Reports

Dated

12/21/1951

Orient No. 2 Mine

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
REGION VIII

FINAL REPORT ON MAJOR EXPLOSION DISASTER
ORIENT NO. 2 MINE
CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY
WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

December 21, 1951

By

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INTRODUCTION

A widespread gas and coal-dust explosion occurred in the Orient No. 2 mine about 7:40 p.m., December 21, 1951, causing the death of one hundred and nineteen men. Two hundred and fifty-seven men were in the mine when the disaster occurred of which number one hundred and thirty-three escaped to the surface uninjured and unaided, four were rescued and hospitalized and one, who survived, was rescued 58 hours after the explosion. Of the four injured men, one died later in the hospital. The names of the men who were killed, their ages, marital status, number of dependents, and social security numbers are shown in Appendix A of this report. The explosion originated near the junction of 3 south off 27 east north west and No. 3 stub entry off 3 south when a moving body of gas was ignited by an electric arc or spark. The explosion was propagated throughout a large part of the mine and into adjoining working sections by coal dust and possibly by the ignition of other bodies of gas.

GENERAL INFORMATION

The Orient No. 2 mine is located at West Frankfort, Franklin County, Illinois, and is served by the Illinois Central, Missouri Pacific, Chicago and Eastern Illinois, and The Chicago, Burlington and Quincy railroads. The mine was opened by the Chicago, Wilmington and Franklin Coal Company in 1922. The main office is located in Chicago, Illinois, and the officials of the company are as follows:

G. B. Harrington	President	332 South Michigan Avenue Chicago, Illinois
H. A. Treadwell	Vice President	332 South Michigan Avenue Chicago, Illinois
F. Earle Snarr	General Superintendent	Benton, Illinois
John R. Foster	Superintendent	Benton, Illinois
Thomas Garwood	Chief Engineer	West Frankfort, Illinois
Charles Pullen	Underground Supt.	West Frankfort, Illinois
Charles Walker	Safety Engineer	West Frankfort, Illinois
Arlie Cook	Day Shift Mine Manager	West Frankfort, Illinois
Wilford McDaniels	Night Shift Mine Manager	West Frankfort, Illinois

The mine employed 1,127 men, of which number 258 worked on the surface and 869 worked underground on two producing shifts and one maintenance shift, and produced an average of 10,000 tons of coal a day. Four shaft openings are provided, the main hoisting shaft being 500 feet deep, the No. 3 air shaft being 526 feet deep, and the auxiliary shaft being 488 feet deep. The No. 4 shaft through which recovery operations were conducted is 565 feet deep. According to U. S. Geological Survey elevations, the bottom of the 500-foot main shaft is 100 feet below sea level.

The workings are in the Illinois No. 6 coal bed, which has an average thickness of 110 inches and lies flat except for local undulations. From 12 to 24 inches of top coal is left to form the immediate roof and this is overlain with a weak shale. The floor is a medium hard fire clay. A sample of coal cut from the face of 27 west north west entry on February 24, 1951, was analyzed as follows:

Moisture	9.31 percent
Ash	6.79 percent
Volatile Matter	33.09 percent
Carbon	50.81 percent
	100.00
Sulfur	1.08 percent
B.t.u.	12,134

Numerous tests by the U. S. Bureau of Mines have shown that coal having a volatile ratio of 0.12 is explosive and that the explosibility increases with any increase in the volatile ratio. The volatile ratio of the coal in the explosion area of this mine, as determined by a comparatively recent analysis, was 0.39, indicating that dust from this coal is highly explosive.

MINING METHODS, CONDITIONS AND EQUIPMENT

Mining Methods

A panel, room-and-pillar method of mining was employed, with panel entries being driven in sets of 2, 3, and 4 at 572-foot intervals. Cross entries were turned off the main entries in sets of 5 at intervals of 1,608 feet. Barrier pillars 30 feet thick are left between rooms driven off adjacent panels, 50-foot barriers are left between the ends of panel entries, and 150-foot barriers are maintained along cross and main entries.

Room or stub entries in pairs or sets of 3 are turned off the panel entries about every 200 feet and the rooms are then driven parallel with the panel entries. Entries are driven 12 feet wide on 40-foot centers, rooms are driven 24 feet wide on 40-foot centers, and crosscuts are generally 60 feet apart. Room pillars are "slabbed" to the extent that the area caves and is inaccessible for inspection, and the pillars along the cross entries are partly recovered when retreating. All coal is loaded mechanically.

A systematic method of timbering has been established, but was not always followed where safety posts were required at the working faces. Wooden and steel beams were used for support along most haulage roads, and roof bolts were used in a few experimental installations. It was obvious that bolts installed in parts of the zones of extreme violence prevented the roof from falling and hampering rescue or recovery operations.

Blasting of rock and some coal faces was done on the off shift with permissible-type explosives, but all coal in the explosion area was loosened and broken down on shift with compressed air. The air compressors were installed on the surface and the air was forced to the working faces through 1-inch steel pipes tested to withstand internal pressure equivalent to 20,000 pounds per square inch. The coal was undercut and sometimes was undercut and sheared. Fire clay was used where stemming was required and a wooden bar was provided for tamping the charges.

Ventilation and Gases

The mine is classified as gassy by the Illinois Department of Mines and Minerals and by the U. S. Bureau of Mines. Ventilation is provided by an electrically driven centrifugal fan located at the main shaft and an electrically driven axial-flow fan at the No. 3 air shaft. Both fans are installed in fireproof structures on the surface and are operated continuously and blowing. The fans are offset properly from the shafts and are provided with fireproof air ducts, explosion doors, and recording pressure gages. They are also equipped with devices to deenergize the mine electrical circuits when the fans slow down to any great degree or

stop. About 400,000 cubic feet of air a minute is circulated through the mine and from 7,200 to 21,000 cubic feet a minute was passing through the last open entry crosscuts during the last Federal inspection of the mine in July 1951. Permanent stoppings, overcasts, and seals are constructed substantially of incombustible material, and where single doors are used on main or cross entries they are attended. Single doors, however, are not attended in the working sections. The analyses of 20 air samples collected in return-air currents in various parts of the mine during the last Federal inspection showed methane ranging from 0.13 percent to 0.74 percent, and the total liberation of methane for a 24-hour period at that time was 1,570,770 cubic feet.

Preshift, on-shift, and weekly examinations are made for gas and other hazards by the mine examiners, unit foremen, and assistant foremen, and "safety-first men" are stationed in the working sections to keep a constant check on the accumulated gas in the "old ends." These so-called "old ends" are abandoned sections in which pillars have been partly extracted and the entrances to the sections caved so that they can neither be inspected nor ventilated with any degree of certainty. Gas accumulates extensively in these areas and in many instances the air current sweeping along the caves is used to ventilate active working places. This method of ventilation relies on the pressure of the ventilating current to prevent the gas that has accumulated in the "old ends" from bleeding into the active workings. This has not proved to be a reliable means for preventing gas from seeping out of the old workings into active workings, however, as the gas has been found on numerous occasions to flow back and forth freely with the movement of transportation units or by the opening and closing of doors. There is also the constant danger of heavy falls in the abandoned workings forcing the gas out into the active workings and the slowing or stopping of the fan relieving the pressure of the ventilating current from the static atmospheres in the abandoned areas. The results of analyses of air samples collected during the investigation are shown in Table No. I. The caves at the entrances to old ends precluded the possibility of collecting air samples in the abandoned areas, but sample bottles No. A-2175, C-5480, and C-5533 collected where the air current flowed by the edges of the caves contained 8.00, 4.80, and 4.90 percent of methane, respectively. The sample of mine air collected at the main north off 27 west, after it had been bratticed during recovery operations, was found to contain 11.40 percent of methane.

Numerous oil wells penetrating the No. 6 coal bed at the mine are protected by a 150-foot barrier pillar of coal at each location. Booster fans were not used in the mine, but blower fans with tubing were used in conjunction with the McKinley entry driving machines.

Dust

The mine was dry and was rock-dusted to within 80 feet or less of all working faces at the time of the last Federal inspection. It was

TABLE 1 - RESULTS OF ANALYSES OF AIR SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Bottle No.	Date	Time	Location in Mine	Carbon Dioxide	Oxygen	Carbon Monoxide	Methane	Nitrogen
A-2175	12-27-51	10:18 a.m.	Lip of cave, old end D entry 3 and 4 south, 27 east, north west	0.03	17.10	0.02	8.00	74.58
B-9833	12-27-51	10:18 a.m.	do.	0.03	17.10	0.02	8.00	74.58
AX-100	12-27-51	10:50 a.m.	At main north off 27 west inby 7 north	0.06	17.10	0.38	11.40	70.52
A-112	12-27-51	12:45 p.m.	At entrance of 3rd entry of 5 south, 27 west, north	0.23	19.70	0.05	1.70	78.32
C-5499	12-27-51	8:50 a.m.	Mouth 25 west north	0.23	19.78	less than 0.01	0.79	79.19
C-5500	12-27-51	9:45 a.m.	Inby first crosscut on No. 1 north off 25 west, north	0.28	19.76	do.	1.06	78.89
C-5549	12-28-51	3:00 p.m.	No. 1 west, No. 1 south, 27 west, north abandoned area	0.26	19.31	0.01	1.33	79.09
C-5480	12-27-51	9:00 a.m.	Mouth No. 1 east, 3 south, 27 west, north abandoned area	0.48	17.35	0.11	4.80	77.26
A-2880	12-28-51	11:05 a.m.	Inby temporary stopping, 27 west, north, C entry, old main north	0.02	19.40	0.06	4.80	75.54
A-2881	12-29-51	9:30 a.m.	At 4th crosscut, 2 south off 27 east, north west	0.37	19.43	0.02	0.96	79.22

TABLE 1 (Continued) - RESULTS OF ANALYSES OF AIR SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Bottle No.	Date	Time	Location in Mine	Carbon Dioxide	Oxygen	Carbon Monoxide	Methane	Nitrogen
C-5489	12-27-51	11:35 a.m.	At crib in 9 south 25 west north	0.76	16.69	Trace	2.10	80.45
C-5490	12-27-51	12:50 p.m.	Mouth 25 east, north west, return air	0.17	20.19	do.	0.32	79.32
A-2376	12-29-51	9:50 a.m.	At 3rd crosscut in 2 south off 27 west north west	0.27	18.96	Trace	3.56	77.20
A-2754	12-29-51	9:45 a.m.	In 2 north at 4th crosscut, 27 east north west	0.12	20.05	do.	1.52	78.30
A-2795	12-29-51	10:10 a.m.	At 4th crosscut in 3 south off 27 west, north west	0.23	18.59	0.03	2.68	78.47
A-2873	12-29-51	10:00 a.m.	At 4th crosscut in 2 north off 27 west north west	0.11	20.58	Trace	0.30	79.01
C-5518	12-27-51	10:30 a.m.	Inby mouth 4 east, 3 north, 28 west north	0.16	18.97	0.03	2.90	
C-5533	12-27-51	2:30 p.m.	Inby first crosscut, No. 1 air course, 2nd north, 28 west, north	0.59	16.82	0.03	4.90	

apparent, however, during the investigation that coal dust had accumulated excessively along roadways and the amount of rock dust applied was not sufficient to prevent propagation of the explosion. Water sprays were installed on the cutting machines and water was used to some extent on the coal piles before loading to allay coal dust. The holes drilled for the compressed air blasting shells were also washed out before the shells were inserted, and calcium chloride was spread on the shuttle-car roadways. Watering methods employed at this mine are inadequate, however, by reason of the fact that water is not supplied and used in sufficient quantity to control the dust in face regions. Mine-dust samples were collected during the investigation from the area involved in the explosion and from unaffected areas, and the results of the analyses are shown in Table No. 2. A discussion of these analyses is contained in the part of this report entitled "Factors That Prevented the Spread of This Explosion."

Haulage

Shuttle cars, elevating conveyors, belt conveyors, and cable-reel locomotives were utilized in gathering operations in the working sections, and the coal was hauled to the hoisting shaft in 4-1/2-ton capacity steel mine cars pulled by trolley locomotives. The rolling stock and main-line track were kept in good condition. Clean shelter holes were available at frequent intervals along the haulageways, but the clearance space was not always kept free of obstructions. Men were transported in regular mine cars hauled by trolley locomotives and they rode on both sides of the cars. Suitable man-trip stations were provided and the trolley wire was either guarded at these stations or the power was cut off the wire while men loaded and unloaded.

Electric Equipment

Electric power is purchased as 33,000 volts alternating current and is reduced to 4,160 and 2,300 volts alternating current to operate the motor-generator sets and rectifiers. The armored power cables entered the mine through the shafts and boreholes drilled at convenient locations, and the underground substations are in well-constructed fireproof rooms. The underground electric equipment and haulage locomotives were operated from the 275-volt direct-current system, and the surface equipment was operated by 440- and 220-volt alternating-current power.

Bureau of Mines representatives, Mr. R. S. James, mechanical engineer, Pittsburgh, Pennsylvania, and Mr. F. J. Gallagher, mining-electrical engineer, Mt. Hope, West Virginia, made an inspection of electrical equipment in the explosion area on December 26 and 27, 1951, and reported as follows:

> Since no attempt had apparently been made to maintain the electrical face equipment in permissible condition, machines were not moved or taken to a shop for complete inspections as might have been necessary if one particular machine, in

TABLE 2 - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis Percent			
				Moist.	Ash	Comb	Incomb.
		Section A.A. - Explosion Area					
L-780	Rib & Roof	No. 1 entry No. 1 crosscut 3 N, 27 W. N.W.N.	Very large	5.0	28.5	66.5	33.5
K-792	Floor	do. do.	Very large	4.4	34.6	61.0	39.0
Q-71	Rib & Roof	No. 2 entry No. 1 crosscut	Very large	4.3	30.6	65.1	34.9
J-16	Floor	do. do.	Very large	4.9	29.6	65.5	34.5
R-605	Rib & Roof	No. 3 entry No. 1 crosscut	Very large	4.7	31.8	63.5	36.5
F-952	Floor	do. do.	Large	6.4	35.9	57.7	42.3
Q-201	Rib & Roof	No. 4 entry No. 1 crosscut	Large	4.9	30.5	64.6	35.4
M-565	Floor	do. do.	Small	5.2	31.1	63.7	36.3
		Section B.B. - Explosion Area					
L-94	Rib & Roof	No. 1 stub, 3 S. across from #4 room 27 E, N.M.N.	None	7.8	28.8	63.4	36.6
G-635	Floor	do. do.	None	6.7	23.3	70.0	30.0
J-297	Rib & Roof	No. 2 stub	Small	2.9	67.4	29.7	70.3
W-823	Floor	do. do.	Small	8.1	32.1	59.8	40.2
R-656	Rib & Roof	No. 3 stub	Large	3.2	43.9	52.9	47.1
K-955	Floor	do. do.	Small	6.7	27.9	65.4	34.6
V-282	Rib & Roof	Coke only. On 3 B entry, 3 S. last crosscut outby old end cave	Small	4.7	23.9	71.4	28.6

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis, Percent			
				Moist.	Ash	Comb.	Incomb.
		Section C. C - Explosion Area					
B-552	Roof & Rib	25 Ft. inby 27 W. D entry 7 & 8 So.	None	5.4	30.5	64.1	35.9
V-929	Floor	do. do.	None	5.5	25.7	68.8	31.2
R-321	Roof & Rib	25 Ft. inby 27 C entry 7 & 8 So.	Small	5.5	42.4	52.1	47.9
Q-75	Floor	do. do.	Small	5.6	25.5	68.9	31.1
K-509	Roof & Rib	15 Ft. inby 27 W. B entry 7 & 8 So.	Small	5.4	31.5	63.1	36.9
R-751	Floor	do. do.	None	5.5	24.6	69.9	30.1
M-700	Roof & Rib	25 Ft. inby 27 W. A entry 7 & 8 So.	Small	10.3	25.4	64.3	35.7
H-905	Floor	do. do.	Small	13.2	21.6	65.2	34.8
		Section D. D. - Explosion Area					
M-23	Floor	Opposite Entrance #4 Room 3 E, 3 N, 27 W.M.N.	None	6.6	17.4	76.0	24.0
G-574	Rib & Roof	do. do.	None	4.3	53.6	42.1	57.9
E-484	Rib & Roof	Opposite Entrance #4 Room 2 E, 3 N, 27 W.M.N.	None	4.8	41.9	53.3	46.7
M-123	Floor	do. do.	None	6.8	22.3	70.9	29.1
G-211	Floor	Opposite Entrance #4 Room 1 E, 3 N, 27 W.M.N.	None	6.1	19.1	74.8	25.2
V-915	Rib & Roof	do. do.	None	6.2	34.4	59.6	40.4

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine		Amount of Coke	As--Received Basis, Percent Moist	Ash	Comb.	Incomb.
		Section E. E. Explosion Area						
B-264	Floor	Inby 2 N. off 27 W.	old Main N. No. 1 (outby) entry	None	5.9	29.4	64.7	35.3
K-933	Rib & Roof	do.	do	None	8.4	29.1	62.5	37.5
G-727	Rib & Roof	Inby 2 N. off 27 W.	old Main N. No. 2 entry haul.	None	5.0	33.5	61.5	38.5
F-355	Floor	do.	do.	None	4.5	36.2	59.3	40.7
K-619	Floor	Inby 2 N. off 27 W.	old Main N. No. 3 entry	None	2.8	55.3	41.9	58.1
M-634	Rib & Roof	do.	do.	Small	4.7	30.8	64.5	35.5
R-339	Rib & Roof	Inby 2 N. off 27 W.	old Main N. No. 4 entry	None	5.7	16.0	78.3	21.7
U-316	Floor	do.	do.	None	3.5	24.0	72.5	27.5
		Section F. F. - Explosion Area						
X-330	Rib & Roof	28 E. air course	100' west of 3 So. 45° angle	Large	5.4	33.3	61.3	38.7
K-825	Floor	do.	do.	Large	5.5	27.3	67.2	32.8
L-334	Rib & Roof	27 E. air course	do.	Very Large	5.1	26.4	68.5	31.5
H-464	Floor	do.	do.	Large	5.2	28.6	66.2	33.8
G-827	Rib & Roof	28 E. entry	do.	Small	4.3	28.7	67.0	33.0
H-944	Floor	do.	do.	Large	4.4	25.9	69.7	30.3
E -559	Rib & Roof	27 E. entry	do.	None	5.0	25.1	69.9	30.1
R-680	Floor	do.	do.	None	4.4	30.1	65.5	34.5
U-600	Rib & Roof	Parting Entry 27 E.	N. M. N.	Small	5.0	25.0	70.0	30.0
H-348	Floor	do.	do.	Small	5.7	29.9	64.4	35.6

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust from	Location in Mine	Amount of Coke	As--Received Basis, Percent Moist.	Ash	Comb.	Incomb.
		Section G. G. - Outside Explosion Area					
H-301	Rib & Roof	N.M.N. 500' inby 23 W. junction No. 1 entry	None	4.6	56.7	38.7	61.3
C-72	Floor	do. do.	None	4.2	56.7	39.1	60.9
R-139	Rib & Roof	N.M.N. 500' inby 23 W. junction No. 2 entry	None	5.8	42.1	52.1	47.9
M-518	Floor	do. do.	None	3.7	63.2	33.1	66.9
C-228	Rib & Roof	N.M.N. 500' inby 23 W. junction No. 3 entry	None	7.4	17.3	75.3	24.7
S-173	Floor	do. do.	None	8.5	32.3	59.2	40.8
		Section H. H. - Explosion Area					
Y-229	Floor	300' inby 26 W. N.M.N. No. 1 entry	Small	6.3	32.7	61.0	39.0
L-411	Rib & Roof	do. do.	Small	5.9	23.6	70.5	29.5
J-699	Floor	300' inby 26 W. N.M.N. No. 2 entry	None	4.6	23.0	72.4	27.6
T-864	Rib & Roof	do. do.	None	3.5	30.1	66.4	33.6
E-338	Floor	300' inby 26 W. N.M.N. No. 3 entry	Small	3.9	29.5	66.6	33.4
W-806	Rib & Roof	do. do.	Small	4.0	27.2	68.8	31.2
Q-93	Floor	300' inby 26 W. N.M.N. No. 4 entry	Small	3.5	32.4	64.1	35.9
R-912	Rib & Roof	do. do.	Small	3.4	22.4	74.2	25.8
R-63	Floor	300' inby 26 W. N.M.N. No. 5 entry	Large	5.0	23.2	71.8	28.2
C-625	Rib & Roof	do. do.	None	3.3	23.7	73.0	27.0

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis, Percent			
				Moist.	Ash	Comb.	Incomb.
		Section I.I. - Outside Explosion Area					
S-693	Rib & Roof	Outby 17 S. on 21 W. No. 1 entry	None	10.6	35.9	53.5	46.5
C-578	Floor	do. do.	None	6.8	42.6	50.6	49.4
Q-922	Rib & Roof	Outby 17 S. on 21 W. No. 2 entry	None	2.1	74.0	23.9	76.1
U-857	Floor	do. do.	None	0.7	89.6	9.7	90.3
U-968	Rib & Roof	Outby 17 S. on 21 W. No. 3 entry	None	11.3	27.4	61.3	38.7
B-56	Floor	do. do.	None	5.2	10.7	84.1	15.9
G-153	Rib & Roof	Outby 17 S. on 21 W. No. 4 entry	None	10.3	31.5	58.2	41.8
B-444	Floor	do. do.	None	8.7	19.7	71.6	28.4
R-637	Rib & Roof	Outby 17 S. on 21 W. No. 5 entry	None	6.0	24.4	69.6	30.4
C-225	Floor	do. do.	None	6.6	19.9	73.5	26.5
		Section J.J. - Outside Explosion Area					
R-528	Rib & Roof	Outby 7 N. on 21 W. No. 1 entry	Small	12.3	18.5	69.2	30.8
W-117	Floor	do. do.	None	18.4	21.9	59.7	40.3
S-580	Rib & Roof	Outby 7 N. on 21 W. No. 2 entry	None	3.5	61.2	35.3	64.7
M-852	Floor	do. do.	None	1.1	92.3	6.6	93.4
P-490	Rib & Roof	Outby 7 N. on 21 W. No. 3 entry	None	11.5	24.9	63.6	36.4
L-524	Floor	do. do.	None	13.3	27.3	59.4	40.6
S-884	Rib & Roof	Outby 7 N. on 21 W. No. 4 entry	None	11.2	19.6	69.2	30.8
U-286	Floor	do. do.	None	14.6	19.4	66.0	34.0
C-681	Rib & Roof	Outby 7 N. on 21 W. No. 5 entry	None	6.4	28.0	65.6	34.4
G-952	Floor	do. do.	None	7.4	25.1	67.5	32.5

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis, Percent			
				Moist.	Ash	Comb.	Incomb.
		Section K.K. - Outby Explosion Area					
K-42	Rib & Roof	50' inby 21 W. on loaded track old main N. haulage road	None	3.2	78.5	18.3	81.7
L-729	Floor	do. do.	None	4.3	70.3	25.4	74.6
J-315	Rib & Roof	50' inby 21 W. on empty track old main N. haulage road	None	6.2	37.5	57.3	42.7
R-344	Floor	do. do.	None	3.6	67.5	28.9	71.1
		Section L.L. - Explosion Area					
L-697	Rib & Roof	3rd crosscut inby 25 W. No. 2 A. C.	None	5.6	18.5	75.9	24.1
C-101	Floor	do. do.	None	7.0	17.7	75.3	24.7
K-940	Rib & Roof	3rd crosscut inby 25 W. No. 1 A. C.	Small	5.2	30.9	63.9	36.1
M-141	Floor	do. do.	Small	5.5	29.3	65.2	34.8
E-803	Rib & Roof	3rd crosscut inby 25 W. old main track entry	None	4.3	48.0	47.7	52.3
M-480	Floor	do. do.	None	3.2	68.2	28.6	71.4

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust from	Location in Mine	Amount of Coke	As--Received Basis, Percent			
				Moist.	Ash	Comb.	Incomb.
		Section M. M. - Outby Explosion Area					
F-528	Rib & Roof	25' inby 4 N. 25 W. track entry O.M.N.	None	2.3	82.0	15.7	84.3
Q-435	Floor	do. do.	None	2.7	76.4	21.9	79.1
V-933	Rib & Roof	25' inby 4 N. 25 W. No. 1 left aircourse	None	5.8	53.7	40.5	59.5
U-365	Floor	do. do.	None	8.9	24.0	67.1	32.9
M-306	Rib & Roof	25' inby 4 N. 25 W. No. 2 left aircourse	None	10.6	56.3	33.1	66.9
V-635	Floor	do. do.	None	1.9	77.6	20.5	79.5
V-283	Rib & Roof	25' inby 4 N. 25 W. No. 1 right aircourse	None	3.2	81.7	15.1	84.9
B-578	Floor	do. do.	None	23.1	25.5	51.4	48.6
B-232	Rib & Roof	25' inby 4 N. 25 W. No. 2 right aircourse	None	11.2	49.2	39.6	60.4
J-961	Floor	do. do.	None	6.4	66.0	27.6	72.4
P-974	Rib & Roof	Entrance 25 W. track entry Old M.N.	Small	5.3	62.0	32.7	67.3
H-131	Floor	do. do.	Small	3.2	60.7	36.1	63.9
		Section N. N. - Outby Explosion Area					
Q-376	Rib & Roof	3rd crosscut outby 7 & 8 S. 25 W. Track entry	None	2.5	73.1	24.4	75.6
T-602	Floor	do. do.	None	4.4	62.0	33.6	66.4
G-385	Rib & Roof	3rd crosscut outby 7 & 8 S. 25 W. No. 1 L.AC.	None	4.1	59.8	36.1	63.9
X-494	Floor	do. do.	None	3.4	61.0	35.6	64.4
H-410	Rib & Roof	3rd crosscut outby 7 & 8 S. 25 W. No. 2 L.AC.	None	12.6	55.2	32.2	67.8
G-410	Floor	do. do.	None	6.0	30.0	64.0	36.0
Y-820	Rib & Roof	3rd crosscut outby 7 & 8 S. 25 W. No. 1 R.AC.	None	5.5	43.0	51.5	48.5
M-551	Floor	do. do.	None	1.4	83.0	15.6	84.4
Q-674	Rib & Roof	3rd crosscut outby 7 & 8 S. 25 W. No. 2 R.AC	None	8.4	21.5	70.1	29.9
Q-189	Floor	do. do.	None	10.6	19.7	69.7	30.3

TABIE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLIECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis, Percent			
				Moist.	Ash	Comb.	Incomb.
		Section 0.0. - Explosion Area					
B-481	Rib & Roof	25' inby 14 N. on 25 W. Track entry	Small	5.3	29.1	65.6	34.4
J-974	Floor	do. do	Small	2.5	70.0	27.5	72.5
G-599	Rib & Roof	25' inby 14 N. on 25 W. No. 1 right A.C.	Small	5.7	21.3	73.0	27.0
G-305	Floor	do. do	Small	8.4	21.5	70.1	29.9
V-801	Rib & Roof	25' inby 14 N. on 25 W. No. 2 right A.C.	Small	6.7	19.2	74.1	25.9
L-993	Floor	do. do.	Small	16.4	20.7	62.9	37.1
B-708	Rib & Roof	25' inby 14 N. on 25 W. No. 1 left A.C.	None	5.1	40.8	54.1	45.9
F-589	Floor	do. do.	None	5.6	33.4	61.0	39.0
G-123	Rib & Roof	25' inby 14 N. on 25 W. No. 2 left A.C.	None	7.1	42.8	50.1	49.9
E-473	Floor	do. do.	None	6.4	25.4	68.2	31.8
		Section P.P. - Outside Explosion Area					
B-138	Rib & Roof	Outby 1 N. on 25 W. No. 1 entry	None	4.6	60.5	34.9	65.1
T-841	Floor	do. do.	None	6.2	29.1	64.7	35.3
C-959	Rib & Roof	Outby 1 N. on 25 W. No. 2 entry	None	2.8	77.9	19.3	80.7
H-409	Floor	do. do.	None	4.2	64.4	31.4	68.6
M-748	Rib & Roof	Outby 1 N. on 25 W. No. 3 entry	None	3.2	63.7	33.1	66.9
E-61	Floor	do. do.	None	6.1	18.8	75.1	24.9
R-601	Rib & Roof	Outby I N. on 25 W. No. 4 entry	None	8.0	63.1	28.9	71.1
H-324	Floor	do. do.	None	8.6	53.1	38.3	61.7
G-366	Rib & Roof	Outby 1 N. on 25 W. No. 5 entry	None	10.8	53.0	36.2	63.8
U-785	Floor	do. do.	None	6.2	35.6	58.2	41.8

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis. Percent Moist.	Ash	Comb.	Incomb.
		Section Q. Q. - Explosion Area					
V-548	Rib & Roof	300' inby N.M.N. 25 W. No. 1 entry	None	3.2	66.0	30.8	69.2
E-96	Floor	do. do.	None	5.1	35.3	59.6	40.4
C-685	Rib & Roof	300' inby N.M.N. 25 W. No. 2 entry	None	4.3	44.4	51.3	48.7
V-798	Floor	do. do.	None	4.2	45.1	50.7	49.3
G-498	Rib & Roof	300' inby N.M.N. 25 W. No. 3 entry	None	18.3	38.0	43.7	56.3
E-59	Floor	do. do.	None	9.8	34.9	55.3	44.7
V-522	Rib & Roof	300' inby N.M.N. 25 W. No. 4 entry	None	14.1	32.5	53.4	46.6
J-817	Floor	do. do.	None	6.5	54.1	39.4	60.6
U-294	Rib & Roof	300' inby N.M.N. 25 W. No. 5 entry	None	2.8	66.3	30.9	69.1
G-231	Floor	do. do.	None	6.0	43.1	50.9	49.1
		Section R. R. - Outby Explosion Area					
F-826	Rib & Roof	3rd crosscut outby 25 E. on O.M.N. track entry	None	3.9	48.4	47.7	52.3
R-544	Floor	do. do.	None	4.0	51.4	44.6	55.4
T-234	Rib & Roof	3rd crosscut outby 25 E. on O.M.N. No. 1 Right	None	8.8	19.7	71.5	28.5
U-97	Floor	do. do.	None	16.8	17.9	65.3	34.7
L-613	Rib & Roof	3rd crosscut outby 25 E. on O.M.N. No. 2 Right	None	8.5	26.1	65.4	34.6
F-344	Floor	do. do.	None	7.3	15.9	76.8	23.2
M-516	Rib & Roof	Entrance 23 W. on track entry O.M.N. Haulage Road	None	3.0	74.9	22.1	77.9
Q-611	Floor	do. do.	None	2.9	79.4	17.7	82.3

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis, Percent Moist.	Ash	Comb.	Incomb.
		Section S. S. - Outby Explosion Area					
F-395	Rib & Roof	No. 1 Entry N.M.N. 200' outby 23 West	None	4.1	67.6	28.3	71.7
J-746	Floor	do. do.	None	5.6	62.3	32.1	67.9
W-464	Rib & Roof	No. 2 Entry N.M.N. 200' outby 23 West	None	5.1	78.4	16.5	83.5
V-580	Floor	do. do.	None	7.9	41.1	51.0	49.0
L-769	Rib & Roof	No. 3 Entry N.M.N. 200' outby 23 West	None	4.8	54.9	40.3	59.7
U-851	Floor	do. do.	None	16.4	18.8	64.8	35.2
C-198	Rib & Roof	No. 4 Entry N.M.N. 200' outby 23 West	None	6.0	25.7	68.3	31.7
W-647	Floor	do. do.	None	14.8	22.7	62.5	37.5
M-271	Rib & Roof	No. 5 Entry N.M.N. 200' outby 23 West	None	4.9	42.2	52.9	47.1
B-857	Floor	do. do.	None	13.9	24.9	61.2	38.8
		Section T. T. - Explosion Area					
G-835	Rib & Roof	15th Crosscut inby Rectifier on N.M.N.	Small	4.6	56.2	39.2	60.8
Q-80	Floor	do. do.	Small	4.6	49.5	45.9	54.1
J-599	Rib & Roof	15th Crosscut inby Rectifier on No. 1 L.AC	Small	6.7	37.5	55.8	44.2
X-830	Floor	do. do.	Small	13.4	28.0	58.6	41.4
W-397	Rib & Roof	15th Crosscut inby Rectifier on No. 2 L.AC	Small	7.1	25.0	67.9	32.1
L-156	Floor	do. do.	None	8.1	17.8	74.1	25.9
		Section T. T. - Intake air course- no explosion area					
J-571	Rib & Roof	6th Crosscut inby Rectifier N.M.N. No. 3 Left A.C.	None	4.5	68.3	27.2	72.8
T-47	Floor	do. do.	None	5.5	26.5	68.0	32.0
T-768	Floor	6th Crosscut inby Rectifier N.M.N. No. 4 Left A.C.	None	4.6	34.3	61.1	38.9
J-22		do. do.	None	5.8	47.1	47.1	52.9

TABLE 2 (Continued) - RESULTS OF ANALYSES OF DUST SAMPLES COLLECTED DECEMBER 1951

ORIENT NO. 2 MINE, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Can No.	Sample of Dust From	Location in Mine	Amount of Coke	As--Received Basis, Percent Moist.	Ash	Comb.	Incomb.
		Section U. U. - Outby Explosion Area					
P-785	Rib & Roof	125' outby 23 W. M. N. Load haulage on face	None	2.7	84.7	12.6	87.4
U-145	Floor	do. do. do.	None	1.3	87.3	11.4	88.6
J-155	Floor	125' outby 23 W. M. N. East runaround track	None	7.5	29.5	63.0	37.0
U-634	Rib & Roof	do. do. do.	None	2.8	80.8	16.4	83.6
C-256	Rib & Roof	125' outby 23 W. M. N. M. N. passing track	None	11.2	32.0	56.8	43.2
M-207	Floor	do. do. do.	None	19.3	20.5	60.2	39.8
L-192	Floor	125' outby 23 W. M. N. No. 1 M. N. air course	None	15.9	24.3	59.8	40.2
L-950	Rib & Roof	do. do. do.	None	9.1	21.5	69.4	30.6
G-595	Rib & Roof	125' outby 23 W. M. N. No. 2 M. N. air course	None	11.6	21.5	66.9	33.1
Q-277	Floor	do. do. do.	None	14.8	22.0	63.2	36.8

relatively good condition, had been suspected of being the ignition source. While it is known that electrical practices and maintenance of electrical equipment in the mining industry in general are not what they should be, it was found that almost no safety factor against ignitions was afforded by most of the electrical equipment in the explosion area at the Orient No. 2 mine.

The underground electrical distribution system has a nominal potential of 250 volts direct current. Bare trolley wire and rails are used to supply electric power to locomotives and machines along the haulageways. Both positive and negative feeders are run along stub entries to supply the face equipment. In some cases connections are made by individual male and female connectors, one part being permanently attached to the feeder and the other part attached to the end of a trailing-cable conductor. In other cases conventional "nips" are used. These "nips" are usually "home made" from No. 6 steel wire bent to form a hook and are attached to the trailing cable.

It is common knowledge that electric arcs from trolleys, electrical parts of open-type locomotives, or "nips" will ignite explosive mixtures of methane and air; therefore, the operation of this equipment in other than pure intake air is considered hazardous.

In the explosion area, open-type, combination trolley, and cable-reel locomotives are used for gathering haulage Flat-type reels having vertical shafts are used on all of those locomotives. If this type of locomotive were to encounter explosive mixtures of methane and air, it would, when operated, ignite the gas.

Cable-reel shuttle cars of the explosion-tested type were used for carrying the coal from the face to loading points. Maintenance and alteration of almost all of these machines were such that they cannot be considered explosion-proof. The practice of attaching a power take-off to the shuttle-car contactor box for the purpose of operating rock dusting machines, as found, presents two hazards; the possibility of opening a power circuit under load, and, in most cases, no packing or glands were used where the cable for the Miller plug entered the box, leaving an opening in supposedly "explosion-proof" compartments".

It was general practice to use only part of the bolts or cap screws to hold in place such parts as controller or contactor covers, drill switch housings, resistor covers, and

other parts of permissible, explosion-proof type, or open-type machine compartments. For example, the 10 BU mining machine at the inby end of No. 2 stub off 3 south off 27 east, new main north had 18 adjacent cap screws missing from the flat steel plate cover of the controller box at the rear of the machine on the right side. An explosive mixture of methane and air ignited inside a box in this condition would either spring the cover open at the flanges where the cap screws are missing or blow it completely off the box. In either case, any explosive mixture of methane and air surrounding such a box would be ignited.

All post drills were found to have a connector inserted in the trailing cable about one foot from the drill. These connectors are of the ordinary industrial male and female type. This presents the danger of arcs produced by (1) loose contact at these connectors or (2) opening a power circuit under load. One set of post drills had power supplied by lines made up of single conductor No. 14 ordinary house or "code" wire. Two wires from each drill were run far enough to join and be spliced to one set of two similar wires coming from the power source. Packing glands were found loose or missing, moreover, they would be ineffective if used with these wires. This practice resulted in openings into compartments on permissible-type equipment.

On some permissible-type cutting machines, headlights were installed that were not supplied by the manufacturer and some of these were open-type headlights. Some had little or no insulation or mechanical protection for the headlight cables.

In most cases the rear conveyor lights on the 11 BU loaders had broken red lenses. The main lenses were so loose that they could in some cases be pushed up and down about 1/4-inch to 3/8-inch. No seals or padlocks were found on any face equipment.

Fuses were found in the trailing-cable taps, but the ratings were too high. The machine trailing cables observed were of the "flame-resistant" type. Table No. 3 shows the location and condition of the various pieces of mining equipment in affected sections.

TABLE NO. 3 - LOCATION AND CONDITION OF VARIOUS PIECES OF MINING EQUIPMENT IN AFFECTED SECTIONS

ORIENT NO. 2 MINE EXPLOSION, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY, WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Location	Equipment	Perm Type	Perm Cond.	Operation at Time of Explosion	Remarks
	3 South Section - 27 E New Main North				
1 stub 3 south 27 east north	Rubber-tire-mounted drilling machine - two drills	No	-	Drilling center hole on right rib and center hole in crosscut on left rib	3 cap screws out of explosion-tested resistor cover plate
2 stub 3 south 37 east north	Rubber-tire-mounted universal-type mining machine	Yes	No	Cutting right rib for crosscut to 1 west stub	18 cap screws missing from cover plate on control compartment - 7 cap screws out of cover plate on resistor - protective hose on headlight cable broken at packing gland.
Room No. 8, 3 stub - 3 south 27 east north	Tractor-mounted loading machine	Yes	No	About one-half of cut loaded out	Protective hose broken on conveyor light lead - no packing in gland for light lead from control box - 7 studs out of cover on control box - 5 studs out of cover on resistor
Room 2 - 3 stub 3 south 27 east north	Two post-mounted drills	Yes	No	Both drills set up and drilling right and left rib center holes	6 cap screws which secure body of drill to switch casing were missing from each drill - no packing gland in drill on left rib - plug-type connectors used for trailing cable; plugs on pigtails from switch housing.

TABLE NO. 3 (Continued) - LOCATION AND CONDITION OF VARIOUS PIECES OF MINING EQUIPMENT IN AFFECTED SECTIONS

ORIENT NO. 2 MINE EXPLOSION, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY, WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Location	Equipment	Perm Type	Perm. Cond.	Operation at Time of Explosion	Remarks
	3 South Section - 27 E New Main North (Continued)				
Mouth of 2 stub 3 south 27 east north	Elevating conveyor - two shuttle cars	Explosion-tested permissible motor and control box on conveyor	-	Two shuttle cars at elevating conveyor waiting to unload. Loaded trip to cable-reel locomotive at conveyor head	18 cap screws missing on controller box cover Jeffrey car - 9 cap screws missing from control compartment cover on Joy car - start-stop button destroyed and lost
Mouth of 2 stub 3 south - 27 east north	Cable-reel loco. and loaded trip at conveyor boom	No	-	Locomotive apparently preparing to pull out loaded trip	Locomotive directly in front of conveyor boom with loaded trip coupled - evidently force had pushed trip into such a position
	3 North Section - 27 West New Main North				
D entry - 3 north 27 west new main north	Rubber-tire-mounted drilling machine	Yes	No	Drilling top hole in left rib	Two cap screws missing from control box cover - hose broken at headlight gland - switch "on".
C entry - 3 north 27 west new main north	Rubber-tire-mounted universal-type mining machine	Yes	No	Undercutting face	24 cap screws missing from cover plate on control box - 6 cap screws missing from cover plate on resistor
2 east - 3 north 27 west new main north	Tractor-mounted loading machine and shuttle car	Yes - loader explosion tested	No	Loading shuttle car	9 cap screws missing from control compartment of loader - 12 cap screws missing from cover plate of control compartment of shuttle car
South of C entry	Loaded shuttle car	Explosion tested	No	At loading point	12 studs from control panel cover

TABLE NO. 3 (Continued) - LOCATION AND CONDITION OF VARIOUS PIECES OF MINING EQUIPMENT IN AFFECTED SECTIONS
ORIENT NO. 2 MINE EXPLOSION, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY, WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Location	Equipment	Perm Type	Perm Cond.	Operation at Time of Explosion	Remarks
	3 North Section - 27 West North				
Mouth of 4 north 27 west north	Trolley and cable-reel locomotive	No		Connected to loaded trip at 4 north belt head	- - -
Mouth of 3 north 27 west north	Main belt drive unit	No		Belt loading trip	- - -
Mouth of 2 east 3 north - 27 west north	Cross-entry belt drive unit and remote control switch for main belt	No		Cross-entry belt loading onto main belt	- - -
Room No. 4 - 3 east - 3 north 27 west north	Rubber-tire-mounted universal-type mining machine	Yes	No	Place undercut and machine prepared to move	Two cap screws missing from resistor cover plate - one cap screw missing from cover on control compartment - tramming control "on" position
Room No. 5 - 3 east 3 north 27 west north	Drilling machine - two drills	Yes	No	Place drilled and drill prepared to move	Hose on headlight lead broken at packing gland - 3 cap screws missing from resistor cover plate
3 east - 3 north at No. 7 room 27 west north	Shuttle car	No - Explosion-tested type	No	Car empty - traveling toward loading machine	Cover plates on control and resistor compartments completely bolted
Room 10 - 3 east 3 north - 27 west north	Shuttle car	No - Explosion-tested type	No	Car loaded and located under boom of loading machine	Thirteen cap screws missing from cover plate on control compartment
Room 10 - 3 east 3 north - 27 west north	Tractor-mounted loading machine	Yes	No	Place almost cleaned up - loaded shuttle car under boom	Four cap screws missing from cover plate on control compartment
3 north - 60 feet inby 27 west north	Cable-reel locomotive	No			Apparently in operation
27 west north near mouth of 3 north	Cable-reel locomotive	No			Apparently in operation

TABLE NO. 3 (Continued) - LOCATION AND CONDITION OF VARIOUS PIECES OF MINING EQUIPMENT IN AFFECTED SECTIONS

ORIENT NO. 2 MINE EXPLOSION, CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY, WEST FRANKFORT, FRANKLIN COUNTY, ILLINOIS

Location	Equipment	Perm Type	Perm Cond.	Operation at Time of Explosion	Remarks
	7 South Section - 27 West North				
1st "45" off 27 west north	Cable-reel locomotive	No			Apparently in operation
1 east - 7 south 27 west north	Shuttle car	Explosion-tested type	No	Under boom of loading machine	No packing in headlight gland - 15 cap screws out of cover plate on control compartment
Face of 1 east 7 south - 27 west north	Tractor-mounted loading machine	Yes	No	Loading shuttle car	Six cap screws missing from cover plate of control compartment
On 7 south entry at mouth of 3 east 27 west north	Rubber-tire-mounted drill machine	No	-	Tramming controller half open	Apparently tramming drilling machine
9 south entry	Rubber-tire-mounted universal-type mining machine	Yes	No	Moving in to make cut	Open-type headlight - 20 cap screws out of cover plate on resistor compartment - 26 cap screws missing from cover plate on control compartment
9 south entry	Two post-mounted drills	Yes	No	Set up and drilling right and left rib bottom holes	Six cap screws which hold drill frame to switch box casing missing from each drill - plug-type connectors for cable Standard No. 14 wire used for drill cable
8 south at 2 east 27 west north	Elevating conveyor				
At elevating conveyor	Shuttle car	Yes	No	Unloading into elevating conveyor	Sixteen cap screws missing from cover plate on control compartment

Miscellaneous

All underground employees used permissible electric cap lamps for illumination, but evidence found during previous inspections and during recovery operations indicated that the practice of carrying matches and cigarettes underground was not uncommon.

None of the mine personnel had been trained in recent years in mine rescue, with the possible exception of some individuals that might be members of State maintained teams. Specially trained and fully equipped mine rescue teams are stationed at Benton, Herrin, Eldorado, DuQuoin, Benld, Springfield, and Belleville, Illinois, and these teams, as well as a team from the New Kathleen mine, Union Collieries Company, DuQuoin, Illinois, participated in recovery operations and worked tirelessly and relentlessly in the hope that some of the men in the remote sections of the explosion area might be alive. In addition to the rescue teams, the State had three completely equipped mobile mine rescue units at the mine a short time after the explosion occurred.

Fire-fighting equipment was provided in each section, consisting of bratticing materials, fire extinguishers, rock dust and water. Fire extinguishers and rock dust were standard equipment at substations, and extra large extinguishers, water tanks and hose were provided on trucks for general use.

Two travelable passageways were available as escapeways from each working section to the surface, and one was ventilated with intake air. At the time of the last Federal inspection the back-entry escapeways were obstructed with falls, and loose, unsupported roof was noted at numerous points. A check-in and check-out system was in effect and each employee carried an identification check on his person while in the mine.

PREVIOUS EXPLOSIONS AT THIS OR NEARBY MINES

A gas ignition in this mine in 1926 caused the loss of 5 lives and another in 1947 caused the loss of 3 lives. Several other major explosions that occurred in this area in recent years were:

Date	Mine	Location	Lives Lost
12/28/41	No. 47	Harco, Illinois	8
3/25/47	No. 5	Centralia, Illinois	111
7/24/47	Old Ben No. 8	West Frankfort, Illinois	27

ACTIVITIES OF BUREAU OF MINES PERSONNEL

The Vincennes office of the Bureau of Mines first learned of the explosion about 8:25 p.m., December 21, 1951, when Mr. Frank Kolisek, coal-mine inspector at the Benton, Illinois office of the Bureau, telephoned Mr. F. J. Smith. Mr. Kolisek had been notified about 8:00 p.m. by Mr. F. Earle Snarr, general superintendent, that there was "some trouble" at Orient No. 2 mine, but that he did not know what it was. Messrs. Snarr and Kolisek proceeded immediately to the mine arriving there about 8:15 p.m. However, they were still unable to ascertain what had happened and it was not known definitely until several hours later that an explosion had occurred. Kolisek called Smith at 8:25 p.m. and Smith immediately notified Mr. W. H. Tomlinson, Chief, Vincennes Branch. Mr. Tomlinson called all of the Vincennes inspectors and engineers who were available at the time and requested them to remain on call until further word was received from the mine. Kolisek advised Smith that he would call back just as soon as he could find out what had happened, but as nothing further was heard from him by 10:30 p.m. Tomlinson called him but he still could not give any further information. It was not until 11:30 p.m., December 21, that definite word was received that an explosion had occurred and that 200 or more men were underground. Upon receipt of this information Tomlinson called Mr. James Westfield, Chief of the Accident Prevention and Health Division, Bureau of Mines, Region VIII, Pittsburgh, Pennsylvania, and Mr. W. J. Fene, Assistant Chief, Health and Safety Division, Bureau of Mines, Washington, D. C. At the same time Tomlinson ordered Vincennes inspectors F. J. Smith, C. M. Dovidas, James A. O'Connor, R. W. Whittaker, and James Sheridan, to proceed immediately to the scene of the disaster. These men, accompanied by Tomlinson, left Vincennes by automobile at 1:00 a.m. and arrived at the mine about 4:00 a.m., December 22, 1951.

Inspectors Frank Kolisek, W. R. Chick, J. R. Summary, and C. L. South, all from Benton, Illinois, were already participating in the recovery work, Kolisek on the surface and the others underground. Upon arrival of the party from Vincennes, Tomlinson took charge of activities of the Bureau of Mines representatives, and arranged the inspectors in groups so that the Bureau would have men on each shift day and night. Later in the day, as it became apparent that additional help would be needed, Inspectors Leon W. Kelly, Vincennes, Indiana; Frank Perz, Terre Haute, Indiana; Loren A. Belt and Clifton H. Dupree, Madisonville, Kentucky; T. Alvin Scully and Roy E. Seiger, Belleville, Illinois; W. W. Kessler and George W. Hammons, Staunton, Illinois, were ordered to the scene. Inspector Perz arrived about 4:00 p.m., the others arrived throughout the night and early morning of the next day.

Mr. Westfield arrived at the mine about 8:00 p.m., December 22, 1951, and took immediate charge of the Bureau of Mines activities in connection with the recovery work. He went underground at 10:40 p.m. that

night and remained inside until 11:25 a.m. the next morning. Upon learning of the vast amount of electrical equipment involved in the explosion area, Mr. Westfield ordered Engineers Robert S. James (mechanical), Pittsburgh, Pennsylvania Station, Bureau of Mines, and F. J. Gallagher (electrical-mining), Mt. Hope, West Virginia Station, to assist with the investigation. They arrived on the scene about 8:00 a.m., Monday, December 24, 1951.

Mr. J. J. Forbes, Director, Bureau of Mines, arrived on the scene about 1:00 p.m., Sunday, December 23. The Secretary of the Interior, Mr. Oscar L. Chapman, together with Mr. M. J. Ankeny, Chief, Coal Mine Inspection Branch, Washington, D. C., arrived about 3:25 p.m., December 23. Mr. Forbes conducted Secretary Chapman on a tour of the surface of the mine, and also accompanied him and Mr. John L. Lewis, President, United Mine Workers of America, several company officials, and Bureau of Mines representatives, on a short trip underground. Mr. Forbes also took charge of the official investigation for the Bureau of Mines, which started at 8:00 a.m., Wednesday, December 26, 1951. The official Bureau investigation party consisted of Messrs. J. J. Forbes, M. J. Ankeny, James Westfield, W. H. Tomlinson, F. J. Smith, W. R. Chick, and C. L. South. Twenty-two Bureau of Mines representatives, including the Director, assisted with the rescue and recovery work and the official investigation.

STORY OF EXPLOSION AND RECOVERY OPERATIONS

The night shift entered the mine at the No. 4 shaft at about 6:00 p.m. and the man-trips left the shaft bottom about 6:25 p.m. Normally from 20 to 25 minutes was required for the trips to reach their respective sections. Allowing for several minutes for the men to walk from the point where they left the man-trips to their respective places of duty and additional time for them to get ready to work, it is believed that the shift worked but a short time when the disaster occurred. This supposition is borne out by the following facts:

(a) In 3 and 4 north, 27 west north only one mine car of coal had been loaded, the belt was empty, the loading machine was in a working place, and a partly filled shuttle car was under the loading machine boom.

(b) In 3 and 4 south, 27 east north west two loaded shuttle cars were at the (mine car) loading point awaiting empty cars.

(c) In 3 and 4 north, 27 north west a loaded shuttle car at the loading point and a trip of empty mine cars were present but none had been loaded.

The night mine manager was on the surface at the No. 4 shaft, which is used for ventilation and for ingress and egress when the explosion occurred. The first indication he had of unusual occurrence

underground was when the power went off, both in the mine and on the surface, and smoke and dustwere emitted from the upcast shaft. The power was off approximately five minutes. When it cane back on the manager went to the shaft bottom and changed doors there, putting the stairway compartment of the upcast shaft on intake air. He then attempted to contact the different sections of the mine by telephone and was able to reach all of the sections on the south side of the shaft, warning the men to return to the surface immediately. He was unable, however, to reach any of the sections on the north, except the 11 and 12 north, 23 west north west section. After attempting to notify the men underground the manager then called all of the company officials in the immediate area, advising that something unusual had happened in the mine. After notifying the officials the manager then turned his attention toward assisting the men to escape to the surface.

The workmen from the unaffected sections started for the surface; 133 escaped uninjured and unaided - some by way of the main hoisting shaft several miles from the scene of the explosion, and some by way of the No. 4 shaft. No record was available showing how many cane out of either shaft. Some of those who escaped made their way through the intake airways and those near the immediate No. 4 shaft bottom escaped through return airways and to the surface through the hoisting shaft, also on the return.

Three men were rescued, two of whom had to be carried from a point on the new main north entries, approximately 600 feet inby 23 west north west. One of these died in the hospital. Also, another man was rescued alive from a point on the old main north at the entrance to 26 east north. Six others made their way unassisted from the 23 west north west entries, and 10 escaped unassisted from the 26 east north.

Ten men in 1 north 25 west north attempted to erect a barricade; however, they erected only a single ply canvas across the entrance to the No. 1 entry. Apparently no further effort was made to shut off the portion of the mine in which they took refuge and nine of the ten succumbed, the tenth remained alive and was rescued at 5:40 a.m., December 24, 1951, approximately 58 hours after the ignition.

A foreman and six men started to make a barricade in 25 west north west, but when they noticed the air becoming better they changed their minds and made their way to the surface through the intake air course to the No. 4 shaft.

Federal Inspectors W. R. Chick, C. L. South, and J. R. Summary from Benton, Illinois, did not learn of the explosion until 10:15 p.m. They immediately procured their equipment and went to the mine, arriving there about 11:10 p.m. As the hoisting shaft, being on the return, was highly charged with carbon monoxide, Messrs. Chick, South, and Summary,

together with several State inspectors, entered the mine through the manway compartment of the No. 4 shaft at 11:45 p.m., traveling through intake air to the 25 west north west.

Rescue and recovery work was conducted through the No. 4 shaft. Seven State-maintained rescue crews, a like number of State mine rescue station superintendents, and a team from a nearby mine participated in the recovery work. Many workmen from this mine including some who were underground at the time of the explosion also assisted as did hundreds of volunteer workers.

The hoisting compartment was on return air and the air current was contaminated by poisonous gas during the greater part of the recovery work. Some of the rescue workers went underground by way of the stairway compartment (in fresh air) while others went down on the cage. Those using the cage had to travel in return air for a distance of approximately 600 feet from the shaft bottom to a point in 21 and 22 west north entries before reaching intake air. As the air in the hoisting compartment contained at times as much as 0.3 to 0.5 percent carbon monoxide the rescue workers were forced to wear gas masks while traveling between the surface and the double doors separating the intake and return air currents on 21 and 22 west north.

The rescue crews proceeded in fresh air on the 21 west north haulageway for a distance of about a mile from the shaft then north on the new main north air course entries for a distance of approximately 1,000 feet where evidence of force was observed. The first interruption of ventilation encountered was at 23 and 24 west north west where a regulator was damaged but all stoppings from these entries to the 25 and 26 west north west entries were in place. From this point on, the ventilation was completely disrupted as all doors, stoppings, and overcasts inby had been destroyed. The rescue workers advanced as quickly as possible by erecting temporary stoppings and carrying the fresh air with them to a point about 1,200 feet on 27 west north west off the new main north. At this point heavy concentrations of carbon monoxide and five or more percent of methane were encountered necessitating retreat by the workers and obtaining increased quantities of air by tightening of stoppings outby and the changing of a regulator near the shaft bottom. After the ventilation was increased the rescue party advanced and crews protected by oxygen breathing apparatus were sent on short trips to explore ahead of fresh air. The work continued in this manner until all workings in the 27 west north west were examined and bodies in this section recovered.

The workings in 27 west north west were first explored as all indications were that the explosion was east of these workings and it was thought that some workmen may be alive. After these workings were explored the rescue party turned its attention to the workings to the east of new main north. By erecting temporary stoppings the rescuers were

enabled to advance to the entrance of 3 south 27 east north west but were again forced to retreat because of air leakage behind them. Additional air was received by erecting temporary stoppings across the entrances to 25 and 26 east north west thus throwing practically all of the air to the 27 east north west. An opening was left in one of the stoppings in 25 and 26 east north west to permit partial ventilation of these entries.

After recovery of the bodies in 3 and 4 south 27 east north west the rescue crews advanced by restoring the ventilation to 7 and 8 south 27 west north. While the bodies were being removed from the latter entries a company official, a Bureau of Mines representative, and a State inspector traveled to the shaft bottom by way of 27 west north main north entries. As these entries were on the return following the explosion previous attempts to travel them were impossible.

Up to this point all bodies were removed without respiratory protection. As it was inadvisiable to delay recovery operations in order to restore ventilation in the 3 and 4 north 27 west north entries, rescue crews were used to remove the bodies from these workings. While the last bodies were being carried from these entries, a crew entered the 25 west north entries used as a main haulageway and in which it was known that 12 men were working. All of the bodies had been accounted for except the 12 known to be in these entries and one other. The crew traversed the 25 west north entries almost to the new main north but found only two bodies, then retreated to the first north where the missing ten men were found, one of whom was still alive. The last body was found in the third entry at the mouth of 3 north, 27 east, north west by the investigating party at 1:30 p.m., December 26, 1951.

PROPERTY DAMAGE

The explosion caused no damage on the surface. The ventilation system in the explosion area was completely destroyed in that practically all stoppings and doors, including one main overcast, were demolished.

Other property damage consisted of the blowing down of power wires, power feeder cables, trolley wires, and high pressure air lines throughout the entire explosion area. Many timbers were dislodged causing a number of caves, but they were not extensive. Some damage occurred to the face equipment but this was not considered extensive. There was considerable damage, however, to haulage equipment in that cars were damaged and locomotives in many instances were blown off the track and parts, such as reels and covers, were blown off by the explosion. Considerable damage was done to the motor-generator set at the junction of the new main north and the 25 west north west, and a rectifier set just outby the 1 and 2 north off the 27 west north was also badly damaged. It is estimated that it will take about a month to clean up and repair the equipment before operation can be resumed.

INVESTIGATION OF CAUSE OF EXPLOSION

The investigation of the disaster was started about 8:30 a.m., December 26, 1951, by representatives of the U. S. Bureau of Mines, United Mine Workers of America, Illinois Department of Mines and Minerals, a representative of the Governor of the State of Illinois, and officials of the Chicago, Wilmington and Franklin Coal Company. The investigation was continued on December 27. The names of the persons in the investigating party on December 26 and 27, 1951, are as follows:

U. S. Bureau of Mines

J. J. Forbes	Director
M. J. Ankeny	Chief, Coal Mine Inspection Branch
James Westfield	Chief, Accident Prevention and Health Division Region VIII
W. H. Tomlinson	Chief, Accident Prevention and Health Division Vincennes Branch, Region VIII
James A. O'Connor	Mining Engineer
R. W. Whittaker	Mining Engineer
W. R. Chick	Coal-Mine Inspector
C. L. South	Coal-Mine Inspector
Frank Kolisek	Coal-Mine Inspector
F. J. Smith	Coal-Mine Inspector
J. R. Summary	Coal-Mine Inspector
R. S. James	Mechanical Engineer
F. J. Gallagher	Electrical Engineer

United Mine Workers of America

John L. Lewis	President
Hugh White	President District 12
Sherman Whitlow	President Local No. 1265

Illinois Department of Mines and Minerals

Walter Eadie	Director
William Johnson	Assistant Director
Murrell Reak	Inspector-At-Large (Benton, Illinois)
John J. Kotzman	Inspector-At-Large (Staunton, Illinois)
James Wilson	Inspector
James Sneddon	Inspector
Albert H. Morris	Inspector
John L. Romine	Inspector
Arthur Roidlinger	Inspector
Roscoe Moore	Inspector
Edmond Grezlak	Inspector
Edward Mallaburn	Inspector

Representative of the Governor, State of Illinois

Harold Walker	Professor, Head of School of Mining Engineering, University of Illinois

Chicago, Wilmington and Franklin Coal Company

H. A. Treadwell	Vice President
F. Earle Snarr	General Superintendent
John R. Foster	Superintendent
Thomas Garwood	Chief Engineer
Charles Pullen	Underground Superintendent
Charles Walker	Safety Engineer
Arlie Cook	Day Shift Mine Manager
Wilford McDaniels	Night Shift Mine Manager
George Chrisman	
Lloyd Saylor	Chief Electrician

On December 28, Messrs. H. A. Treadwell, Charles Walker, Lloyd Saylor, M. J. Ankeny, James Westfield, Sherman Whitlow, William Johnson, and James Sneddon made a trip underground to obtain additional information in connection with the investigation of the explosion, and were accompanied by Mr. Curtis Johnson, official investigator of the Labor and Management Committee of the United States Senate, and Mr. Charles Ferguson, assistant safety director of the United Mine Workers of America.

Representatives of the U. S. Bureau of Mines, Illinois Department of Mines and Minerals, and the company collected air and dust samples in the section of the mine affected by the explosion on December 27, 28, and 29, 1951.

No final report as to the cause and origin of the explosion had been released by any of the investigating groups at the time this report was completed.

MINE CONDITIONS IMMEDIATELY PRIOR TO THE DISASTER

The mine was operating normally, and no unusual conditions insofar as could be ascertained had been reported prior to the time of the explosion. No interruption had occurred to the ventilation system. The recording chart showing the water gage at the fan for December 21 is shown in Figure 1. The weather was clear and fair, and no sudden change in barometric pressure or unusual temperature change had occurred.

A recording barometer was kept at the main office of the company and the barograph is shown as Figure 2.

The normal barometric pressure in this area is approximately 29.5 inches of mercury. The readings of the barometer taken on Friday, December 21, the day of the explosion, for 2:00 a.m. to 10:00 p.m., are as follows:

2:00 a.m.	29.25 inches of mercury
4:00 a.m.	29.40 inches of mercury
6:00 a.m.	29.50 inches of mercury
8:00 a.m.	29.60 inches of mercury
10:00 a.m.	29.65 inches of mercury
12:00 noon	29.65 inches of mercury
2:00 p.m.	29.65 inches of mercury
4:00 p.m.	29.70 inches of mercury
6:00 p.m.	29.80 inches of mercury
8:00 p.m.	29.80 inches of mercury
10:00 p.m.	29.82 inches of mercury

According to the barograph the barometric pressure increased steadily from a low of 29.10 at 1:30 a.m., December 20 to a high of 29.82 at 10:00 p.m. on December 21, indicating that atmospheric pressure was not a factor in the cause of the explosion.

DETAILS OF EVIDENCE

The map, Appendix B, shows the portion of the mine affected by the explosion, location of the No. 4 shaft, and the course of the ventilating current previous to the explosion. This map also shows the probable origin of the explosion, the approximate area traversed by the flame, and the approximate area affected by violence. In addition, this map shows the location of the bodies of the victims of the disaster, the number and the locations of the areas from which men escaped after the explosion, and the location where dust samples were taken.

The sketches of the active working sections in the explosion area appear as Appendix C, D, E, F, G, and H. These sketches give the details as to the location of the bodies, location of mining equipment, the direction of major forces, and the evidence of flame such as coke and soot.

Flame

The area traversed by the flame of the explosion was determined by a careful examination within the explosion area. In this examination evidence of flame was indicated by burns of the victims of the disaster, burned clothing, deposits of coke particles on mine surfaces and timbers, soot stringers, bits of burned paper, charred and burned sight strings, and charred and burned splinters on timbers left standing throughout the explosion area. Evidence of extreme heat was shown in some areas by the melting and actual burning of the insulation on power cables.

The first indication of flame encountered during the recovery operation and investigation was some charred paper and charred splinters on timbers at a point on the new main north approximately 240 feet outby the 25 west north west. There were indications of flame from this point to the face of the new main north, and the flame extended the entire length of the five entries of the 27 west north west. There was indication of flame the entire length of the 27 east north west entries and the flame extended on the 27 west north to a point approximately 680 feet outby the 1 and 2 north off 27 west north. The extent of flame in the explosion area is shown on the map, Appendix B.

The flame extended into all of the active and abandoned workings driven off the 27 west north west, 27 east north west, and 27 west north. The coked areas indicating flame in the working sections driven off the above-mentioned entries are shown in Appendix C, D, E, F, G, and H. The presence of flame was indicated in the 3 and 4 north working entries off 27 west north west. Dust samples taken in this area showed deposits of coke. (See Section AA, Appendix B) There were coke stringers in all four entries extending to within 25 to 70 feet of the faces.

There were very few signs of burning and flame in the 3 and 4 south off the 27 west north west. There was very little sign of burning and coking in 1 and 2 south and the 1 and 2 north off the 27 west north west. The flame extended into the 3 and 4 north and the 5 and 6 south. Indication of flame in this area was coke and soot on the roof, and the coke and soot extended to within 20 to 40 feet from the faces. These two sections were not working on the night of the explosion.

The 3 and 4 south off the 27 east north west was an active section and was being worked the night of the explosion. The flame extended into the 3 and 4 south entries to the caved area as shown in Appendix C. The flame extended in the No. 1 stub off the 3 south a distance of approximately 50 feet, in the No. 2 stub a distance of 250 feet, which was within 100 feet of the face, and in the No. 3 stub 300 feet, which is about 25 feet outby the face.

The flame extended into the face of Nos. 1, 2, 3, and 4 rooms off the No. 3 stub and into rooms Nos. 5, 6, and 7 about one-half the depth of the room. It was noted, however, that the flame extended a greater depth on the right rib into these rooms than it did on the left rib. The flame did not extend into rooms Nos. 8 and 9. The extent of flame in this section was determined by the presence of coke stringers deposited on the roof.

There were signs of extensive heat along the No. 3 stub and particularly on the outby section in that the insulation on the power cable was charred.

Analyses of dust samples taken in the Nos. 2 and 3 stubs showed particles of coke while samples taken in No. 1 stub showed no signs of coke. Location of samples are shown on Section BB in Appendix B. All of the bodies found in the 3 and 4 south showed signs of burns. The bodies found along No. 3 stub showed signs of extreme burns. The five bodies found in No. 1 stub showed signs of burns but apparently were burned by the hot gases given off from the explosion.

The flame extended into the 1 and 2 north, 5 and 6 north, 7 and 8 north, 3 and 4 south, 5 and 6 south, and the main north entries, all of which are driven off the 27 west north. All of these sections were abandoned or idle the night of the explosion. Bags of rock dust stored in the 1 and 2 north showed signs of burning in that the top layer of rock-dust bags were partly consumed. There was evidence of extensive burning in the 5 and 6 north and the 7 and 8 north, in that there were deposits of coke on the roof and soot stringers which extended to within 6 to 12 feet of the faces of these entries. There was little evidence of flame entering the 3 and 4 south off the 27 west north. The 27 and 28 west north air courses inby the main north showed considerable signs of burning in that coke deposits and soot were found and extended almost to the faces. At the time the map showing the explosion area was completed the main north entries could not be explored, therefore, the extent of forces and extent of flame into this area is not shown on the maps submitted with this report. Subsequent to the close of the official investigation the main north entries have been explored and it was found that the flame traveled into these entries to within 200 feet of the faces. This was determined by the pieces of burned rock-dust bags.

The 7 and 8 south entries off the 27 west north was an active section and was working the night of the explosion. The flame of the explosion extended throughout the 7 and 8 south and there were signs of considerable heat in this area, as coke was deposited on the roof and tar on the power cables had melted and run. The tar from the cables was not burned, and the deposit of coke did not extend to the face of these entries but was within 10 to 20 feet outby the face. There were soot stringers from the roof almost through the entire 7 and 8 working section.

Very little flame entered the 3 and 4 north off the 27 west north. The bodies of the men found in this working section showed very little signs of burning. The analyses of the dust samples taken across the 1, 2, and 3 stubs off of the 3 and 4 north did not show the presence of coke. The location of these samples are shown as Section DD on the map, Appendix B.

Forces

The 27 and 28 east north west and 27 and 28 west north are a continuous set of east-west entries connecting the new and old main north entries. These entries are shown in Appendix D. In future reference to these entries they will be called the cross entries. In these entries there was a conflict in direction of major forces at some points; therefore, it is extremely difficult to follow the sequence of this explosion. Summarizing the evidence of the forces the major force seems to have traveled generally both east and west from the vicinity of the 3 and 4 and 5 and 6 south to the east and the west extremities of the cross entries and southward in the old main north and new main north.

A door and a stopping separated the working sections on the east and west portions of the cross entries. Parts of the door were blown east and other parts in the opposite direction. The stopping was blown east apparently by the first wave of the explosion. The conflicting forces extended from this door and stopping eastward to the main north. Mine cars were moved in both directions with violence near main north and 7 and 8 south. It is not known exactly where the cars were before the explosion; however, they may have come out of the main north entries. The car in the haulage 45 from main north and the door were moved southward. The cars in the cross entries were moved westward. The sand car attached to the locomotive was moved from the west, and practically all forces from that point appeared to have moved eastward to 3 and 4 north and beyond. The forces were violently eastward at the mouth of 3 and 4 north. The outby end of the conveyor was moved eastward. The whole trip at the conveyor loading point was moved several car lengths eastward, and the locomotive was derailed. Six empty cars on the west end of the trip were jammed into a 35-foot length of the entry. However, the two cars shown in 27 west air course west of 3 and 4 north came from the vicinity of 3 and 4 north. Farther eastward where the entries angle to old main north a rectifier house was demolished and the rectifier set moved 20 feet westward. The evidence near the door separating the east and west portions of the cross entries indicated without question that the last forces in that area were moving westward. Hangers installed in No. 28 entry supporting a messenger wire for a cable were brightly polished on their east sides, and dust and soot stringers had collected on all their west sides. This was a McKinley-driven entry, and the corrugations made by the cutting bits offered similar evidence. The east side of each little ridge was polished, and dust and soot stringers had collected on the west side.

The general direction of the forces was toward the new main north from the 3 and 4 and 5 and 6 south, thence southward in the new main north and westward in the cross entries.

The overcast at the junction of new main north and 27 west north west was completely demolished, and the rubble was blown mostly westward. The force wave moved from there westward and into the 3 and 4 north and 3 and 4 south panels. It rebounded from the 3 and 4 north panel, blowing out the stoppings in the cross entries at the mouth of the panel toward the south, and it also threw an empty trip at that point violently against the south rib.

In panel 3 and 4 south, 27 east north west, see Appendix C, forces were violent inby from the mouth of the panel entries. The panel entries are designated A, B, C, and D, from west to east in this case. The force carried a stretcher in a closed tubular metal case, a fire extinguisher, and extra brattice boards from a fire station in C entry near the main cross entries southward to the 45-degree haulageway, and thence eastward toward D entry. One cap, or lid, of the stretcher container was carried to the location of the wrecked 2-car trip in D entry over 300 feet from its starting place.

The force apparently struck the 8-car empty trip on its north side as the trip was moving toward D entry through the door in the 45-degree (track) haulageway. Four cars of the trip were uncoupled and scattered about; the other four remained coupled as they were blown into the trackless B entry, and they dragged the locomotive with them, aided perhaps by the momentum of the trip at the moment when the force struck, until the locomotive was derailed. Dust and small pieces of debris were piled against the north end of the locomotive after it stopped.

Several items of evidence indicate that the single door in the 45 between B and C entries was open. The empty trip was apparently stretched across both B and C entries when it was struck broadside by violent forces from the north. The eight cars at the loader head in C entry were fully loaded, and the fact that both shuttle cars were waiting loaded at the loader head indicated that the loaded trip was waiting for sometime for the empty trip to clear. The locomotive of the loaded trip would have been close to the track switch at the 45 when the last car was being loaded. A shield plate, or lid, from the top of the loaded-trip locomotive was found about half-way between the 45 and the loader head, indicating that the locomotive was outby toward the 45 when the shield was blown off, since all forces appear to have traveled generally southward.

The bumper at the northwest corner of the loaded-trip locomotive exhibited a dent, and the motorman's seat at the same corner was torn off with sufficient force to shear off the bolts which held it to the frame. The inby side of the inby empty car in C entry was bent inward and

it is assumed that this car struck the loaded-trip locomotive. The C entry is down grade toward the caved area, and the loaded trip ran down grade for a short distance. Further evidence that the door was open was the position of the door and its frame. The door was thrown only a few feet eastward from its position and was not broken but the header of the frame, which was relatively heavier and had less area to offer resistance was thrown nearly as far as the wrecked cars in the C entry.

The start-stop push-button switch box of the loader head and the positive power nip, each with a piece of cable attached, and the locomotive gong were torn off and blown inby to the next crosscut. The headlight lens on the north end of the locomotive was broken and the headlight was filled with coal dust and small pieces of coal.

The locomotive and two cars in D entry were thrown completely off the track southward from the curve into the reverse 45. One shield section from the top of the locomotive, the gong, reel nip, and one set of spooling rollers were blown into the car next to the locomotive, and dust, coal, small pieces of wood were piled two feet high against the north side of the motor after it stopped.

In B entry the concussion shattered the board stoppings and piled the debris against one shuttle car. In A entry the saloon doors were blown southward, but the frame was left standing. The shuttle cars appeared undisturbed; even the coal on top of the loads was not blown off. Partly-filled oil drums were blown from the mouth of No. 1 stub southward in A entry and were badly battered; one traveled as far as the 45-degree crosscut inby No. 3 stub. The board stoppings and the saloon doors from the loader head inby between B and C entries were damaged but not completely destroyed, the force being eastward from B toward C entry. The board stoppings between Nos. 1 and 2 stub entries were damaged to different degrees, as shown in the sketch, the force first being from No. 1 into No. 2 and then back to No. 1.

In the face regions of the stub entries and rooms off No. 3 stub, no signs of violence were observed. All of the men in the stub moved away from the immediate face areas, and they were found in the Nos. 1 and 3 stubs. One man had apparently moved from No. 2 stub into No. 1 stub, leaving his flame safety lamp and cap in No. 2 stub, and most of the men in the south panel entries were found close to their working stations.

In panel 3 and 4 north, 28 west north west (Appendix E) forces within the panel were not violent. Force in the 4 north D entry appeared to have been inby from the mouth of the panel toward the face of the entry. In the rest of the panel the forces moved eastward and southward toward the main cross entries. The force did not extend to the face regions. Loose objects on machines and rock dust on ribs and roof appeared undisturbed. At the mouth of the panel evidence of force was more pronounced toward the south.

In panel 3 and 4 south, 27 west north west (Appendix F) forces moved in a southerly direction into the panel entries and thence eastward through crosscuts in the panel entries (or northeastward in the case of the 45). Part of the equipment from the fire station in the mouth of one of the intake entries was blown nearly 150 feet southward. The cars were blown violently off the track southward and eastward in the 45.

In panel 7 and 8 south, 27 west north (Appendix G) violence was great. The south entries in this panel are designated A, B, C, and D from east to west. Indications of forces moving southward into the panel were noted in D entry, but in the other three entries all major forces traveled to the north and westward through the crosscuts. The trip at the loading point in C entry lacked only a half car of being fully loaded, and an empty trip was moving into B entry. Both trips were blown partially off the track with considerable violence, the forces driving the cars northward and westward. One man was blown forcibly westward under the loaded trip at the loading-point crosscut. The air compressor for shuttle-car tires was blown northward against the empty trip. All doors and stoppings were demolished by the forces traveling westward through the crosscuts, except in the 45-degree haulageway, where the northward moving forces were deflected eastward. Signs of violence were absent in the face regions of the panel entries and the east stub entries. Few, if any, of the men had moved any appreciable distance from the locations where they were working when the explosion occurred.

In panel 3 and 4 north, 28 west north (Appendix H) direction of major forces was north in all four panel entries. The cable reel of a locomotive was blown 100 feet northward, and stoppings and the stub-entry belt which were placed east-west, or broadside to the direction of force, were blown northward. Forces through the crosscuts in the panel entries removed or damaged all stoppings from west to east. The forces veered eastward into the No. 1 stub entry and blew out some of the stoppings in a northerly direction. No violence was observed in the face regions. All men had come out of the face area bringing their dinner buckets and were found huddled in a small area in the panel entries at the mouth of the stub, where they had died.

Methane as a Factor in the Explosion

This mine is classed as gassy by the Illinois Department of Mines and Minerals and explosive gas was recorded in air samples in all of the 16 Federal inspections made of this mine.

The mine was producing 1,570,770 cubic feet of methane in 24 hours at the time of the last Federal inspection which was in July 1951. It is a known fact that abandoned panels and sections of panels termed "old ends" contain methane. This fact has been stated in all of the Federal inspection reports.

The following statement is taken from the first reinspection of the Orient No. 2 mine made March 18-25, 1943: "One of the greatest potential gas-ignition hazards in this mine exist at points known locally as 'old ends.' Briefly, the formation of an 'old end' is as follows: The inby third of a panel including the rooms on each side is worked out, and the pillars extracted. The area then caves, and gas is released. An entry crosscut near the caved area is then opened, and the ventilating current is allowed to flow past the edge of the gas accumulation, with the idea of diluting it and eventually carrying it away. This air current is then used to ventilate the outby side of the panel in which men and nonpermissible electrical equipment are working. Theoretically, these bodies of gas are supposed to remain stationary and dilute gradually from the fringes, but in practice the gas body has been observed to move back and forth when a locomotive was moving in the panel or when a door has been left open. When it is realized that all haulage roads are on return air, the latent hazards in this system of mining become more apparent."

The last inspection report cited the following violation of the Federal Mine Safety Code: "Methane was detected in numerous abandoned entries (termed old ends) by means of a permissible flame safety lamp. The ventilation was short-circuited at No. 1 room in these abandoned entries generally. Trolley locomotives were being operated 150 to 300 feet outby the old ends." This violation was cited in five of the previous inspection reports and, during the investigation of the explosion, samples were taken in a number of the old ends in the area of the mine affected by the explosion, the analyses of which are shown in Table 1. The methane content at the point of sampling in these old ends contained methane varying from 1.52 percent to 8.0 percent.

All of the working sections affected by the explosion were ventilated by air that had passed by the entrances to abandoned workings (old ends).

In checking the mine examiner's records it was found that three of the abandoned sections and old ends were "working" or caving just previous to the explosion. The mine examiner's book showed that: "The 1 and 2 east and 5 and 6 south 27 west north is on the move and falling. Clear as far as I could get." It was also reported that the abandoned places in the 3 and 4 south off the 27 west north west were "working" and caving.

Gas was reported in No. 3 and 4 air courses (old ends) of the 3 and 4 north off the 27 west north on December 18, 19, 20, and 21.

Samples taken in old ends in the explosion area showed methane as follows:

Bottle No.	Location	Methane
C-5480	Mouth of No. 1 east, 3 south, 27 west north	4.80 percent
A-2376	At 3rd crosscut in the 2 south off 27 west north west	3.56 percent
A-2754	In 2 north at 4th crosscut, 27 east north west	1.52 percent
A-2795	At 4th crosscut in 3 south off 27th west north west	2.68 percent
C-5518	Inby mouth of 4 east 3 north, 28 west north	2.9 percent
C-5533	Inby 1st crosscut No. 1 air course 2nd north 28 west north	4.9 percent
A-2175	Lip of cave, old end D entry, 3 and 4 south, 27 east north west	8.0 percent
B-9833	Lip of cave, old end D entry, 3 and 4 south, 27 east north west	8.0 percent

Inasmuch as these samples were taken at the outer edges of falls in the abandoned areas, the concentrations of methane within the abandoned areas undoubtedly were much higher.

The mine examiner for the morning shift of December 20 reported: "The 3 and 4 east 3 south 27 east new main north is working and falling this morning. Gas in rooms 1, 2, and 3." In accordance with the engineer's markings this location would be rooms 1, 2, and 3 off No. 6 stub off the 3 and 4 south, 27 east north west. The same mine examiner made the following report on December 21: "The head end and 3 and 4 south 27 east new main north is unsettled and falling. Clear as far as I could get."

During the day shift on December 20 and 21 a gas watchman was assigned to watch the abandoned workings inby the No. 3 stub at the 3 and 4 south. The mine examiner for the night shift on December 21 did not report any gas in the 3 and 4 south panel but stated when questioned after the explosion, that the workings inby the No. 3 stub were unsettled and falling.

During the recovery operations it was found that the abandoned workings had caved to the junction of No. 4 stub and the 3 and 4 south entries and that explosive gas was present just inby the location of the bodies of two timbermen in the 3 south air course. Explosive gas was also found at the falls in 4 south entry and air course.

During the recovery of the 3 and 4 south of the 27 east north west a certified man and an assistant were left in the area and instructed to warn the person in charge of recovery operations if the gas started to come out of the abandoned workings.

Accumulations of explosive gas were also found in 4 south entry on December 26, 27, and 28, during the time of the investigation. The analyses of an air sample taken at the edge of caved area (old end) in 3 and 4 south at 10:18 a.m., December 27, contained 8.0 percent methane, a highly explosive mixture.

From evidence after the explosion it was found that the main ventilating door in the 3 and 4 south at 27 east north west was open. From the location of the trip of empty cars and the location of the door it was apparent that the door was open at the time of the explosion to permit the shifting of empty and loaded trips. The opening of this door would relieve the ventilating pressure on the abandoned area of the 3 and 4 south entries and would have a tendency to let the gas from the old ends come out onto the active workings. From the reports of the fire boss the old ends in the 3 and 4 south were working and caving and, from the positions of the caves in the 3 and 4 south, a cave occurred sometime after the night fire boss made his inspection of this place about 5:00 p.m. on December 21. A large cave occurring in this area would force gases out into the live workings of the 3 and 4 south.

During the recovery operations a package of cigarettes was found near the bodies of the two timbermen in the 3 and 4 south off 27 east north west, and bits of cigarettes were near the location of these two bodies. These cigarettes were broken but there was no sign that they had been burned. Paper covering on the package of cigarettes did show signs of burning as did other paper found in this area, such as parts of rock-dust bags. The bodies of these two men were found near the cave (old end). A thorough search was made during the recovery operations and also during the investigation and no matches or cigarette lighters were found at this location.

Evidence obtained during the recovery operations and during the investigation indicated that the two post-mounted electric drills in the No. 2 room, No. 3 stub, 3 and 4 south off the 27 east north west were in operation. The bodies of the two men operating these drills were found near the mouth of the No. 2 room, 18 feet and 26 feet from the drills. The 5 B.U. Joy loader in the No. 3 room, No. 3 stub was not operating. This is a stand-by loading machine and it was parked across the entrance to the room with the cable coiled up on the loading head. The 11 B.U. Joy loading machine in No. 8 room, No. 3 stub was apparently not in operation. The loading head and boom were loaded with coal and the shuttle cars were at the car-loading station at the 3 and 4 south entries.

The cutting machine near the face of the No. 2 stub was apparently in operation as were the Dooley drills in the face of the No. 1 stub. The mining machine and the Dooley drills were not in the area which showed flame, as there was no coke or sign of burning at the face of No. 1 stub and at the face of the No. 2 stub.

The two shuttle cars were found loaded at the elevating conveyor at the car-loading station at 3 and 4 south. The shuttle cars were completely loaded and were bumpered together. There was no empty car under the elevating conveyor, see Appendix C.

The two post-mounted electric drills in the No. 2 room were of the permissible type but were in nonpermissible condition and were capable of igniting an explosive mixture of methane and air. The two shuttle cars were of explosion-tested construction but upon examination were found to be capable of igniting an explosive mixture of methane and air. The conveyor elevator was also capable of igniting an explosive mixture of methane and air.

The condition of the electrical equipment in the 3 and 4 south entries off the 27 east north west is described in detail in this report under the heading "Electrical Equipment".

Factors that Prevented the Spread of the Explosion

The forces of the explosion and flame extended through the four working sections and propagated along the haulage entries of the 27 west north west, 27 east north west, 27 west north, and along the old and new main north entries.

From evidence found after the explosion, flame was propagated by clouds of coal dust raised from accumulations of coal dust on the floor of the entries and possibly by the emission of accumulated gas from numerous "old ends" in the explosion area. There was evidence that these entries had been rock-dusted but the incombustible content was not sufficient to render the accumulation of coal dust non-explosive. Samples taken on these entries, as shown by Sections EE and FF, (see Appendix B) averaged 36.8 percent and 33.0 percent incombustible respectively.

Inasmuch as these samples were taken in the explosion area they are not truly representative of the incombustible content of the dust prior to the explosion; however, they indicate that sufficient inert matter was not present to prevent propagation of an explosion. Large accumulations of fine coal dust remained along the floor of these entries after the explosion.

Dust samples were taken at Sections TT, GG, and SS (see Appendix B) on the new main north outby the area affected by the flame and near the

edge of the extent of force in the explosion area, and the analyses of these samples are shown in Table No. 2. The average incombustible content of dust samples at Section TT is 45.51, at Section GG is 50.41, and at Section SS is 52.21 percent.

Dust samples were taken on the old main north entry outby the area covered by the flame and at the edge of the forces of the explosion at Sections LL, RR, and UU. The average percentage of incombustible content of these samples was 40.56, 48.61, and 52.03, respectively.

Unquestionably the relatively high inert content of the dust along the new main north and the main north limited the spread of the explosion outby the 25 east north west and the 25 west north. The analyses of dust samples taken across the 25 west north west at Section QQ average 53.40 percent incombustible.

Dust samples taken in Sections OO, NN, and MM on the entries of the 25 east north west and 25 west north averaged: 39.34, 56.72, and 66.64 percent incombustible, respectively.

Dust samples were collected at Section PP, on the 23 west north west and the incombustible content averaged 57.99 percent. The incombustible contents of the dust in these locations, although less than the 59 percent required to render the coal dust of the Illinois No. 6 coal bed incapable of propagating an explosion, together with the effect of expansion into open and abandoned workings prevented the propagation of this explosion into the active workings of the 25 west north west, 25 west north, and the 23 west north west.

Dust samples were taken at Section KK on the main north at the junction of 21 west north and at Sections JJ and II on the 21 north west. These locations were out of the explosion area. The analyses of the four samples taken at Section KK range from 42.7 percent to 81.7 percent incombustible and average 67.52 percent. The analyses of the ten samples taken at Section JJ range from 30.8 percent to 93.4 percent incombustible and average 43.79 percent. The analyses of the ten samples taken at Section II range from 15.9 percent to 90.3 percent incombustible and average 44.40 percent.

Three of the four samples taken at Section KK contained more than the 65 percent incombustible material recommended. Of the ten samples taken at Section JJ only one of the samples contained more than the recommended 65 percent incombustible material and of the ten samples taken on Section II only two contained more than 65 percent incombustible. This indicates that sufficient rock dust had not been applied in this area.

SUMMARY OF EVIDENCE

Conditions observed in the mine during the recovery operations and the investigation following the disaster together with information available from previous Federal coal-mine inspection reports provide ample evidence as to the cause and probably origin of the explosion. The evidence from which the conclusions of the Federal investigators are drawn in summarized as follows:

1. Flame and forces of the explosion traversed the entire 27 west north west, 27 east north west, and 27 west north system of cross entries and most of the active workings therefrom.

2. The direction of travel of the explosion throughout most of the affected area was difficult to determine because of conflicting evidence of forces particularly with respect to the movement of heavy equipment.

3. The recording pressure gage at the fan indicated two positive pressure waves with an interval of approximately three minutes between each peak. This is an indication that there may have been two distinct blasts of great intensity and would account for the conflicting evidence of forces found after the explosion.

4. Every working section in the explosion area was ventilated by air that had first passed by the openings to abandoned caved areas (old ends).

5. Explosive gas was found at the openings to every abandoned caved area, except one, by mine examiners on one or two days before the explosion, or by representatives of the Bureau of Mines during the recovery operations and the investigation.

6. Three of the abandoned areas within the section affected by the explosion were reported to be caving by the mine examiners during the 24-hour period prior to the explosion.

7. All electric equipment in the explosion area was capable of igniting gas. Several nonpermissible electrical machines, capable of igniting gas, were in operation in each working section in the explosion area.

8. It is recognized by the investigators that the explosion could have originated in any working section in the explosion area because of the conflicting evidence of forces.

9. At the junction of 3 and 4 south off the 27 east north west the predominant forces divided. From this point initial major forces traveled west into the 27 west north west areas of the mine and east into

the 27 west north area. This separation of major initial forces indicates that the explosion probably originated in the working section known as 3 and 4 south off 27 east north west.

10. The mined-out area inby 4 and 5 stub entries off 3 south off 27 east north west was known to be caving and gas was found in this area on the morning of December 20.

11. By the morning of December 21, the day of the explosion, the worked-out area was caving to the junction of the 4, 5, and 6 stub entries with the 3 and 4 south entries.

12. At the beginning of the shift on which the explosion occurred, two timbermen were stationed at the junction of 4 west stub entries with the 3 south air course for the purpose of erecting timbers to prevent the 3 and 4 south entries from caving. This was to protect the active mining operations in 3 and 4 south. Unquestionably the mined-out area in 4, 5, and 6 stub entries and in the 3 and 4 south panel entries was still caving when the explosion occurred.

13. At the instant of the explosion the single ventilating door between the intake and return air currents in 3 and 4 south was open to permit the movement of mine cars and locomotives.

14. The air current for the working section was partly short-circuited while the single ventilation door was open. The open ventilation door had the effect of reducing the normal ventilating pressure at all points inby, including the entrances to the caved and caving areas.

15. The reduced ventilating pressure, plus the caving action of the roof in the abandoned area undoubtedly caused the gas to flow from the abandoned area into the active working section.

16. Evidence of flame was not found in No. 1 stub entry off 3 south which was the normal ventilation return entry from the working section; moreover, evidence of flame was not present in the faces of No. 2 or No. 3 stub entries off 3 south or in the faces of Nos. 5, 6, 7, 8, and 9 rooms off No. 3 stub entry. Evidence of violent burning was present along almost the entire length of Nos. 2 and 3 stub entries off 3 south. These were the intake entries of the working section. Rooms 1, 2, 3, and 4 had been filled with flame. It is evident from the foregoing condition that the body of gas flowing from the abandoned area and mixing with the intaking air was ignited before it had time to reach the faces of Nos. 1, 2, and 3 stub entries. It was evident therefore, that a moving column of gas-air mixture rather than a standing body of gas was ignited.

17. Explosive gas was found at the edge of the caved area in 3 and 4 south entries during the recovery operations and each time this

location was visited over a period of three days during the investigation. A sample of air collected at this point at 10:18 a.m., December 27, contained 8.0 percent methane.

18. Cigarettes were found near the bodies of the two timbermen at the junction of 3 south air course and 4 west stub entry during the recovery operations. This is one of the points where the gas is believed to have been emerging from the worked-out area. There was no evidence that the men were smoking or lighting cigarettes at the instant of the ignition and a thorough search of the immediate location failed to reveal the presence of matches or cigarette lighters.

19. The two shuttle cars for the section were in tandem with each other at the elevating conveyor in the mouth of No. 2 stub entry off 3 south. The shuttle cars were laden with coal and evidently waiting for the transfer of empty cars to the conveyor head. These shuttle cars were at a location in the return air circuit from the abandoned area and at the first place that would be reached by the moving column of gas-air mixture. Eighteen cap screws were missing from the controller box cover on one of these cars and nine cap screws were missing from the control compartment cover on the other car; therefore, either one of the cars would be capable of igniting gas if the motors were operated. Whether or not the motors were being operated at the time of the explosion could not be determined from available evidence.

20. Two post-mounted electric drills were being operated in No. 2 room, No. 3 stub entry off 3 south at the instant of the explosion. This location is on the return air circuit from the abandoned area and with the exception of the two shuttle cars is the second place where electrical equipment was being operated that would be reached by the moving column of gas-air mixture. The drills were of the permissible type but they were in nonpermissible condition and capable of igniting gas by reason of the fact that six cap screws which secure the switch casing to the body of the drill were missing from each drill; the drill at the left side of the place did not have a packing gland at the cable outlet, and ordinary plug-type connectors were installed on short leads from the switch housings.

CAUSE OF THE DISASTER

Representatives of the U. S. Bureau of Mines who investigated the disaster are of the opinion that the explosion probably originated near the junction of 3 south off 27 east north west and No. 3 stub entry off 3 south; that the disaster was caused by the emergence of a large body of explosive gas from an abandoned and caving area resulting from the combined effect of caving in the abandoned area and simultaneous short circuiting of the ventilating current; that the gas was ignited by

an electric arc or spark from nonpermissible electrical equipment; and that the propagation of flame throughout a large part of the affected area of the mine was by coal dust and possibly by gas from other worked-out and abandoned areas.

Conditions considered responsible for this disaster are: (1) An inadequate ventilating system in which air that ventilates the open approaches to abandoned and caving areas is coursed therefrom to active working places or haulage roads and in which provision has not been made to keep abandoned areas free from accumulations of explosive gas. (2) The operation of nonpermissible electrical equipment, capable of igniting gas, in return air from the open approaches to abandoned and caving areas containing large accumulations of explosive gas. (3) The presence of large accumulations of fine coal dust created by mining operations. This coal dust, principally along the roadways, was not removed from the mine or rendered inert by the application of sufficient rock dust.

RECOMMENDATIONS

Recommendations concerning the safe operation of this mine were made in reports of previous Federal inspections, the last inspection having been made July 10-13, 16-20, 23-27, 30, and 31, 1951. Recommendations in this report, therefore, are limited to conditions as related to this disaster.

Ventilation

1. A split system of ventilation should be adopted providing for the operation of not more than two but preferably not more than one mechanized unit (section) on each split of air.

2. The air entering each split should be pure intake air"* exclusively.

3. The air in each split should be circulated to each active working place and all dead ends on the split after which it may be used to ventilate abandoned worked-out areas or the edges thereof before passing into the main returns.

4. A system of bleeder openings and air courses providing for the continuous movement of air through the abandoned or caved areas should be established to prevent the accumulation of standing bodies of gas in these areas and to minimize the effect of variations in atmospheric pressure.

5. Worked-out abandoned areas should be either ventilated or sealed. If abandoned areas are sealed, the seals should not be adjacent to the intake airways but the openings in which the seals are placed should communicate directly with the return airways.

6. The ventilation system should be so designed that the air will circulate to the working faces without the possibility of interruption. The use of doors for controlling the ventilation should be eliminated so far as possible but where doors are used they should be erected in pairs to form air locks.

Inspections

7. Tests should be made with a permissible flame safety lamp for methane before any electrical equipment is taken inby the last open crosscut, immediately before such equipment is operated at the face, and in the case of cutting and drilling, after each place has been cut or drilled.

8. Mine examiners should be required to enter their reports in the official record book with indelible pencil or ink in such a way that there can be no question as to the locations referred to or the conditions found.

Ignition Sources

9. No electrical equipment other than permissible equipment should be taken into or operated in other than pure intake air.*

10. The installation of trolley wire and all other power wires and cables except trailing cables and insulated cables leading to permissible junction boxes should be confined to pure intake air.*

11. All power connections for face electrical equipment should be made in "pure intake air"* unless such connections are made through permissible junction boxes.

12. All permissible electrical equipment should be maintained in permissible condition and operated in accordance with the conditions of permissibility as prescribed by the U. S. Bureau of Mines.

13. Welding and cutting torches should not be operated in other than "pure intake air."*

14. Compressed air lines used to supply compressed air for blasting should not be installed in any entry where trolley wire or power cables are installed.

15. Insulated couplings should be installed between the ends of the compressed air lines and the flexible tubing leading to the blasting shells.

16. All persons entering the mine should refrain from taking matches, cigarette lighters, cigarettes or other smokers articles underground. The management should prevent this practice by instituting a regular and systematic search, and any person found in violation should be prosecuted under the laws of the State of Illinois.

Coal Dust

17. Water or water with a wetting agent should be applied to the cutter bars of mining machines, the loading heads of loading machines, the coal piles after blasting, and the loading conveyors used in conjunction with shuttle cars and conveyor belts, in sufficient quantity to allay the coal dust effectively at its source.

18. All loose coal left by the mining operation, loose coal spilled from coal cars, and loose coal resulting from the spalling of ribs should be kept cleaned up. The mine should be cleaned up and kept free of accumulations of loose coal and coal dust.

19. Rock dust should be applied to the ribs, roof, and floor of all entries and rooms up to and including the last open crosscuts but in no case should the applications of rock dust be more than 40 feet from the faces. The rock dust should be maintained in such quantity that the incombustible content of the mine dust will not be less than 65 percent, plus 1 percent for each 0.1 percent of methane in any ventilating current.

Miscellaneous

20. A self-rescuer should be provided for each person underground and all underground personnel should be instructed in their maintenance, use, and limitations.

*"Pure intake air" is defined as air which has not passed through any active working places in face regions and has not passed through any worked-out abandoned areas or through or by the unsealed entrances to any abandoned or worked-out areas.

ACKNOWLEDGMENT AND COMMENDATIONS

The writers acknowledge the courtesies extended and the help given by officials of the Chicago, Wilmington and Franklin Coal Company, members of the United Mine Workers of America, representatives of the Illinois Department of Mines and Minerals and the personal representative of the Governor of Illinois who gave, without reservation, all information requested in connection with this investigation.

The Bureau of Mines commends the efficient, courageous, and humanitarian services rendered by the mine rescue teams of the State of Illinois, the mine rescue team of the Union Collieries Company of DuQuoin, Illinois, the hundreds of volunteer rescue workers, the Illinois State Police, the Salvation Army, and various volunteer fire companies.

Respectfully submitted,

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Coal-Mine Inspector

Approved: J. J. FORBES

J. J. Forbes
Director, Bureau of Mines

APPENDIX A

VICTIMS OF EXPLOSION, ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

December 21, 1951

Name	Age	Marital Status	Dependents	Social-Security Number
George L. Pollock	25	M	1	321-20-0224
Ted Tapley	47	M	0	349-07-7080
Robert Rice	32	M	4	327-18-1185
Lawrence Bell	32	M	2	334-12-9878
Warren Mitchell	24	M	1	343-22-3290
J. W. Fairbanks	43	M	4	355-22-8620
Roy Westray	36	M	3	349-07-1894
Carl Williams	36	M	1	344-03-2865
Thomas Pierson	48	M	7	355-09-8532
W. L. Woodward	48	M	3	327-18-1835
John Quale	25	S	0	320-20-6282
George Novak	40	M	3	331-01-6678
Roy Hutchins	41	S	1	342-07-8753
John Metalic	40	M	1	345-03-1623
Earl Overturf	40	M	0	356-03-4738
Wayne Spencer	25	M	1	320-20-8616
Harry Morthland	52	S	0	361-09-5738
Oral Bradley	26	M	2	349-14-2934
Max Nolen	34	M	2	349-07-1951
J. E. Haynes	57	M	0	349-03-9977
Robert Hines	33	M	2	347-07-8316
Archie Ferbus	51	M	1	355-03-9375
Mike Senkus	63	S	2	236-10-2820
William W. Bell	38	M	3	355-09-8158
Max Wawrzyniak	57	M	1	353-07-6221
Audrey Huffstutler	21	M	0	343-22-3904
Earl H. Smith	53	S	0	315-09-9319
Roy B. Beaty	33	M	2	330-16-5418
Guy Rice	24	M	2	343-22-3629
R. L. Newell	47	M	0	356-01-8012
Andrew Cunningham	26	M	1	346-16-3511
Hearstel Summers	24	M	2	320-20-9260
John Kucewsky	37	M	2	343-03-6151
Frank Evrard	33	M	2	361-09-1859
William R. Smith	33	M	2	323-16-7071
Arthur Adams	43	M	3	342-01-8134
Vallie L. Pritchett	39	M	4	342-01-7997
Bill E. McDaniel	19	S	0	341-26-8127
Clyde Moses	39	M	3	328-07-4077
Wilburn L. Bell	31	M	1	429-26-1134

(Cont'd.)

VICTIMS OF EXPLOSION, ORIENT NO. 2 MINE
CHICAGO, WILMINTON AND FRANKLIN COAL COMPANY

December 21, 1951

Name	Age	Marital Status	Dependents	Social-Security Number
Fay Austin	52	M	1	343-09-3205
R. E. Ashmore	61	M	0	342-03-9793
Earl Payne	42	M	0	521-16-0244
Pete Petroff	56	M	1	343-10-6602
Stanley Sandusky	48	M	0	342-01-8222
Bill Akins	30	M	1	346-16-8214
Paul Taylor Sr.	51	S	0	342-05-9643
Chalon H. Smith	26	M	2	349-14-3697
Joseph Quayle	25	M	1	320-20-6283
Claude Milligan	40	M	3	345-03-2160
Edward Mundy	40	M	0	342-05-9444
Alexander Ramsey	29	M	1	347-12-4194
Guy Johnson	42	M	3	351-12-5450
Jos. L. Fitzpatrick	29	M	1	339-14-3960
Victor Younkin	41	M	2	355-09-1429
Andy Peska	61	S	0	343-10-6436
John Palic	48	M	1	342-01-7476
Wallace Miller	29	M	2	349-14-0566
Herschel Harris	54	M	0	344-03-7416
John Sadoskie	41	M	1	342-01-9079
Charles E. Boyd	53	M	0	333-10-5524
Oscar Bartley	30	M	1	325-18-7455
Alberic Vancouvwelert	49	M	0	357-01-1909
John Farkas	59	M	0	345-03-3340
Ellis Reach Sr.	57	M	0	346-03-0533
H. O. Harper	54	S	0	342-03-2181
William Sanders	27	M	1	347-12-3823
George R. Smith	44	M	3	357-09-9208
Lafet Lipsey	32	M	2	359-09-9029
Roy L. Neibel	50	M	2	356-09-5452
Jas. H. Williams	57	M	0	344-03-2866
Sam Montgomery	41	M	2	334-12-9372
Burton Spencer	34	S	0	324-14-4950
Tom Roberts	43	M	2	342-03-2257
Joe Zeboski	46	M	3	342-03-2459
W. E. Wilson	55	M	1	401-32-9391
Aston L. Bufford	40	M	4	359-01-6569
Earl Rees	38	M	1	493-05-2788
Otis Lewis	28	M	1	349-14-3563
Clyde Dupree	51	M	1	333-10-6064
Carroll Stubblefield	42	M	3	357-03-9441
Mynett Lockhart	49	M	0	355-09-1436
John F. Bennett	35	M	2	341-09-8473
Jas. O. Cantrell	44	M	1	342-01-7308
Louis Zancuchi	43	M	0	343-07-7470

(Cont'd.)

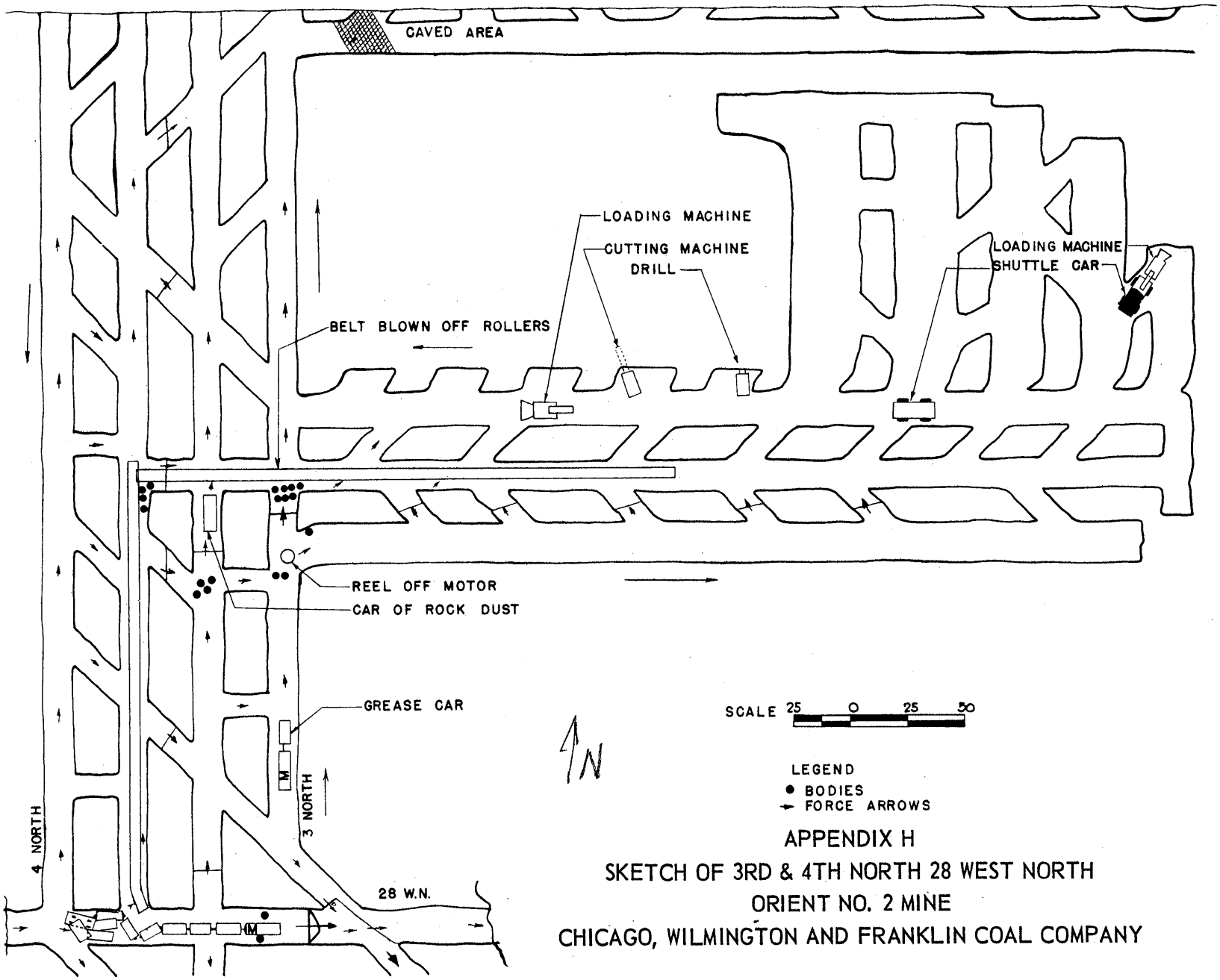
VICTIMS OF EXPLOSION, ORIENT NO. 2 MINE
CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

December 21, 1951

Name	Age	Marital Status	Dependents	Social-Security Number
Charles Southern	43	M	2	344-07-8545
James L. Black	57	M	0	343-09-3309
Thomas Clark	45	M	1	345-05-9236
Ellis Reach Jr.	32	M	4	332-12-5869
Marion Odle	37	M	0	342-05-9583
Charles Whitlow	52	M	1	349-09-1948
Carroll Bridges	41	M	2	343-03-8198
George Dunlop	39	M	2	335-01-2592
Rolla Jones	48	M	4	342-03-3683
B. R. Williams	40	M	1	356-09-5541
Louis Trapper	45	M	5	341-10-7738
Leon Summers	35	M	4	356-09-7757
Roscoe Karnes	55	M	4	322-01-5884
L. J. Cairel	37	M	2	343-07-3688
Birgil Dollins	46	M	1	345-07-2107
Charles Rose	32	M	0	334-16-8437
Clarence Eubanks	44	M	2	355-09-6655
Jesse Conner	39	M	2	355-09-7812
Howard Wall	39	M	3	350-05-2823
John Dobruff	62	M	1	359-09-8084
James Fowler	37	M	3	357-09-5493
Zell Yates	33	M	5	352-01-5542
Paul Coats	33	M	1	332-07-6910
Estel Bradley	44	M	5	355-10-5927
Chas. A. Bartoni	38	M	3	497-03-5412
Shelby Pasley	40	M	3	361-09-5938
Charles R. Smith	25	M	2	346-16-8568
Joe Revak	49	M	0	358-05-3158
Claude Roland	46	M	2	326-14-7604
Thomas Runnels	35	M	2	353-09-9383
Silas Stewart	60	M	1	342-01-8231
John D. Thomas	29	M	2	346-16-7618
Harry Gunter	38	M	3	357-09-7834
Ralph Kent	47	M	0	327-12-5897

Average age of victims 40.8 years

Total number of dependents 301

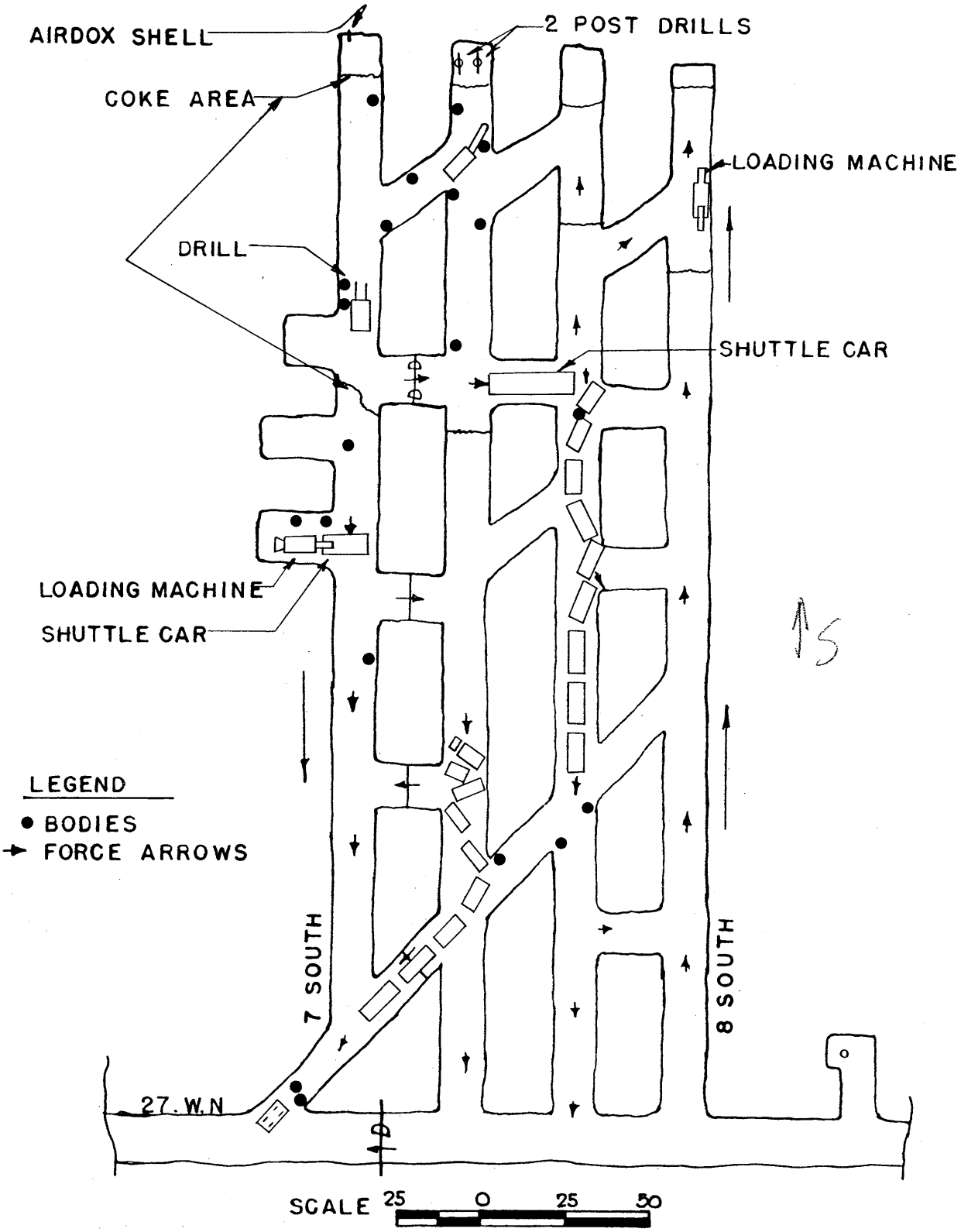


APPENDIX H

SKETCH OF 3RD & 4TH NORTH 28 WEST NORTH

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

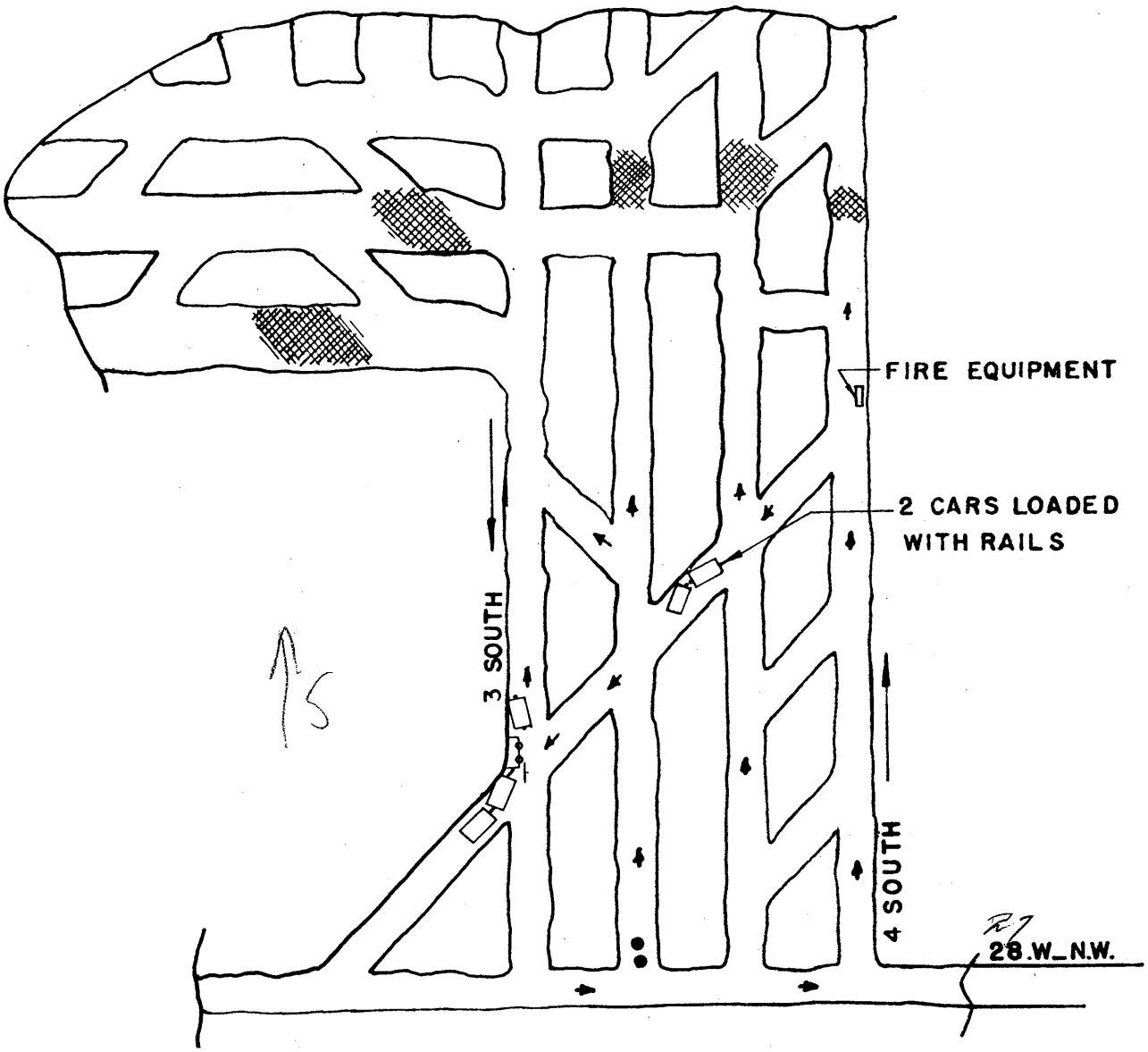


APPENDIX G

SKETCH OF 7TH & 8TH SOUTH 27 WEST NORTH

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY



SCALE 25 0 25 50

LEGEND

● BODIES

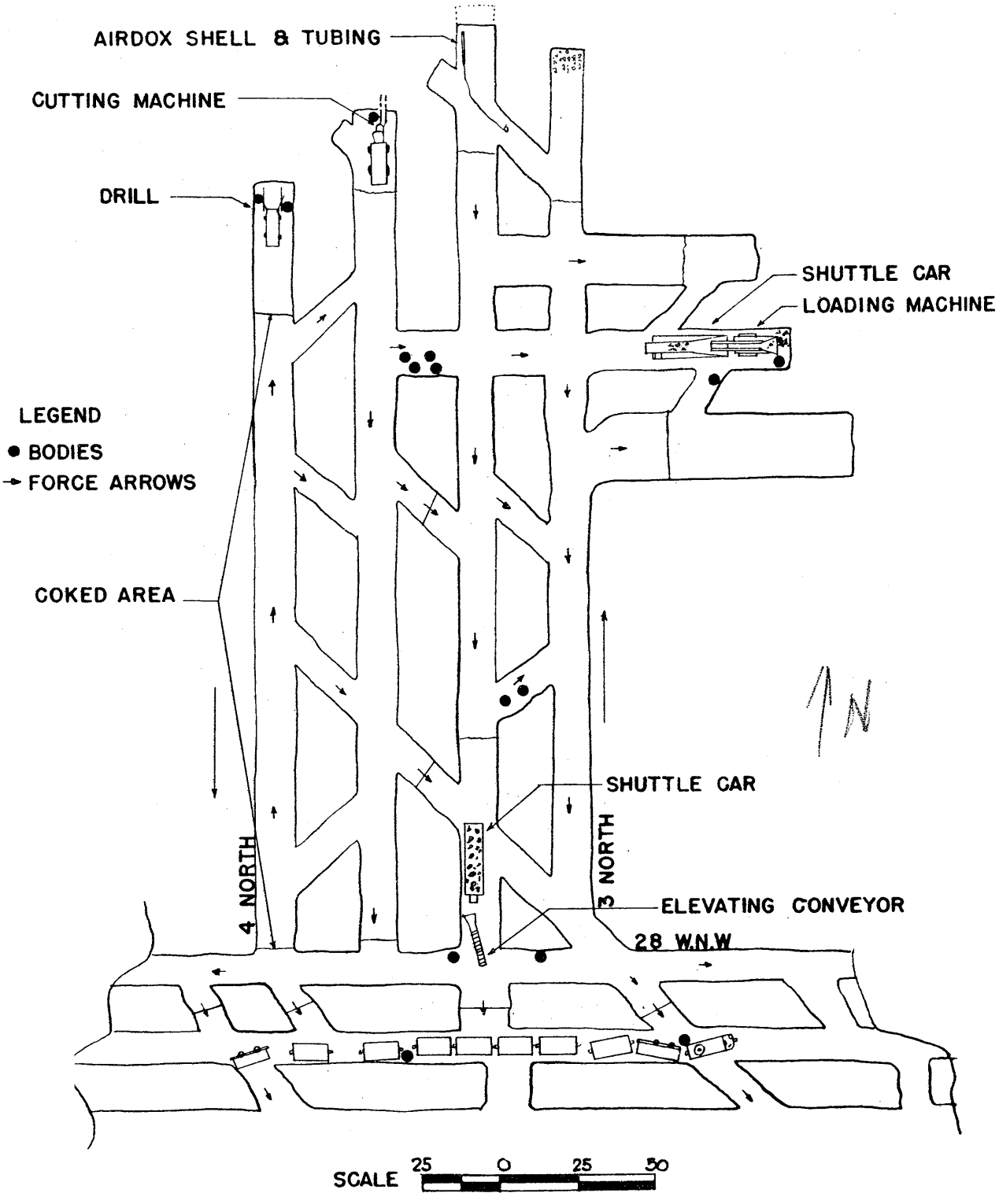
FORCE ARROWS

APPENDIX F

SKETCH OF 3RD & 4TH SOUTH 27 WEST NORTH WEST

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

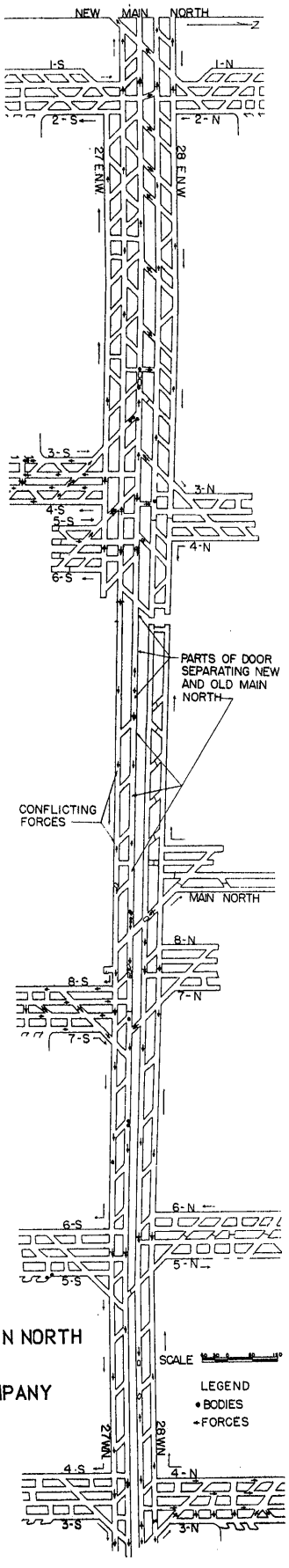


APPENDIX E

SKETCH OF 3RD & 4TH NORTH 28 WEST NORTH WEST

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

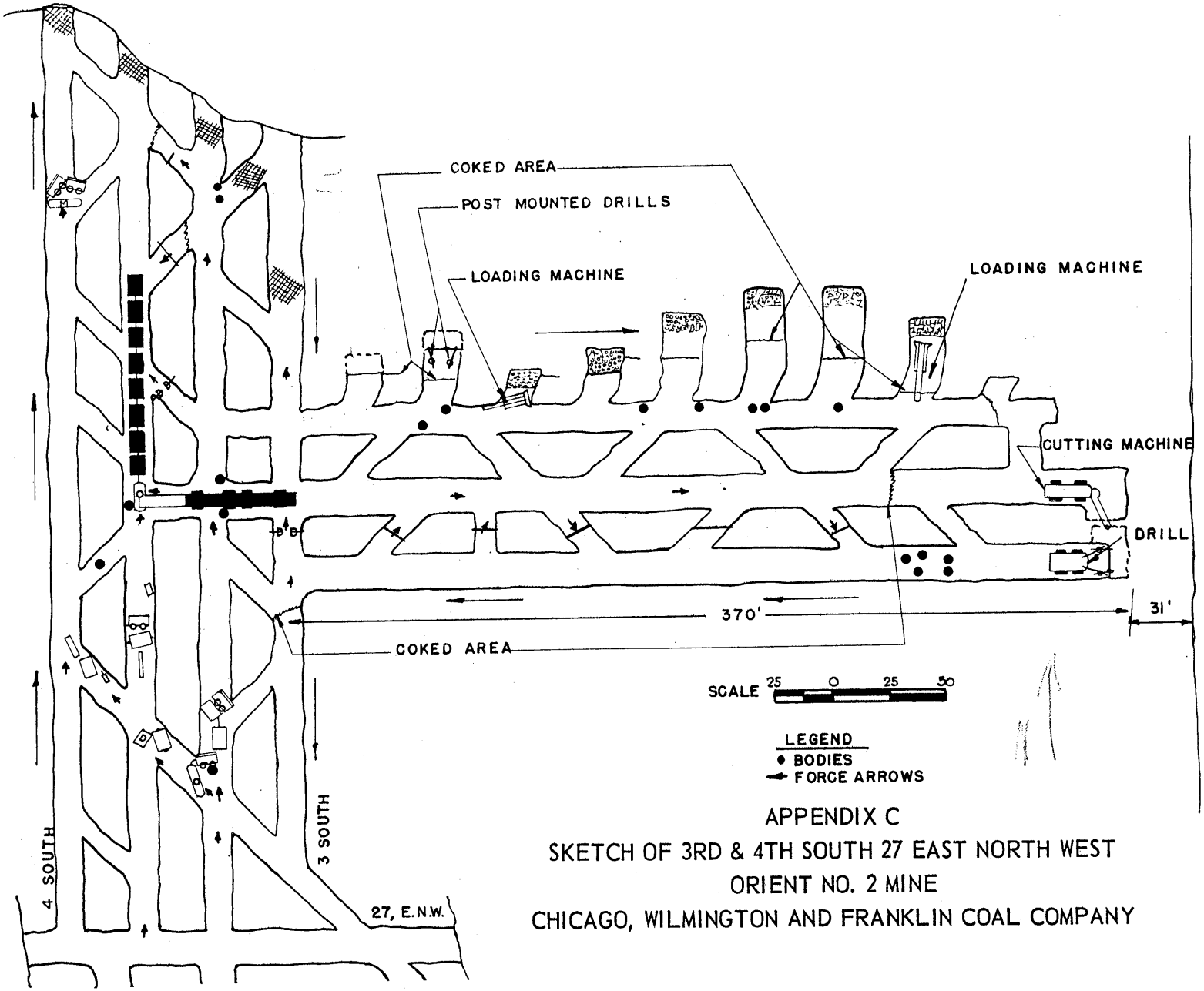


APPENDIX D

SKETCH OF ENTRIES CONNECTING NEW AND OLD MAIN NORTH

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

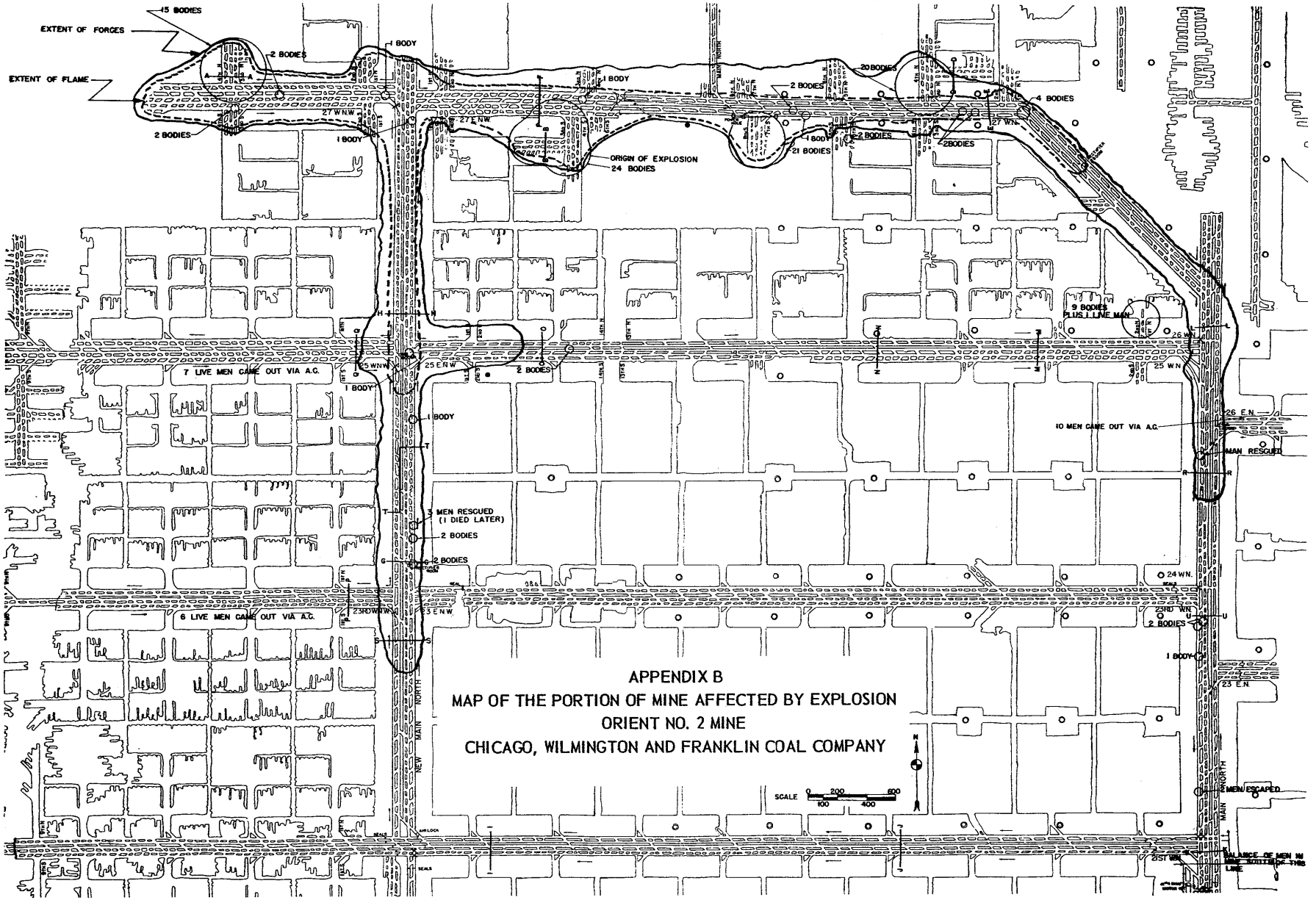


APPENDIX C

SKETCH OF 3RD & 4TH SOUTH 27 EAST NORTH WEST

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY



APPENDIX B

MAP OF THE PORTION OF MINE AFFECTED BY EXPLOSION

ORIENT NO. 2 MINE

CHICAGO, WILMINGTON AND FRANKLIN COAL COMPANY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
REGION VIII

REPORT ON FATAL HAULAGE ACCIDENT
NO. 52 MINE
CLINCHFIELD COAL CORPORATION
DANTE, RUSSELL COUNTY, VIRGINIA

December 21, 1951

By

Harold Wiley
Coal-Mine Inspector

Originating Office - Bureau of Mines
Federal Building, Norton, Virginia
J. B. Benson, Chief, Norton Branch
Accident Prevention and Health Division

REPORT ON FATAL HAULAGE ACCIDENT
NO. 52 MINE
CLINCHFIELD COAL CORPORATION
DANTE, RUSSELL COUNTY, VIRGINIA

December 21, 1951

By

Harold Wiley
Coal-Mine Inspector

Introduction

Charles Bartee, employed as a helper on a mining machine in the No. 52 mine of the Clinchfield Coal Corporation, died instantly of a broken neck when his head struck a crossbar while he was riding on the cutter bar of a mining machine. The accident occurred at 5:10 p.m. December 21, 1951, and Mr. J. B. Benson, Chief, Norton Branch, was notified of the accident at 9:15 a.m., December 22, 1951, by a company official, and the investigation was made the same day.

Bartee was 53 years old; had 17 years mining experience, all of which was at the No. 52 mine, and had been employed as a helper on a mining machine for the past 15 years. He is survived by his wife and a married daughter.

General Information

The No. 52 mine is at Dante, Virginia, and is served by the Clinchfield Railroad. The mine is opened by drifts in the lower Banner coal bed, which averages 44 inches in thickness in this mine. At the time of the investigation 143 men were employed, of whom 13 worked on the surface and 130 worked underground on 2 shifts. The average daily production was 750 tons of coal, all loaded by hand into mine cars. The mine was developed by a room-and pillar method. Main and room entries were driven in pairs or sets of three, and room entries were turned at intervals of 300 feet. Entries were driven 16 feet wide and rooms 20 to 26 feet wide. Crosscuts were about 80 feet apart. Electric face equipment consisted of shortwall mining machines, hand-held drills, and cable-reel locomotives.

Generally, the immediate roof was fragile shale that required extensive timbering. Timbers with cap pieces were set on each side of the track. Crossbars were set where necessary.

The rolling stock was maintained in fair-to-good condition; the haulage tracks were poorly alined; many high-low joints and loose splice bars were present; and the roadways were covered with considerable spilled coal and refuse. The clearance space at and near the scene of the accident was obstructed by loose coal, rock and refuse.

Electric power, 250 volts direct current, was used underground. The electric face equipment was of the open type, maintained in good operating condition. Trailing cables were of fire-resistive construction and, except on the locomotives, were protected against excessive overload.

Information for this report was obtained by an investigation at the scene and from Leroy Herndon, an eyewitness to the accident.

The investigating committee consisted of:

A. B. Smith	Superintendent	Clinchfield Coal Corporation
Troy Sutherland	Safety Director	Clinchfield Coal Corporation
W. D. Richmond	Personnel Training Supervisor	Clinchfield Coal Corporation
Leroy Herndon	Mining Machine Operator	Clinchfield Coal Corporation
W. R. Stewart	Coal-Mine Inspector	United States Bureau of Mines
Harold Wiley	Coal-Mine Inspector	United States Bureau of Mines

Description of Accident

The accident occurred on 9 right haulageway off 15 right at a location about 10 feet inby the No. 4 room track switch frog. Leroy Herndon, mining machine operator, and his helper, Charles Bartee started to work at 2:30 p.m., and had completed cutting seven places. Herndon trammed the machine out of No. 4 room and as he cleared the switch Bartee, who was riding the cutter bar, got off the machine and threw the switch. Bartee then got back on the cutter bar and Herndon started tramming the machine along the 9 right entry toward No. 5 room. Herndon stated that when he reached a point about 10 feet inby the track switch frog that he noticed Bartee reach down and pick up a lump of coal from the left side of the track; and as he raised up, his head struck a crossbar. Bartee groaned once and fell off the cutter bar into the clear on the left side of the track. When Bartee's head struck the crossbar, Herndon shut the power off the machine immediately and it stopped within a few feet. Herndon called for help and Hale Castle and Sam Hulsey, who were standing at the mouth of No. 3 room, responded quickly. Bartee was apparently dead when the men reached him. He was taken to the surface, placed in an ambulance and taken to the hospital. He was pronounced dead on arrival at the hospital by Dr. James Foster. The crossbar which the victim struck was 35-1/2 inches above the top of the rail and the three other crossbars in the area were each 36 inches above the top of the rail. There were no marks on the deceased, and an examination of his safety-type cap disclosed no evidence of damage.

Conclusions

This accident resulted from a violation of a basic rule of safety; that is, riding on the cutter bar of a mining machine. This has long been recognized as a hazardous practice and should be prohibited.

The shock of the blow that broke the victim's neck apparently had little force, but it was probably aggravated by the twisted position of the victim's head and off-balanced position of his body while trying to retrieve a lump of coal from the side of the track.

Recommendations

Compliance with the following recommendations may prevent similar accidents in the future.

1. No person should be permitted to ride on the cutter bars of mining machines.

2. When men are operating moving machinery along haulageways and an area of reduced horizontal or vertical clearance is encountered, additional precautions and attentiveness is indicated; such conditions should occupy the full attention of those operating or working around such moving equipment until such danger areas are passed.

3. Haulage roads should be kept free of coal spillage and debris.

4. Clearance should not be obstructed by loose rock or coal, supplies, or other materials.

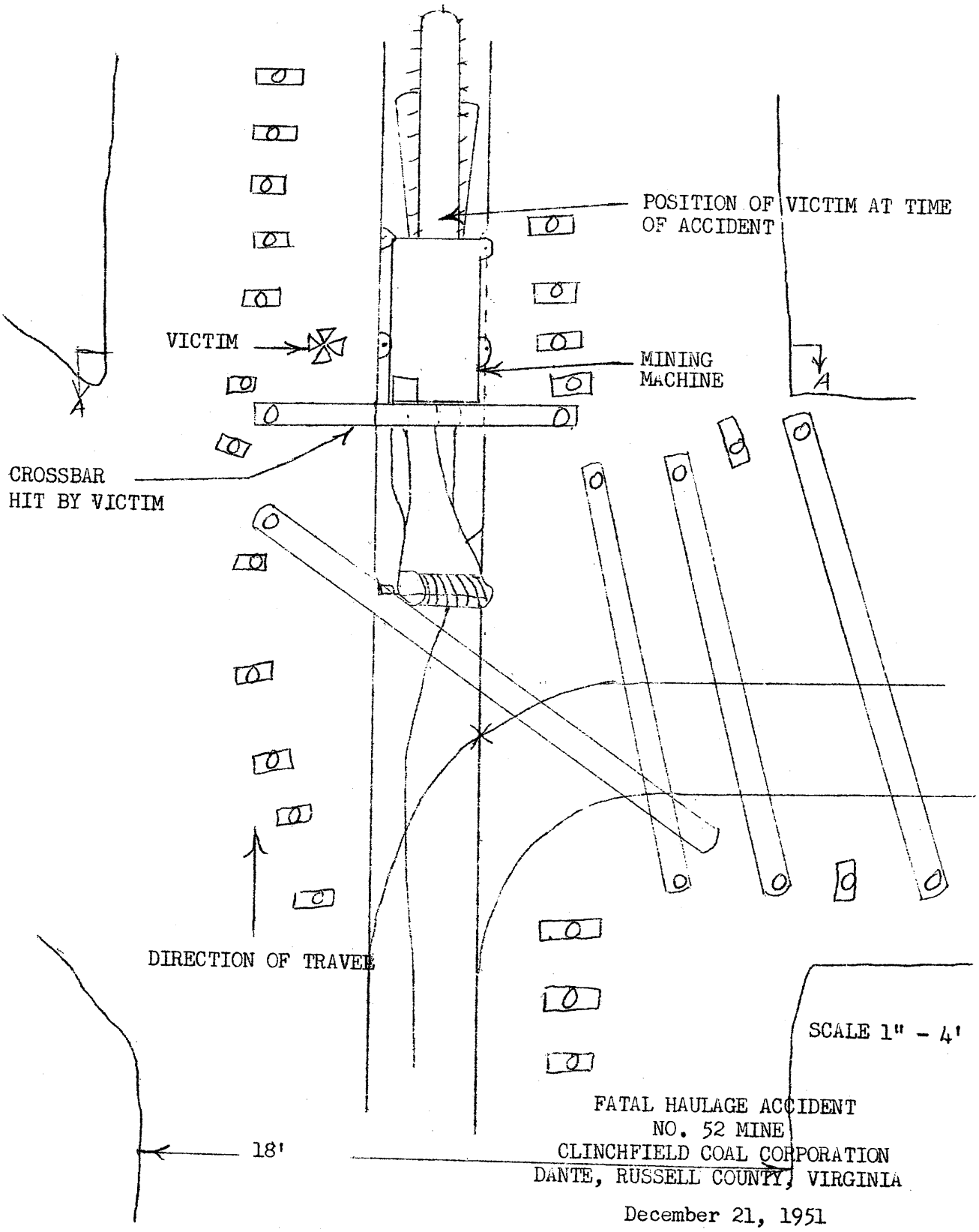
ACKNOWLEDGMENT

The cooperation of officials and employees during this investigation is gratefully acknowledged.

Respectfully submitted,

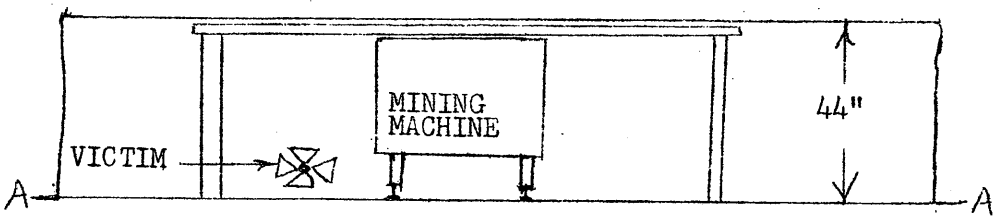
/s/ Harold Wiley

Harold Wiley
Coal-Mine Inspector



FATAL HAULAGE ACCIDENT
NO. 52 MINE
CLINCHFIELD COAL CORPORATION
DANTE, RUSSELL COUNTY, VIRGINIA

December 21, 1951



Correspondence

Dated

02/08/1952 - 02/15/1952

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

FEDERAL BUILDING
BARBOURVILLE, KENTUCKY

Region VIII

February 8, 1952

Through: J. B. Benson

Mr. J. J. Forbes, Director
U. S. Bureau of Mines
Washington 25, D. C.

Dear Mr. Forbes:

The personnel of the Barbourville Section met in Barbourville, Kentucky, on February 4, 1952, and discussed in detail the report on the Orient No. 2 disaster. The attendance of five inspectors at the meeting of the Kentucky Mine Rescue Association, Post No. 2, at Harlan, Kentucky, where Mr. Westfield spoke on this disaster, gave them detailed information of conditions at the mine.

All at the conference, as well as numerous coal company officials in Eastern Kentucky who have had an opportunity to read the report, commented on how well the report was written, particularly with reference to covering conditions at the mine, recovery operations, and recommendations to prevent a similar occurrence. As would be expected from a group of men from Eastern United States, the methods of ventilating the Orient No. 2 mine caused considerable discussion, most of which was unfavorable. However, the greater part of our time in the meeting was spent on having each man express his opinion concerning the recommendations in the report and how the recommendations might be used to cover conditions in inspection work in this area.

The one item in the report that caused more comment, some rather heated, than anything else was the definition of "pure intake air". The possible definitions of abandoned areas and worked-out areas also were discussed at great length; numerous specific conditions in mines in the area were mentioned and questions raised of whether or not the specific area or condition should be considered active, worked-out, or abandoned workings. The afore-mentioned comments were made generally with reference to the Nos. 2 and 5 recommendations in the Orient No. 2 report.

During the conference, we concluded that this disaster proved definitely that our Barbourville methods of inspecting and reporting conditions were not entirely adequate and should be revised to some extent. We have been reporting conditions and practices covered by provisions of the Federal Mine Safety Code well, but we have not used Part II of the report to any large extent. However, comments and discussions during the conference indicated we have found during inspections of mines in this area numerous conditions and hazards somewhat similar to those present in the Orient No. 2 mine before the explosion.

Our past nonreporting of such conditions and hazards has been caused by different opinions of inspectors, interpretations of Code and Noncode provisions, and lack of positive defining of many items, such as intake air, active workings, abandoned workings, excessive dust accumulations, etcetera. During the conference, one of the inspectors stated that we should have an official interpretation of controversial items, such as those listed above. We believe such a list of interpretations would be helpful to all Bureau of Mines employees and possibly to the industry.

One additional important factor that has caused nonuse of Part II of our inspection reports has been the small amounts of methane that has been found in the mines in Eastern Kentucky. Five of the ten inspectors from this office have not detected methane with a flame safety lamp in an Eastern Kentucky mine, and more than 0.25 percent methane has been shown in only one or two air samples collected in many gassy mines in the area.

We believe that most of the recommendations listed in the Orient No. 2 report may be applied to cover similar conditions in mines in this area. We are of the opinion that recommendations such as Nos. 1, 2, 3, 4, 6, 9, 10, 11, 13, 14, 15, and 20 in the Orient No. 2 report may be used to better advantage in Part II of our inspection reports; recommendations similar to Nos. 5, 7, 8, 12, 16, 17, 18, and 19 may be covered by Code provisions.

Sincerely yours,

W. R. Park

W. R. Park, Chief
Barbourville Section
Accident Prevention
and Health Division

cc: W. J. Fene
M. J. Ankeny
James Westfield
J. S. Benson
Files

REGION VIII

JSN/mcs
February 15, 1952

Mr. J. J. Forbes
U. S. Bureau of Mines
Washington 25, D. C.

Dear Mr. Forbes:

A meeting of all inspectors working out of the Norton office was held in Norton, Virginia, on February 1, 1952, and the report on the Orient No. 2 disaster was discussed in detail. As Mr. Benson has been busy in Lexington, Kentucky the past few weeks, I have been requested to submit a report on the meeting to you. Ten of the men had heard Mr. Westfield give a clear and concise discussion of the disaster in Harlan, Kentucky on January 19, and were, therefore, familiar with the report and conditions following the explosion. We had in the Norton meeting, Mr. H. C. Brumbaugh, who had inspected the Orient No. 2 mine several times, to explain to us clearly the method of mining followed, and the system of ventilation employed in the mine. Mr. Brumbaugh also explained the term "old ends" as used in the report.

The inspectors commented favorably on the completeness and thoroughness of the report which explained the conditions in the mine, the recovery operations, summary of evidence, and recommendations. All of the inspectors working out of the Norton office have gained their mining experience in the eastern coal mining states, and they were rather critical of the system of ventilation used in the Orient No. 2 mine. Criticism of the mine was kept at a minimum, as the intention of the meeting was to discuss the recommendations and how they would apply to mines in this district.

A subject that created considerable discussion and comment was that which pertained to air being used to ventilate pillar lines or abandoned workings, and being reused to ventilate active workings. This was of particular interest and concern relative to some of the mines in this area as some of the air passing through pillar lines is coursed through nearby rooms that are in the process of development. It was agreed that such a condition should be cited as a violation. Another item that raised considerable comment was the sealing or ventilating of abandoned areas, and the need of a clear-cut definition of "abandoned areas."

cc: Mr. Fene
Mr. Ankeny
Mr. Westfield
Mr. Benson
Files

Recommendation No. 7 in the report was considered a very good recommendation for gassy mines, and that tests for gas should be made before any electric equipment is taken into the last open crosscut. This recommendation, as well as a recommendation that drillers and other personnel operating electric equipment should use permissible flame safety lamps, could be placed in part II of an inspection report.

From discussion during the conference, some of the inspectors indicated that they have found conditions, especially dust, somewhat similar to those present in the Orient No. 2 mine.

We have not taken full advantage of reporting hazards in part II of an inspection report, largely because of differences of opinion and interpretation by individual inspectors. Some items on which there is a need for clear-cut definitions are: excessive dust in suspension; excessive dust accumulations, acting workings, abandoned workings, and intake air. These items are controversial and could be reinterpreted at this time.

The majority of the mines in eastern Kentucky and Virginia are nongassy, and some are classed gassy on the basis of a sample containing 0.25 percent methane. This no doubt accounts for a large extent of our not taking advantage of part II in the coal-mine inspection reports.

It was felt that many of the recommendations listed in the Orient No. 2 report could be applied to cover similar conditions in mines in this district. Recommendations similar to Nos. 1-4, parts of 6 and 7, 10, 11, 13, 14, 15, and 20 in the Orient No. 2 report could be used in part II of an inspection report. The other recommendations could be covered by Code provisions.

On January 17, 1952 Mr. Westfield sent out a helpful memorandum containing preliminary instructions on recommendations made in the Orient No. 2 disaster report to be used in coal-mine inspection reports. We hope that detailed information will be submitted so that our inspectors may make the type of inspections and prepare the kind of reports that you desire.

Sincerely yours,

Joseph S. Malesky for
J. E. Benson, Chief
Norton Branch
Accident Prevention
and Health Division