.06	20.90	0.10		78.94	14,800	21,312
6056	164402	Left side main west return	0.07	20.79	0.42		78.72	26,667	161,282
7608	164403	6 north 16 west last crosscut between #7 and 8 rooms	0.04	20.92	0.04		79.00	2,520	1,452

Lab. Nos. C-98865 to C-98892 incl. Sheet No. 1

TABLE 3. ANALYSES OF DUST SAMPIES. COLIECTED August 1948

Mine Edgewater Company Tenn. Coal, Iron & Railroad Co. Collected By H. N. Smith & Arthur Guthrie

Can No.	Sample of Dust From	Location in Mine	As Received Basis, Percent				Percent Through 20-Mesh
			Moist.	Ash	Comb.	Incomb.	
M-299	Timber-Ribs	8 feet inby 11 No. turnout on main west	.6	96.1	3.3	96.7	98.3
J-817	Timbers	2nd crosscut outby 2 W. off 11 south	1.0	78.0	21.0	79.0	97.6
U-926	Floor	do.	1.0	80.1	18.9	81.1	81.4
U-30	Floor	2nd crosscut outby 3 west off 11 south-ribs wet	1.3	71.1	27.6	72.4	77.1
U-712	Floor	40' inby 6 west off 11 south-ribs wet	1.4	48.8	49.8	50.2	84.3
W-546	Ribs	40' from face 9 W. L.AC. off 11 So.- Evidence of soot	2.6	46.4	51.0	49.0	75.3
K-971	Floor	do.	1.6	36.6	61.8	38.2	74.7
U-671	Ribs	In 11 south R.A.C. at 13 west between LAC and heading	1.6	56.1	42.3	57.7	76.0
U-35	Floor	do.	1.2	46.1	52.7	47.3	76.8
U-403	Timber-Ribs	In 11 So. heading, 70' inby 13 west turnout	1.8	46.0	52.2	47.8	81.9
E-262	Floor	do.	1.3	43.1	55.6	44.4	75.8
U-677	Ribs	At right rib 14 west, LAC. in 11 So. No. 1 LAC. (Heavy Coke)	1.7	48.6	49.7	50.3	67.0
U-106	Floor	do.	1.3	58.1	40.6	59.4	76.8

TABLE 3 ANALYSES OF DUST SAMPLES COLLECTED August 1948

Mine Edgewater Company Tenn. Coal, Iron & RR Co. Collected By H. N. Smith & Arthur Guthrie

Can No.	Sample of Dust From	Location in Mine	As Received Basis, Percent				Percent Through 20-Mesh
			Moist.	Ash	Comb.	Incomb.	
K-700	Timber-Ribs	48' inby 14 west LAC. in 11 So. No. 2 RAC.	2.1	62.4	35.5	64.5	76.8
L-810	Floor	do.	1.6	36.0	62.4	37.6	74.2
U-449	Timbers	In 11 So. No. 2 RAC. 108' inby 14 west LAC. (Heavy Coke)	2.1	54.4	43.5	56.5	86.3
U-25	Floor	No. 11 xcut, No. 3 AC. off 10 S. outby xcut 11 So. barrier	.8	73.7	25.5	74.5	85.2
U-704	Ribs	do.	2.2	84.0	13.8	86.2	93.3
T-502	Floor	No. 5 xcut No. 3, 10 So. AC. inby 11 xcut barrier	1.2	35.9	62.9	37.1	75.1
U-452	Ribs	do.	1.2	68.3	30.5	69.5	89.5
U-148	Floor	No. 5 xcut 10 So. No. 3 AC outby 11 west off 10 So.	.6	79.6	19.8	80.2	84.0
T-481	Ribs	do.	1.8	84.4	13.8	86.2	96.2
U-479	Floor	No. 12 xcut, 11 west heading outby No. 3 10 So. AC.	.7	77.3	22.0	78.0	88.7
U-353	Ribs	do.	1.0	87.0	12.0	88.0	94.0
T-939	Floor	No. 10 xcut No. 3 AC. inby 11 west off 10 So.	.7	86.0	13.3	86.7	91.3
U-566	Ribs	do.	1.1	90.3	8.6	91.4	96.7

Sheet No. 3

TABLE 3 . ANALYSES OF DUST SAMPLES COLLECTED August 1948

Mine Edgewater Company Tenn. Coal, Iron & RR Co. Collected By H. N. Smith & Arthur Guthrie

Can No.	Sample of Dust From	Location in Mine	As Received Basis, Percent				Percent Through 20-Mesh
			Moist.	Ash	Comb.	Incomb.	
R-366	Floor	No. 10 xcut outby pump station on 10 So. 17 west LAC	2.2	55.1	42.7	57.3	89.5
U-56	Ribs	do.	1.5	82.6	15.9	84.1	96.6

Table 4

ALCOHOL COKE TEST

CAN NO.	COKE PARTICLES PRESENT
M-299	None
J-817	None
U-926	None
U-30	None
U-712	None
W-546	Large
K-971	Very Large
U-671	Small
U-35	Small
U-403	Small
E-262	Large
U-677	Small
U-106	Small
K-700	None
L-810	Small
U-449	Small
U-25	None
U-704	None
T-502	None
U-452	None
U-148	None
T-481	None
U-479	None
U-353	None
T-939	None
U-566	None
R-366	None
U-56	None

Edgewater Mine, Jefferson County, Alabama.

APPENDIX "A"

Preliminary Report

State of Alabama, Department of Industrial Relations, Div. of Safety & Insp.

Edgewater Coal Mine Explosion

At 9:00 A.M., Friday, July 30, 1948, a local methane (CH_4) gas explosion occurred on the 11th South Slope off the Main West entry of the upper level of the Edgewater mine; owned and operated by the Tennessee Coal, Iron and Railroad Company.

This mine is at Edgewater, Jefferson County, about 14 miles Northwest of Birmingham, Alabama, and the Post office address is Birmingham, R.F.D. (14) Jefferson County, Alabama.

Edgewater mine was opened up in 1911 in the Pratt seam of coal by means of a shaft sunk close to a dislocation fault which divides the mine into two sections, the upper and lower levels. The depth to the upper level is 237 feet and to the lower level is 387 ft. making the displacement of coal seam 150 ft. at this point.

The American Seam underlying this area has been opened up and partly developed from the lower level; but neither the lower level (Pratt seam) or the American Seam have been worked for the past several years.

The average height of the Pratt Seam being worked is 66 inches to 72 inches including 9 inches of slate partings with slate and sandstone roof. The mine is worked room and pillar on the panel system. Coal is under-cut by shortwall and caterpillar mounted mining machines and blasted on shift by permissible explosives and electric detonators. All mining machines use water on the cutter bars when operating and are provided with ground wire. Water is also used on loading machines, conveyors and loading points. Coal is loaded with mobile loading machines and conveyed to car loading points by shuttle cars and conveyors. All employees wear electric cap lamps, hard hats and hard-toed shoes.

Main and room entries are driven in sets of four (4). Entries driven about 20 ft. wide.

The mine is ventilated on the split system, there being 22 splits. Four fans are provided which are located on the surface at different parts of the mine, with recording pressure gauges indicating #2 Fan, 3-2/10"; #3 Fan, 2-3/10"; #4 Fan 4-6/10"; #5 Fan 2-2/10", each has dual drive; one with electric motor and steam engine; two with electric motor and gasoline engine and one with two electric motors using power from different sources. All fans work exhausting and the total volume of air handled is 615,000 cu. ft. per min. Auxiliary or blower fans are not used underground in this mine.

There are six (6) rock slopes driven to different parts of the mine as fresh airintakes and escapeways. One hoisting shaft and a rock slope material and manway.

There are 715 men employees at Edgewater mine on three (3) shifts, producing about 7,000 tons per day.

Four men were removing a seal in 11 south slope 2 right air course just inby 14 west. This was one of the first 3 seals erected to control the air that would enter the mine when the new 11 south slope escapeway connected with the mine. Because the escapeway missed the original sealed area the seal being removed had little effect on the ventilation. Earlier in the shift these 4 men had removed another seal from the original sealed area. This first seal removed was in the first crosscut inby 14 west and between the 1 and 2 air courses of 11 south slope. All of these 4 men were seriously burned, and one of them suffered crushing injuries to the face. Two of these men escaped through the new escapeway and suffered no injuries other than burns. One of these 2 men who escaped died later in a hospital. The body of the fourth man was found in 11 south slope entry just inby 14 west. His tracks in the dust showed that he had collided with posts and was lost for a period of time. The crushing injuries to his face may have resulted from his collisions with posts.

Four men were in the pump room which is in a crosscut between 11 south slope entry and the left 11 south slope air course at the west barrier heading. Two of these men were building a concrete-block wall. They were killed by violence and were both burned. Their bodies were blown into the west barrier heading about 90 feet and 180 feet respectively. The other two men in the pump room were not burned, but they suffered contusions when they were forced into a post and a water line, respectively. They were connecting hose to an acetylene tank and an oxygen tank at the time of ignition. These relatively little-injured men crawled to the open end of a 14-inch pipe elbow at the foot of a drill hole in the pump room and thus received fresh air from the surface. Soon after the explosion they explored part of the area between the pump room and the bottom of the new escapeway and found two badly burned men whom they assisted from the mine through the new 11 south slope escapeway. One of these burned men had been at the seal being removed at the time of the ignition. Both of these burned men later died in a hospital.

One man was at the pump control room in the next crosscut outby the pump room. He was drilling or had just completed drilling a hole in a concrete block in the west wall of the control room. The drilling was done with a steel hammer and a steel chisel. This man was severely burned, but suffered no other injuries. He was one of the men recovered by the men from the pump room.

Four men were at the face of the new 11 south slope escapeway mucking rock at the time of the ignition. These men were all seriously burned, but suffered no other injuries. One of them escaped unaided from the slope. The other 3 were assisted by the men who were escaping from the mine. Three of the 4 men working in the slope died later in a hospital.

Other men in the area affected by dust, smoke or concussion and escaped uninjured were:

8 west off 10 south slope, 18 men
11 west off 10 south slope, 16 men
1 west off 11 south slope, 18 men

Possible Points of Origin

Several possible sources of ignition were present; however, the investigation eliminated all but 2 of them.

1. Open flame caused by smoking was considered, but the clothing and other property of the men in the area did not contain any matches nor any other smokers' articles.

2. The oxygen-acetylene torch was considered, but evidence showed that the acetylene tank valve had not been opened. An accumulation of methane in the pump room was most unlikely, first because of the fresh air entering the pump room through the 14-inch pipe; and second, because the pump room was being ventilated with a large volume of air almost directly from the new escapeway.

3. The power tap, for the pump room lights, which was attached to the trolley wire in 11 south slope entry at the outby end of the first crosscut outby the control room, was considered. Evidence by a survivor indicates the lights were on at the time of ignition; moreover the power tap was in fresh air direct from the new escapeway.

4. A spark caused by striking a steel chisel with a steel hammer was considered, but evidence in the form of coke deposited at this point eliminated this source. This location was ventilated with fresh air direct from the new escapeway.

5. An arc from the trolley pole harp on the trolley locomotive inby 6 west on 11 south slope entry is considered the point of origin by some investigators.

6. The flame safety lamp with a small hole in the glass chimney which was found at the seal being removed in 11 south slope 2 right air course was considered by some investigators to be the igniting agent.

Summary of Evidence

The accumulation of methane was caused by either a reduction of the volume of air coursed through the 11 south slope entries from 2 west to the foot of the 11 south slope escapeway and intake, or by a complete stoppage in ventilation between these two points. This condition was caused by the entrance of air through the new escapeway in quantity large enough to satisfy the regulators on the split, and because air from this new source had a path more than 4,000 feet shorter than the path of the original ventilating current. Evidence was given that the ventilating current was reversed in 11 south slope on Thursday night July 29. The person giving the evidence was riding a locomotive when the direction of air travel was noted. When this man later dismounted from the locomotive and walked in 11 south slope entry, he could not determine in which direction the air was flowing. The stagnation of air probably endured from the time the hole 3 feet in diameter was opened by mucking in the escapeway sometime Thursday, July 29, until the ignition occurred.

A flame safety lamp with carrying hook missing was found under locomotive.

Another flame safety lamp with small hole in glass globe was found in Right Air Course 11th South. New brattice that was being taken down.

Numerous timbers were displaced along the 11th South Heading and air courses.

The track inby 8-West turnout was pushed out of direct line approximately 4 ft.

Fan tubing was blown out escapeway slope to outside.

Explosion doors on exhaust fan was blown open by the force of the blast.

VIOLATIONS OF STATE COAL MINING LAWS

Section 85- Ventilation required- The operator, superintendent or mine foreman of every coal mine, whether a shaft, slope or drift, shall provide and maintain ample means of ventilation and for the circulation of air, properly conducted through the main entries and all working places, as well as abandoned area where possible, to an extent that will dilute, carry off and render harmless the noxious and explosive gases generated in the mine, the same to be not less than one hundred cubic feet per minute per man, and five hundred cubic feet per mule or horse.

Section 86- Accumulation of explosive gas not allowed; fencing abandoned mines. No accumulation of explosive gas shall be allowed to exist in the worked out or abandoned parts of any coal mines in operation and the entrance or entrances to said worked out and abandoned places shall be properly fenced off, and cautionary notices shall be posted upon said fencing to warn persons of danger.

RESPONSIBILITY

Responsibility is chargeable to management and supervision for an accumulation of explosive gas existing in idle or temporarily abandoned places.

RECOMMENDATIONS

1st- That when a new opening is to be made to any coal mine that could disrupt the regular coursing of the ventilating air current, the said new opening must be provided with doors that can be closed immediately when connection is made to the mine.

2nd- That when a crew or crews of men are to work inby idle or temporarily abandoned places, these places must be examined by the fire boss within four hours prior to beginning of shift before the workers are allowed to enter therein.

3rd- That when a new opening is to be made to a coal mine that the Division of Safety and Inspection be notified prior to making the connection, in order that we may examine brattices, doors or other devices that may effect the regular coursing of the ventilating current.

Mine rescue teams from the Alabama By-Products Corporation, Sloss-Sheffield Steel and Iron Company, Woodward Iron Company, as well as those from the Tennessee Coal, Iron and Railroad Company, assisted in the rescue operation. Rescue crews from the Republic Steel Corporation, New Castle Coal Company and Railway Fuel Company, offered their services but were not needed.

The writer expresses appreciation for the courtesies shown by all of the Company employees. The Federal Bureau men assisting were H. N. Smith, Arthur Guthrie, Coal Mine Inspectors, G. C. Farren, Safety Instructor, and M. C. McCall, Supervising Engineer.

The following members of the Mine Safety Committee of the Local Union #6256 of the United Mine Workers of America were most helpful and co-operative in this investigation, C. E. Pierson, G. O. Smith and Richard Cannon.

The following personnel of the Division of Safety and Inspection, Department of Industrial Relations, State of Alabama, assisting were O. H. Youngblood, A. G. Crane, H. T. Williams, J. H. Chapman, F. L. Weston and J. A. Ivie, Mine Inspectors, H. J. Gentry, Chief Mine Inspector and T. L. Ball, Chief of Division.

APPENDIX F

List of men killed (or died), explosion Edgewater mine, Tennessee Coal, Iron and Railroad Company, July 30, 1948:

Name	Occupation	Color	Age	Married or Single	No. dependents under 18 years of age
Killed					
William S. Pentz	Asst. Mine Foreman	White	61	Married	0
John T. Starnes	Ventilation Inspector	White	62	Married	0
Alvin K. McGaha	Rock Helper	White	25	Single	0
William Gragg	Head Rockman	Colored	54	Married	2
Eddie Jones	Rock Helper	Colored	18	Single	0
Sandy Gary	Rockman	Colored	42	Married	8
Died from Burns					
James Jordan (Died July 30, 1948)	Mucker	Colored	33	Married	4
Willie J. Hartley (Died July 31, 1948)	Rockman Helper	White	41	Married	2
Ernest Franks (Died July 31, 1948)	Hoist Engineer	White	28	Married	1
Audrey E. Romine (Died August 1, 1948)	Rockman Helper	White	24	Single	0
Walter Wilson (Died July 31, 1948)	Mucker	Colored	44	Single	0