REPORT ON AN EXPLOSION OF GAS
IN THE
AVONDALE SHAFT, AVONDALE COLLIERY
GLEN ALDEN COAL COMPANY

On October 30, 1950

MEMBERS OF COMMISSION

Andrew Wilson
Mine Inspector, 7th District

Daniel H. Connelly
Mine Inspector, 8th District

John D. Edwards
Mine Inspector, 13th District

November 28, 1950

Honorable Richard Maize
Secretary of Mines
Harrisburg, Pennsylvania

Dear Mr. Maize:

On October 30, 1950, at 12:20 A.M., an explosion of gas occurred in Avondale Shaft, Avondale Colliery, Glen Alden Coal Company, Plymouth Township, Pennsylvania, causing the death of four workmen. The explosion occurred in No. 28 Tunnel, which had been driven from the Red Ash on through the Chauncey seam to the Ross seam. The four workmen fatally injured were the only persons in the tunnel at the time. Another workman, a road cleaner, was on No. 5½ West gangway, approximately 200 feet outside of the line of the tunnel at the time of the explosion.

The mine is ventilated by an electrically driven exhaust fan located on the surface. The total quantity of air entering the Red Ash seam in this section on November 2 was 51,670 cubic feet. This total quantity is divided into four splits. Split No. 1 ventilates No. 19 Slope section; Split No. 2 ventilates No. 220 Road; Split No. 3 ventilates No. 227 Road; and Split No. 4 ventilates No. 28 Tunnel, the scene of the explosion.

The openings between the intake and return airways on Splits Nos. 1, 2 and 3 were closed with concrete, stone, or concrete blocks laid in cement.

Split No. 4 was established on October 19, 1950. To accomplish this, it was necessary to erect four new stoppings, which were constructed of boards.

The air current ventilating No. 28 Tunnel enters the tunnel from No. 5½ West gangway. A ventilating door is located in the tunnel approximately 30 feet outside of the Chauncey seam. This door is used to deflect the air current behind a plank brattice to the face of the tunnel and thence out the tunnel on the return side of the brattice to the Chauncey seam and to the 45 degree rock return to the Red Ash seam. The pressure recording chart indicated that the fan had been in continuous operation on October 29, with the exception of two brief intervals of a few seconds each at 9 A.M. and 1:30 P.M., when the auxiliary power and auxiliary fan were being tested. This test is made every Sunday.

Permissible electric cap lamps are used by all workmen in this mine and all miners are furnished with permissible flame safety lamps. Compressed air-driven jackhammers are used for drilling purposes in the tunnel. Permissible explosives are used in blasting coal.

An electric locomotive, equipped with trolley and reel cable, is used in the tunnel for transportation purposes. The reel cable is used from a point 80 feet outside of the opening to No. 28 Tunnel in the Red Ash seam. Under normal operating conditions the locomotive would not be in return air currents when moving in No. 28 Tunnel to the Chauncey seam.

Property damage was confined to the tunnel and consisted of the tearing down of a ventilating door and several lengths of the plank brattice, and the dislodging of several sets of cross timbers.

Rescue and recovery operations were started at once by the assistant foreman who was in the mine at the time, and shortly after the apparatus men entered the section the bodies of the three workmen in the tunnel were removed to the surface.

Our investigation consisted of an examination of the affected section, an examination of the electric locomotive by the electrical inspector, interviewing workmen and officials, examination of the legal records for a period of three months prior to the explosion, and the conducting of an experiment to determine the source of the methane, the cause of the accumulation and the time required for sufficient gas to accumulate to render the atmosphere explosive from the face of the tunnel to a point in the vicinity of the Chauncey seam.

The assistant mine foreman, who made the morning examination of No. 28 Tunnel on Sunday, October 29, which was an idle day at the colliery, testified that he examined the tunnel workings at approximately 5 A.M. and that the face of the tunnel was clear of gas at that time. In his opinion the ventilating current in the tunnel and in the three other splits was moving normally at the time of his examination. He was positive that the door in No. 28 Tunnel was closed during his inspection. The assistant foreman's date of inspection was found by us on the under side of a dislodged length of brattice.

The work of driving this tunnel, which has a grade of 5 per cent to the rise, from the Red Ash seam to the face, has been under way for a considerable period of time. After tapping the Chauncey seam, which is a virgin seam in the tunnel area, the tunnel was continued to the Ross seam, also virgin, and for twenty additional feet beyond the Ross, where it was stopped. The face of the tunnel has not advanced since the early part of August 1950. For the purpose of establishing ventilation and to provide a second opening, the Chauncey seam was connected with the underlying Red Ash seam by a 45° rock hole on October 17, 1950.

On October 18, preparations were started to provide a separate split of air for the tunnel, which would make the tunnel haulageway a fresh air intake to the door in the tunnel. On the afternoon of October 18, after the night assistant foreman had inspected and left the tunnel, the rock contractor and two workmen, while setting up the drilling machines, noticed a "gas cap" on the safety lamp. They were located at the intersection of the tunnel and the Chauncey seam, where they were about to start to lift bottom rock. The rock contractor and the two rockmen immediately discontinued work, placed a danger board across the tunnel outside of the Chauncey seam, attempted to contact the assistant mine foreman, but were unable to do so, and then went to the surface.

On October 19, the morning assistant foreman, while making an examination of the working places prior to the men entering the mine, found gas in No. 28 Tunnel out to the Chauncey seam, a distance of 150 feet. This is the only entry in the legal report book between August 3, 1950 and October 30, 1950, the day of the explosion, where the finding of gas has been noted in No. 28 Tunnel or in any other place in the Red Ash seam.

The workmen were not permitted to enter No. 28 Tunnel on October 19, but were allowed to enter the other sections of the Red Ash seam. The gas was removed under the supervision of the day shift assistant foreman,

although no record was entered in the legal report book by this foreman to indicate that the gas was removed. It was on October 19, that the four board stoppings were erected in the Red Ash seam to provide the new split of air for No. 28 Tunnel.

After the new split had been established in the tunnel, the rock contractor started to lift the bottom rock in the Chauncey seam. On October 27 the mine foreman visited No. 28 Tunnel workings and while there attempted to make arrangements with two rockmen and two company men to work on Saturday night, October 28, on the 11 P.M. shift. The two rockmen agreed, but the two company men refused. However, the company men stated they would work on Sunday, October 29, on the 11 P.M. shift. The mine foreman then told one of the company men, McLaughlin, to "come out with the rockmen and look after things", and then arranged with the rock contractor to have two men report for work on the 11 P.M. shift Sunday night. The same two rockmen worked on Saturday afternoon in the tunnel and loaded six cars of rock by hand.

On Sunday night the four workmen who were to work in the tunnel, together with 15 other workmen, 12 to work in No. 26 Tunnel, Ross seam, mining and loading coal, a pumprunner, a road cleaner and an assistant mine foreman, entered the mine at 10:30 P.M. With the exception of the pumprunner and the road cleaner, the group of men, after being lowered down the shaft, were lowered to the bottom of No. 2 Slope in two man cars. This same group of men then walked into the assistant foreman's office. The assistant foreman then checked in the workmen from No. 26 Tunnel, Ross seam, while the four workmen who were to work in No. 28 Tunnel continued on their way, with the exception of the motorman, Michak, who informed the assistant foreman that he was to operate the motor in No. 28 Tunnel.

The assistant foreman stated that after he checked in the men from No. 26 Tunnel, Ross seam, he entered the tunnel workings with them and had the men wait at the belt loading point while he, the assistant foreman, made an examination of the working places in this seam. He further stated that after completing the examination of the working places he returned to the belt loading point and instructed the men to enter their working places.

The assistant foreman then returned to the inside office and in a short time the workman who was to load road coal entered the office. After a short discussion with the workman it was decided by the workman that he would load road coal along 5½ West gangway in the vicinity of No. 28 Tunnel.

There is no record entered in the legal report book that would indicate the assistant foreman had examined the working places in the Ross seam prior to the entrance of the workmen. However, there is an entry in this book that would indicate that he, the assistant foreman, had made an examination of the working places while the workmen were at their place of work. His testimony relative to his examination of the working places in the ross seam prior to the entry of the workmen was contradicted in part by several of the workmen.

The workman who was to load road coal along No. 5½ West gangway stated that when he arrived at the intersection of 5½ West gangway and the back branch to No. 28 Tunnel, the section in which the explosion occurred, he met with the two company men, namely, McLaughlin and Michak, having made previous arrangements with the two men as to where he would load the road coal, and that the two company men assisted him in branching out two empty cars from a lower haulageway and also in re-railing one of the empty cars. They then told the road cleaner to "get out of the way" so they could start work. The road cleaner, with locomotive and two empty cars, traveled out 5½ West gangway for a short distance, where he stopped and loaded approximately 8 to 10 shovelfuls of coal into one of the cars. He then re-entered the motor and moved out the gangway to a point approximately 450 feet from where he had left the two company men, and was about to step out of the motor when his hat was blown off by a concussion. Considerable dust was raised by the concussion, which the road cleaner thought was caused by a blast in the tunnel. This was approximately five

minutes after he had left the company men. After the dust had subsided, the road cleaner started to load loose coal and had loaded approximately one-half car, when he heard someone calling. He immediately started in No. 5½ West gangway and met with Michak. Michak asked to be taken out, and when questioned as to what had occurred stated: "There has been an explosion. The motor lit the gas." Presumably Michak was referring to the reel cable locomotive he was operating in the tunnel.

The road cleaner placed Michak on the locomotive he had been using while loading the road coal and brought him out to the inside foreman's office. It later developed that Michak had called on the phone, located at the foot of the inside plane, after being caught in the explosion, and had contacted both the surface and the night shift assistant foreman in the Ross seam.

Michak was taken to the hospital but was never in a condition that would permit an interview. He died as a result of his injuries on November 13, 1950.

Following the explosion a large body of methane was encountered in No. 28 Tunnel and it was not until Thursday, November 2, that we were able to go to the face of the tunnel and start with our investigation and experimenting.

Several of the group engaged in the recovery work were of the opinion that a large concrete block wall, in Chamber 55, off the back branch to No. 28 Tunnel, had been partially destroyed by a fall of top rock prior to the explosion, and because of this, the ventilating current had been short-circuited from No. 28 Tunnel section.

This wall, which had been rebuilt after the explosion, in order to move the body of gas from No. 28 Tunnel, was 14 feet high and 28 feet wide. We decided to remove a board stopping in another crosscut in order to short-circuit the ventilating current from No. 28 Tunnel. The removal of this board stopping would have the same effect on the air current as would the removal of the wall heretofore described as being partially destroyed. On Thursday, November 2, at 11 A.M., prior to the removal of the said board stopping, we obtained an air measurement in the return from No. 28 Tunnel, which was 6,120 cubic feet per minute. After removing this stopping, we obtained an air measurement in the return of 2,880 cubic feet. During this experiment, the door in No. 28 Tunnel, used to deflect the air current to the face of the tunnel, was closed. A methane reading of .3% or 8.6 cubic feet per minute, was obtained in the return. We determined that the gas was coming from a high point in the roof of the Ross seam where the seam had turned sharply upward. With the board stopping down and the door in the tunnel closed, gas did not accumulate in the tunnel. This condition was permitted to exist for a period of one hour. The fact that gas did not accumulate in the tunnel with this board stopping down and the door closed indicated to us that gas would not accumulate if the wall in Chamber 55 had been partially destroyed and the door closed.

We then opened the door in the tunnel, which, together with the removal of the board stopping, would entirely short-circuit the air current from the face of the tunnel. Gas immediately began to accumulate at the face of the tunnel and in the vicinity of the Ross seam.

Over a period of 18 hours the gas accumulated from the face of the tunnel to a point, along the roof, 20 feet inside of the Chauncey seam, where it remained stationary for six additional hours, when the experiment was discontinued. It was apparent that with the air current traveling in the tunnel to the Chauncey seam and thence to the rock-return, further accumulation, if any, would extend over a long period of time.

There are two other possibilities for the accumulation, namely, a sudden outburst of gas from the Ross seam or the destruction by a fall or otherwise of one or more of three board stoppings erected in the crosscuts

between Chambers 54 and 55 off Road 221, Red Ash seam. The destruction of one or more of these stoppings would allow the ventilating currents off 221 Road to travel into the same return air course to which No. 28 Tunnel is connected. This is a separate return from that through which the air would travel if the stopping in the opening in Chamber 55 off the back-branch was destroyed. The ventilating door in No. 28 Tunnel could be closed on October 29, as is indicated by the testimony of the assistant foreman, and still in the event one or more of the board stoppings were destroyed, 28 Tunnel would be deprived of sufficient air to dilute any gas that might accumulate therein.

If one or more of the board stoppings had been damaged prior to the explosion, they were repaired without our knowledge.

The electric locomotive at the time of the explosion was approximately 90 feet outside of the Chauncey seam, as is indicated on the attached print. If the electric locomotive operating on reel-cable were the direct source of ignition, the gas would have to be at the roof, 370 feet outside of the face of the tunnel, or 240 feet farther out in the tunnel than we were able to find it after our 24-hour experiment. We do not believe that the gas could accumulate to this point in any case.

Another possible source of ignition, as a result of the operation of the electric locomotive in the tunnel, could have been arcing at the rail joints along the tunnel, which were not bonded, or arcing between the rail and the air line. The inside rail joint was 70 feet back from the face of the tunnel and in order that an arc from this rail joint, or from a rail to the air line, be looked upon as the source of ignition, the gas would have to be in an explosive state along the roof, 216 feet from the face of the tunnel, which is at the high point of the Chauncey seam. This appears to be the most logical point at which gas would accumulate during the period of time between 5 A.M., October 29, and 12:20 A.M., October 30, the rate of gas liberation being 8.6 cubic feet per minute.

On the profile of the attached print we have indicated in red the accumulation of gas that would have to be in the tunnel if an arc from the rail were the source of ignition, and in brown the additional accumulation if the electric locomotive were the source of ignition.

A spent book match and a singed book match cover were found along the tunnel. Both of these were some distance outside of the tunnel door, as will be noted on the attached print. We do not believe that a flame from a match was the source of ignition.

Based upon the testimony of the road cleaner and the position of the bodies of the two rockmen and McLaughlin, we believe that the rockmen had entered the tunnel and were sitting along the rib 20 feet outside the tunnel door awaiting arrival of the locomotive to remove the rock cars which had been loaded on Saturday afternoon, and that McLaughlin was riding in the tunnel on the front end of the locomotive with Michak when the gas was ignited.

The tunnel door was dislodged by the explosion. A flame safety lamp was found under the door on the pavement and we believe that this lamp belonged to the rockmen. Another flame safety lamp was found hanging on an electric cable just inside the intersection of No. 5½ West gangway and the back branch to No. 28 Tunnel. This is a considerable distance from the scene of the ignition. The lamp found under the ventilating door was tested and found to be in good condition.

Based upon the testimony of the road cleaner and the night shift assistant foreman, we fix the time of the explosion as of 12:20 A.M. on October 30. This time was determined as follows:

Time workmen went down shaft:	10:30 P.M.
Time workmen descended inside slope:	10:35 P.M.
Time workmen arrived at foot of slope:	10:47 P.M.

Time workmen arrived at Caswell's office:	10:55 P.M.
Time four workmen traveling to No. 28 Tunnel arrived at branch foot inside plane:	11:20 P.M.
Time Zionce and pumprunner went down slope:	11:15 P.M.
Time Zionce and pumprunner arrived at foot of slope:	11.27 P.M.
Time Zionce arrived at Caswell's office:	11:35 P.M.
Time Zionce arrived at branch at foot of inside plane:	12:00 Midnight
Time Zionce and two company men (McLaughlin and Michak) were branching and rerailing empty cars:	12:15 A.M.
Time Zionce arrived at location where hat was blown off by concussion from explosion:	12:20 A.M.
Time of explosion:	12:20 A.M.

From the testimony given by the mine foreman, it was learned that he had asked McLaughlin on Friday, October 27, to come out on Sunday night, October 29, on the 11 P.M. shift, to look after things in the tunnel. He was to assist in moving the rock loader from the branch into the tunnel and show the rockmen how to operate the rock loader. McLaughlin did not possess either a mine foreman's or an assistant mine foreman's certificate, nor was he ever employed as a mine foreman or an assistant mine foreman. The facts and the testimony indicate that McLaughlin's first visit to the tunnel on the night of the explosion was as heretofore described, namely, that he and the motorman, aboard the locomotive, entered the tunnel at about 12:20 A.M.

The mine foreman declared that he has the right in law to select any workman who, in his opinion, is competent and to assign to such person the job of performing the legal duties imposed upon the assistant mine foreman. If this were true - fortunately it is not - the foreman could select any miner, or all of the miners, when about to enter a mine at the beginning of a shift, to perform such legal duties as are imposed on the foreman or his assistant, thus eliminating the need for the employment of an assistant foreman.

The law imposing upon the mine foreman or his assistant the duty to make a careful examination every morning of all working places within three hours at most before time for commencing work is the most important mine safety measure in the statute books of the Commonwealth, and has been in force for more than sixty years.

During all of our years of experience, this is the first time that we have encountered a practice such as heretofore described, a practice which has no support in law and is contrary to the intent and purpose of the Legislature.

The law strictly and clearly provides that sections of a mine, such as the ill-fated section in question, shall be examined by the mine foreman or the assistant mine foreman within three hours prior to the entrance of workmen. In this case no such examination was made. Had McLaughlin made the examination, it would still not be recognized in law as a legal examination, because McLaughlin was neither a mine foreman nor an assistant mine foreman. This title was never assigned to him by his employer. He was merely an ordinary worker, his occupation being that of a company laborer. In the midst of all this, an assistant mine foreman was available in the mine. He could have examined the section in which the explosion occurred prior to the entrance of the workmen in a matter of about 45 minutes.

The assistant mine foreman in question, who was in charge of the mine on the night of the explosion, declared that he had not been informed by anyone that men were to work in No. 28 Tunnel, but there is no denying the fact that this knowledge did come to him at 10:30 P.M. on the night of the explosion, nearly two hours prior to its occurrence, when

the men who were fatally injured reported for work. Notwithstanding this knowledge, and knowing that the section of the mine in which these men expected to work was not examined by a mine foreman or an assistant mine foreman, he did nothing to prevent their entering. This assistant foreman, in his testimony, assumed the attitude that he was in charge only of the few men engaged in two working places in No. 26 Tunnel, Ross seam.

The colliery superintendent testified that he had not been informed by anyone that men were to work in No. 28 Tunnel on the 11 P.M. shift.

Rule 5 of Article 12 of the Anthracite Mining Laws provides as follows:

> "In mines generating explosive gases, the mine foreman or his assistant shall make a careful examination every morning of all working places and traveling roads and all other places which might endanger the safety of the workmen, before the workmen shall enter the mine, and such examination shall be made with a safety lamp within three (3) hours at most, before time for commencing work, and a workman shall not enter the mine or his working place until the said mine or part thereof and working place are reported to be safe. Every report shall be recorded without delay in a book which shall be kept at the colliery for the purpose and shall be signed by the person making the examination."

No. 28 Tunnel had not been examined by a mine foreman or assistant mine foreman since 5 A.M. on October 29, 1950. The explosion occurred 19 hours and 20 minutes following this examination.

Rule 7 of Article 12 reads as follows:

> "A station or stations shall be established at the entrance to each mine or different parts of each mine, as the case may require, and a workman shall not pass beyond any such station until the mine or part of the mine beyond the same has been inspected and reported to be safe. It shall be the duty of the fire boss to remain at the danger station until relieved by some person, authorized by himself or the mine foreman, who shall stand guard until said mine or part of mine shall be reported safe, and he shall not let any person pass without permission from the fire boss."

The night shift assistant mine foreman in charge of the 11 P.M. shift allowed the four workmen who were fatally injured to pass his station and enter No. 28 Tunnel with the knowledge that this part of the mine had not been examined and declared to be safe.

SUMMARY OF FINDINGS

1. Permissible flame safety lamps and electric cap lamps are used in the mine.

2. Compressed air-driven jackhammers are used for drilling purposes.

3. Permissible powder is used for blasting coal.

4. An open-type electric trolley and trailing cable locomotive was used in the tunnel, and under normal operating conditions would operate in intake air.

5. The four workmen employed in No. 28 Tunnel on the night of the explosion were not held at the "station" legally established in the mine until No. 28 Tunnel had been inspected and reported to be safe.

6. The last examination by an assistant foreman in No. 28 Tunnel was at 5 A.M. October 29, 19½ hours prior to the explosion.

7. No examination had been made by a mine foreman or an assistant mine foreman with a flame safety lamp, within three (3) hours at most, before the four workmen entered No. 28 Tunnel.

8. A workman employed as a company miner and at times as a company laborer was told by the mine foreman to look after things in a tunnel that had not previously been examined by a mine foreman or an assistant mine foreman.

9. A report of an examination, prior to the entrance of the workmen in No. 26 Tunnel, Ross seam workings, was not recorded in the legal report book.

10. The tracks in No. 28 Tunnel were not bonded.

11. The electric locomotive was in operation, traveling in No. 28 Tunnel at the time of the explosion.

12. The source of the ignition was an electric arc, either from the locomotive or from the track joints in the tunnel.

13. The amount of methane being given off, 8.6 cubic feet per minute, was such that it would require a long period of time for the gas to accumulate in the tunnel from the face back to the Chauncey seam, a distance of 150 feet.

CONCLUSIONS

1. Rule 7 of Article 12 of the Anthracite Mining Laws of Pennsylvania was violated by the assistant mine foreman employed on the 11 P. M. shift October 29, when he allowed the four fatally injured workmen, employed in No. 28 Tunnel, to pass beyond the station established in the mine, before the section of the mine had been inspected by an assistant mine foreman and reported to be safe.

2. Rule 5 of Article 12 of the Anthracite Mining Laws was violated by the mine foreman in charge of this mine when he failed to examine or to have examined, by an assistant mine foreman, the workings in No. 28 Tunnel, within three hours prior to the entrance of the four workmen.

RECOMMENDATIONS

To prevent accidents of this nature in the future, the following extracts of the Anthracite Mining Laws should be rigidly enforced:

1. In mines generating explosive gases, an examination should be made by the mine foreman or his assistant with a flame safety lamp, within three (3) hours at most, prior to the entrance of the workmen into the mine.

2. Workmen should not be allowed to pass danger stations, established as required by law, until the mine or portion of the mine beyond the same has been inspected and reported to be safe.

3. The reports of examinations made by the mine foreman and the assistant mine foreman should be promptly recorded