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**FINAL REPORT  
MAJOR ROOF-FALL DISASTER IN CRUCIBLE MINE  
CRUCIBLE FUEL DIVISION, CRUCIBLE STEEL COMPANY OF AMERICA  
CRUCIBLE, GREENE COUNTY, PENNSYLVANIA  
MARCH 12, 1945**

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*lost 1/27/41 B m 1/30/41*

**UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF MINES**

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INTRODUCTION

Falls of roof material occurred on the day shift about 8:30 and 8:45 a.m., Monday, March 12, 1945, in the Crucible mine, Crucible Fuel Division, Crucible Steel Company of America, Crucible, Greene County, Pennsylvania. Five men were killed, and three men narrowly escaped injury. The accident occurred when the timbers were tripped out from under roof by falling material in a pocket off a split that was driven through a 90-foot-square block of coal near No. 5 room, 23 butt left, off 3 flat west entries. The bodies were recovered by tunneling through the fallen material. The last of the five bodies was recovered at 3:15 a.m., March 13, 1945.

Mr. G. W. Grove, supervising engineer, District A, Bureau of Mines, was notified of the accident about 5:45 p.m., March 12, by Mr. E. M. Lewis, Federal coal-mine inspector, Uniontown, Pa. Mr. Lewis learned of the accident from the Uniontown evening paper. Mr. Grove instructed Messrs. F. E. Griffith, E. M. Lewis, and G. M. Smith to report to the mine at 8:00 a.m., March 13, to make an investigation. State Mine Inspectors J. V. McKenna and Olin S. E. Conrad supervised and assisted with the recovery of the five bodies. Messrs. J. V. McKenna, E. W. Wilkinson, and J. R. Walthour, State mine inspectors, investigated the accident for the Pennsylvania Department of Mines.

GENERAL INFORMATION

Location and Operating Officials

The Crucible mine of the Crucible Fuel Division, Crucible Steel Company of America, is located at Crucible, Greene County, Pennsylvania. Coal is shipped on the Monongahela River and on the Monongahela Railway.

The names and addresses of the operating officials are:

Joseph H. Callum	President	Chrysler Building, New York City
W. J. Whittaker	General Manager	Oliver Building, Pittsburgh, Pa.
T. P. Latta	General Superintendent	Crucible, Pa.
L. E. Mechling	Chief Engineer	Uniontown, Pa.
W. E. Hart	Safety Engineer	Crucible, Pa.
Thomas Mark	Mine Foreman	Crucible, Pa.

### Employees and Production

The report of an inspection of this mine, which was made December 15 to 22, 1944, and January 3 to 6, 1945, showed that 776 men were employed, of which number 565 work underground on two shifts.

The average daily production of coal is 4,800 tons. The total production for 1944 was 1,228,634 tons of coal. The probable life of the mine is 30 years.

### Roof and Floor

*natural*  
The condition of the roof and floor in this mine is from medium to bad. The immediate roof in the 23 butt section is approximately 12 inches of top coal and 12 inches of draw slate. Above the draw slate is several inches of shale, and above the shale is a layer of solid black "slate" varying from 4 to 8 feet in thickness. The bottom is fire clay which softens when exposed to air. In the area in which the accident occurred an unusual number of cleavage or slip planes was observed in the intermediate roof.

### Type of Mine

The mine, opened by a slope 570 feet long on a 17° pitch and four shafts ranging in depth from 165 to 432 feet, is developed in the Pittsburgh coal bed, which has an average thickness of 84 inches in this mine and has the characteristic impurities of this bed. The coal bed dips in a westerly direction on an average of about 1 percent, and the maximum cover is approximately 500 feet thick.

## UNDERGROUND MINING METHODS, CONDITIONS, AND EQUIPMENT

### *abstract* Method of Mining

The mine is generally laid out with reference to butts and faces and is developed on the room-and-pillar system of mining. Main entries vary in number from 5 to 13, cross entries from 4 to 6, and room entries driven on the butt cleats are in pairs. Entries are 12 feet wide on 50-foot centers. Rooms and pockets are 16 feet wide, and rooms are on 100-foot centers. Crosscuts are made in rooms and entries at 100-foot intervals.

The extraction of pillars is accomplished by driving pockets and breaking through the rib to the open end at intervals, leaving small stumps of coal which are not recovered. Fairly definite pillar lines are maintained, and good pillar falls are experienced. An estimated 85 percent of the coal bed is recovered.

The coal is top-cut and sheared to a depth of about 8-1/2 feet. All coal is loaded mechanically by mobile loading machines.

### Timbering

A uniform system of timbering has been adopted at this mine, and the system is generally enforced. However, no plans or diagrams of the system

are made. The system requires cross bars on 4-foot centers to within 4 feet of the face before cutting so that the operators of cutting and loading machines are not beyond the last cross bar while at the controls of the machines. Breakline posts and cribs are set where, in the judgment of the officials, they are needed. Timber crews are provided with slate bars and timber jacks. The roof is tested by the vibration method with picks or slate bars.

#### Ventilation and Mine Gases

A centrifugal and a propeller-type fan are operated continuously to induce air flow in the mine. The fans are operated exhausting. They circulate a total of about 352,000 cubic feet of air a minute. The air flow in the mine can be reversed, and a split system of ventilation is used. The ventilation is controlled by a system of doors, stoppings, regulators, overcasts, and line brattices. Stoppings are constructed with bricks or cement blocks. Doors are hung in pairs to form air locks, and haulageways are in intake air.

The mine is rated gassy by the Pennsylvania Department of Mines, and, from analysis of air samples collected by a Federal inspector during the period December 15 to 22, 1944, and January 3 to 6, 1945, a total of 753,926 cubic feet of methane was being liberated in the mine in 24 hours. About 75 permissible flame safety lamps and 1 electric methane detector are provided for gas testing.

#### Drainage

The working places and haulage roads in the 23 butt section are naturally dry.

#### Dust

Finely divided coal dust in this mine is explosive. Excessive accumulations of coal dust were not observed. Water is used to allay coal dust during cutting, after blasting, on loaded trips, and at the underground dump. The mine roof, ribs, and floor are rock-dusted by two track-mounted rock-dusting machines. In the Federal inspector's report, previously referred to, the average analysis of the incombustible content in 12 samples collected was 73.9 percent.

#### Haulage

All haulage is done by electric trolley and cable-reel locomotives. Haulage tracks are maintained in good condition, and adequate clearance along tracks is maintained.

#### Lighting

Incandescent electric lamps are located along haulageways at intervals. Permissible electric cap lamps are used by the miners for illumination.

### Electrical Equipment Underground

Direct-current 250-volt permissible-type cutting machines, mobile-loading machines, and hand-held electric drills are used.

### Explosives

Permissible explosives, fired electrically with permissible shot-firing devices, are used for blasting coal and rock.

### CONDITIONS IMMEDIATELY PRIOR TO ACCIDENT

The place where the accident occurred was cut and blasted during the day shift on Saturday, but the coal was not loaded until Monday; the mine did not work on the night shift Saturday on account of high water in the river.

Information, relative to the conditions of the working place prior to the accident, was obtained from statements made by persons who inspected, examined, or worked in the place. These statements are as follows:

(The fire boss, who examined the place at about 4 a.m. on Monday the 12th, stated that the working place was cut and the coal blasted; he observed no evidence of any particular hazard, none of the roof supports was broken, and, in his judgment, the place was in "perfect shape.") He made a second examination of the place at about 8 a.m. and the place was "still in good condition"; the loading machine had loaded five cars, and the helper was digging loose coal from the face. The loading-machine helper tested the roof with a pick, in his presence, and it tested "all right." He stated that he examined the roof near the face and observed a small crack in the roof which would be taken care of by timbers. He stated that the system of timbering was up to standard and he did not think there was any danger.

The face boss stated that he visited the place about 7:50 a.m. after the machine had loaded five cars. He asked the loading-machine helper to test the roof, and from this test the roof was good. He stated that no broken timbers were in the place. The roof was not broken and was perfectly safe. The roof coal was up, and he did not think it necessary to place any cribs because the entire area was protected by cross timbers. He visited the place again, some minutes later, to instruct the timbermen where to go next, but did not go to the face. He was on his way to the sidetrack when notified that a fall had occurred and trapped the men in this place. He returned and tried to get one of the men out from under the fallen roof material. The roof above the fallen material was working, and he retreated in time to avoid being caught by a second fall.

The loading-machine operator stated that he trammed his loading machine into the place the first thing Monday morning. He examined the place thoroughly before loading any coal and considered the place safe; there were no broken timbers. After loading five cars he stopped the machine to wait for a car change, and his helper tested the roof again; he felt the place was

in good condition. While they were in the place, they heard no sound to indicate that the roof was working. He stated that the timbering was within one out of the face and, in fact, the last cross timber was a little too close for free operation of the machine. He said that he did not bump any of the timbers while loading the coal. After loading all of the loose coal, he made another examination and considered the place to be safe.

A trackman stated that he had been instructed by the foreman to go to this place the first thing in the morning and lay track to the face. He was working with two other trackmen (track crew consists of three men in this mine). When he arrived at the place, the timbermen (a bratticeman was assisting the three-man timber crew) had already set one cross timber, and he stood watching the timbermen work. He did not hear any sound of the roof working. He stated that the place was in good condition; he did not see any broken timbers and considered the place safe and better than the average working place. He stated that he left the place to get some ties and, at the time of his departure, the timbermen were preparing to set the second cross timber. He stated that he had left the place only a short time before the fall of roof material occurred.

The other trackman (one was killed by the fall) stated that he was standing near the "bridge bars" of the place watching the timbermen set a cross bar on the jack and lift it against the roof. He stated that no timbers were broken, the place was better than average, and he did not think a fall could occur in the place. A moment later the roof cracked and started falling near the face; he ran from the place, and the other men started to run but were unable to escape. He stated that he did not hear the roof work at all until it made that one crack.

The assistant mine foreman in this section of the mine stated that the stump of coal, that was crushed out by the fall, showed some signs of crushing prior to the accident but, in his opinion, this condition could have been caused by blasting and did not, necessarily, indicate unusual stresses.

#### SIZE OF FALL AND RECOVERY OF BODIES

It is estimated that more than 500 tons of roof material had fallen in the first and second falls that occurred when the timbers collapsed under roof in a split and a pocket driven into the 90-foot-square block of coal near No. 5 room, 23 butt left, off 3 flat west entries. The material in the first fall, that buried the five men beneath it, consisted of 12 to 14 inches of roof coal, 12 inches <sup>or more</sup> of draw slate, and several inches of black shale. The material of the second fall consisted of a solid black "slate" boulder, approximately 30 feet long by 30 feet wide with an average thickness of about 4 feet.

The bodies were recovered by loading the material from under the black "slate" boulder. As the broken material under the boulder was removed, safety posts and 18-inch-square cribs were set to support it. The work of recovering the bodies was supervised by State Mine Inspectors J. V. McKenna and Olin S. E. Conrad.

The body of the first man, a trackman, was recovered from under the fall at about 2 p.m., March 12, 1945; the second, a timberman, at about 6 p.m.; the third, a timberman, at about 11:45 p.m.; the fourth, a timberman, at about 12:50 a.m., March 13, 1945; and the fifth body, a brattice-man, about 3:15 a.m., March 13, 1945. A list of the names of the deceased and their occupations is appended.

#### INVESTIGATION OF CAUSE OF FALL

The accident was investigated on March 13, 1945, by Messrs. F. E. Griffith, mining engineer, E. M. Lewis, Federal coal-mine inspector, and G. M. Smith, mining explosives engineer, from the Bureau of Mines. Messrs. J. V. McKenna, inspector in the 13th Bituminous District, E. W. Wilkinson, inspector in the 5th Bituminous District, and J. R. Walthour, inspector in the 19th Bituminous District, investigated the accident for the Pennsylvania Department of Mines. The Bureau of Mines investigators accompanied the State inspectors underground, but an independent investigation was made by each.

It was learned in the investigation that a split had been driven through a 90-foot-square block of coal and two 8-1/2-foot cuts of coal had been taken from a pocket to the left of this split. The right rib of the pocket was started 6 to 8 feet outby the point where the split had cut through into No. 4 of a group of five entries known as 23 butts. This procedure of splitting the block of coal was contrary to the normal procedure followed at this mine. It was stated that it was carried out in this case because of heavy falls in a breakthrough and falls in the No. 4 entry.

From statements of officials and others who had visited the working place a short time before the accident occurred, the place was timbered in accordance with the adopted standard; three cross bars had been set in the pocket and a fourth was being set at the time of the fall. This could not be verified by observation at the time of the investigation because only a small portion of the fallen material had been loaded out. It was noted, while inspecting other working places in the vicinity, that the timbering standard requiring cross bars at about 4-foot intervals was maintained. It was also noted that cribs were placed near the breakline in most of the other working places. However, no claim was made that cribs were set at any point in the place where the accident occurred. The lack of such a roof support may or may not have a bearing on the initial roof fall, which consisted of coal, draw slate, and shale.

It was observed that a hidden, almost vertical, slip or cleavage plane was parallel with the face of the pocket and another was almost parallel to the right rib of the split. From the statement of the trackman, who narrowly escaped injury when the initial fall occurred, the roof started falling at the face of the pocket. It is thought that the falling of this roof material tripped out the supporting leg posts of the cross bars without breaking them or giving much advance warning.



## SUMMARY OF EVIDENCE AS TO CAUSE OF ACCIDENT

The statements of the officials and other employees show that, in their opinion, the place was satisfactorily timbered, the rock that fell was so heavy that any defects could not be discovered by observation or sounding, and signs of unusual weight did not show on the timbers or pillars of coal. #1

## PROBABLE CAUSE OF ACCIDENT IN THE JUDGMENT OF THE BUREAU INVESTIGATORS

The Bureau investigators believe that the cause of the accident was inadequate timbering for the unusual roof conditions encountered. The timbers collapsed without giving sufficient warning for the men to escape. It is believed that the timbers would have given ample warning before collapsing if cribs had been placed on the outside of the curved track entering the pillar pocket and braces had been placed between the three-piece sets to give collective lateral support.

## STATE INSPECTORS' CONCLUSIONS

A hearing was held during the afternoon of March 13, 1945, by the State inspectors and the coroner. The Federal investigators were informed by Mr. J. V. McKenna that the hearing would be confined to the State inspectors, the coroner, and the witnesses who would be admitted only one at a time. However, the Federal investigators were informed that the State inspectors found no violations of mining laws or company rules and could determine no negligence on the part of anyone.

## LESSONS TO BE LEARNED FROM THE CONDITIONS AS THEY RELATE TO THIS ACCIDENT

In the opinion of the writers, the outstanding lessons to be learned from this accident are:

1. A place should be completely timbered before men are sent into the place to do work other than timbering.

2. In sections where cleavage or slip planes are frequently encountered, three-piece framed timber sets should be erected, with the legs placed in hitches cut into the bottom, and braces or sprags should be placed between the timber sets to give collective longitudinal support.

3. When the accident occurred, more men than necessary were in the working place.

## RECOMMENDATIONS

The following recommendations are made in the belief that their adoption will materially lessen the chances of a similar accident occurring at this mine:

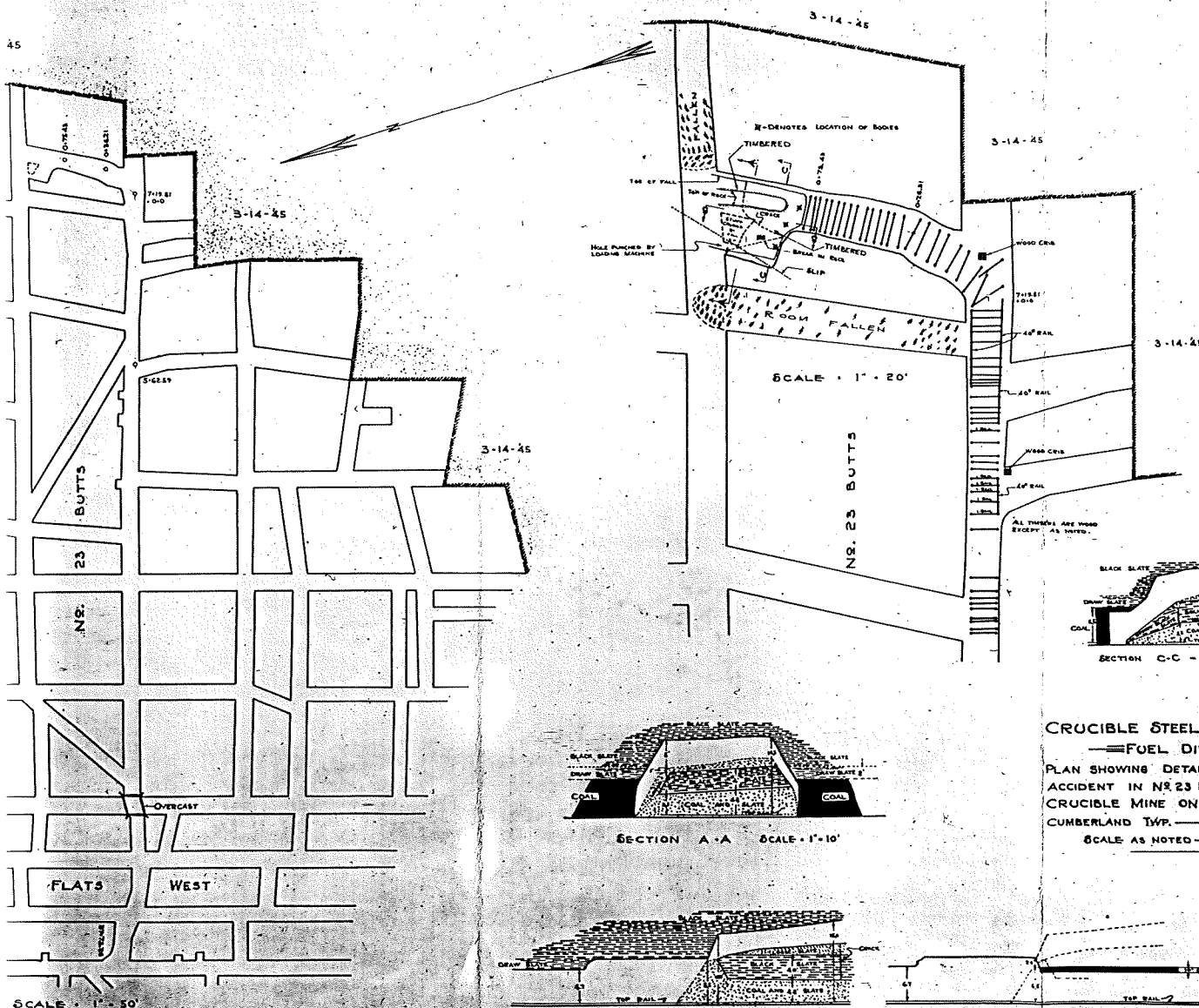
1. Plans for the timbering system should be printed and posted at conspicuous places.

2. Suitable rods or bars, instead of picks, should be used for testing roof.

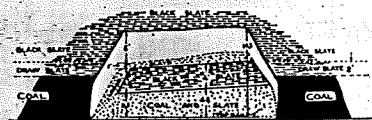
3. The timbering in a place should be completed before men are sent into the place to do work other than timbering.

4. In sections where cleavage or slip planes are frequently encountered, three-piece framed timber sets should be erected, with the legs placed in hitches cut into the bottom, and braces or sprags should be placed between the timber sets to give collective longitudinal support.

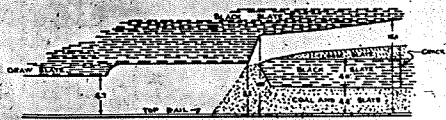
5. In pillar mining, cribs should be placed wherever break-throughs are made and on the outside of the curved track entering pillar pockets.



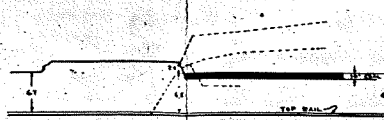
SCALE - 1" = 50'



SECTION A-A SCALE - 1" = 10'



SECTION B-B SCALE - 1" = 10'



SECTION B-B BEFORE FALL



SECTION C-C - SCALE 1" = 10'

## CRUCIBLE STEEL CO. OF AMERICA

## FUEL DIVISION

PLAN SHOWING DETAIL AND LOCATION OF  
ACCIDENT IN NR 23 BUTT, NR 3 FLAT WEST,  
CRUCIBLE MINE ON MARCH 12<sup>TH</sup>, 1945  
CUMBERLAND TWP. — GREENE COUNTY, PA.  
SCALE AS NOTED — F.E. Co. 3-13-45

**APPENDIX II**

**Plan showing detail and location of accident**

LIST OF NAMES, OCCUPATION, ETC. OF DECEASED

Name	Age	Address	Occupation	Marital status	Children under 16	Country of birth	Citizenship	Mine experience, years	Speak and understand, English
Mike Dragich	55	Grucible, Pa.	Trackman	Single	None	Austria	First papers	20	Yes
Robert Bert Mathews	47	Rices Landing, Pa.	Bratticeman	Married	None	U.S.A.	Yes	22	Yes
Martin Spellar	55	Chestnut Ridge, Pa.	Timberman	Widower	None	Yugo-slavia	Yes	25	Yes
*Grover Cleveland Johnson	51	do.	do.	Widower	None	U.S.A.	Yes	25	Yes
*Edward Henry Johnson	28	do.	do.	Married	One	U.S.A.	Yes	4	Yes

\*Father and son.

# ACKNOWLEDGMENT

The courtesies extended and the information furnished by the officials and other employees of the company and the State inspectors are gratefully acknowledged.

Respectfully submitted,

*F. E. Griffith*

F. E. GRIFFITH  
Mining Engineer

*E. M. Lewis*

E. M. LEWIS  
Coal-Mine Inspector

*G. M. Smith*

G. M. SMITH  
Mining-Explosives Engineer

**A P P E N D I X I**

**List of names, occupation, etc. of deceased**

October 18, 1945

From: Fred O. See

To: District Managers

The following report was received from Rodney Simms, Field Superintendent in Central West Virginia, today:

"On October 11, 1945, at 2:30 A.M., the Elk River Coal & Lumber Co. had a fatal accident. Accident was due to fall of "jack rock" on loading machine on #1 Section of Main East Mine.

Bee Scott, loader operator, was instantly killed. Russel Parsons, Foreman, and loader helper received fractured backs.

Short circuits caused from the fall set loading machine cables afire, causing so much smoke and strong fumes that rescue men could not get within reach of the dead or the injured.

Suffocation would have caused the death of the two injured, had it not been for the use of 28 Cardox shells available on the section at the time, notwithstanding the serious damage to the loading machine.

Rescue men came up on the intake air side with the valves open on the shells. This action forced the smoke ahead of them until they reached the fall; then additional shells were placed around and on the fall which quickly put out the fire. Result was the safe rescue of the two injured.

Above statements are made and verified by both the Management and labor of the Elk River Coal and Lumber Company. They feel as though there would surely have been three fatal accidents had not the Cardox been available."

We are very happy that CARDOX made it possible for the rescue party to save the lives of these two men. In addition to the rescue of these two men, a serious mine fire, with large property loss was, no doubt, averted.

  
Fred O. See

FOS:JED