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James Boyd, Director

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MAJOR DISASTERS AT METAL AND NONMETAL MINES AND QUARRIES IN THE UNITED STATES (EXCLUDING COAL MINES)

BY

John Hyvarinen, Leland H. Johnson,
and D. O. Kennedy

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1/ Work on manuscript completed July 1, 1948. The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7493.

2/ Electrical Engineer, Bureau of Mines, Health and Safety Division, Safety Branch, Salt Lake City, Utah.

3/ Mining Engineer, Bureau of Mines, Health and Safety Division, Safety Branch, Salt Lake City, Utah.

4/ Mining Engineer, Bureau of Mines, Health and Safety Division, Washington, D.C.

SUMMARY

A chronological list of accidents at metal and nonmetal mines and quarries (excluding coal mines) in the United States in which five or more lives were lost has been compiled. Many accidents were described in more detail because of their unusual features. Tables have been included to indicate the number of major disasters and fatalities by the principal product mined, by State, and by 10-year intervals prior to 1945. The number of men employed to indicate man-hours exposed is unavailable; therefore, a true picture of disaster data by principal product mined, by State, and by 10-year intervals is not possible. However, the data are presented to indicate the causes of major accidents and bring to the attention of those affiliated with metal and nonmetal mines and quarries the hazards involved and lessons that can be practiced to keep such accidents at a minimum.

INTRODUCTION

The Bureau of Mines was requested to compile a chronological list of accidents at metal and nonmetal mines and quarries (excluding coal mines) in the United States in which five or more lives were lost. Data have been assembled on accidents from all causes in these mines and quarries from the earliest available information (describing an underground mine fire in Nevada in 1869) to the last reported major accident (a fire at a company-owned bunkhouse in Arizona in 1945).

The accounts of the accidents were taken from articles in the technical press and from published and unpublished reports of the Bureau of Mines. Many of the accidents have been selected for more detailed descriptions because of the unique circumstances and to show the variety of dangers involved.

Tables are included to indicate the number of major accidents, with resultant fatalities, by the principal metal and nonmetal producing groups, by State, and by 10-year intervals previous to 1945. The interval 1869-1875 does not cover a 10-year span because of incomplete records previous to 1869.

ACKNOWLEDGMENTS

The information contained in this report was obtained from the Engineering and Mining Journal from 1874 to 1947, the Mining and Scientific Press from 1908 through 1922, from various published and unpublished reports of the Bureau of Mines and from reports by State departments of mines. Daniel Harrington, retired chief of the Health and Safety Division; E. H. Denny, supervising engineer, District H; R. M. Loucks, mining engineer; and other engineers of the Division contributed much valuable information and assisted materially in the study.

Bull-Domingo Mine
Silver Cliffs, Colorado
November 13, 1885 — 10 Killed (2)[5/]

The explosion of a box of powder in the boiler room of the mine at 7 p.m. set fire to the building, and in a few minutes the entire shaft house and hoisting works were burned to the ground. Ten men working in the lower levels were killed.

Silver Bow No. 2 Mine
Butte & Boston Mining Co.
Butte, Montana
April 21, 1893 — 9 Killed (2)

As a result of a fire in the mine, nine men lost their lives. The fire was extinguished early on the morning of April 22, after 800 gallons of water a minute had been poured into the mine, which filled with water to the 600-foot level. The bodies of the victims were found on the 400-foot level, showing that the men had climbed to that level from the place where the fire originated and were suffocated by the smoke.

Mansfield Mine
Crystal Falls, Michigan
September 28, 1893 — 28 Killed (24)

Workings of the Mansfield mine were raised so high in following a rich vein of ore under the bed of a river that the river broke through, filling the entire mine in less than 5 minutes. Twenty-eight miners were trapped and drowned. In 1896, the river was diverted around the area, and the mine was reopened. Only two bodies were recovered, as no attempt was made to reenter some of the old slopes. The cause of this accident was given as neglect to take necessary precautions.

Old Abe Mine
White Oaks, New Mexico
March 10, 1895 — 8 Killed (2)

The shaft house of the mine caught fire, and in a few minutes the flames reached the shaft, which was completely destroyed. Nine men were in the mine at the time, but only one of them escaped.

Smuggler-Union Mine
Pandora, Colorado
November 20, 1901 — 31 Killed (2)

At 7:30 o'clock in the morning, a fire was caused by a defective flue in the tramway bunkhouse at the mouth of the Bullion tunnel, the principal opening from which the property is worked. The boiler and engine house, the blacksmith shop, the tramway terminal with its great ore bins, and several other small buildings were rapidly enveloped in flames.

The tunnel doors were closed but later were opened by men coming out, and the strong draft carried the smoke and gases into the mine.

The bodies of 31 victims were found lying where they had been overcome by the smoke while trying to escape.

Koarsarge Mine
Alder Mining Co.
Virginia City, Montana
November 6, 1903 — 9 Killed (2)

A fire in this gold mine killed 9 men, among them Superintendent R. B. Turner, of Butte. About 5 o'clock in the morning, fire was discovered in the tunnel house on tunnel No. 1, and the timbers in the tunnel were ablaze. How the fire originated is not known. At the first alarm the 170 employees hastened to extinguish the flames; Superintendent Turner entered the tunnel through the fire and smoke to warn the entombed miners and to aid them to escape. He returned and tried to enter the mine by the air shaft but fell from the ladder and was killed.

Cora Mine
Montana Ore Purchasing Co.
Butte, Montana
May 12, 1905 — 7 Killed (2)

Seven men were killed at this mine in an explosion. It was reported that one of them was handling explosives in the magazine on the 1,500-foot level, when grease from the candle in his cap dropped into a box of explosives at his feet, causing it and three other boxes to explode.

Fremont Consolidated Gold Mine
Drytown, California
November 30, 1907 — 11 Killed (2)

A fire that occurred in this mine resulted in the death of 11 miners. They were lowered onto the shaft after the noon hour, but no one was aware of the fire. The skip jammed in the shaft, and only 2 of the 13 men in the skip escaped.

[5/] Numbers in parenthesis refer to references at the end of this circular.

Alaska-Mexican Mine
Treadwell, Alaska
March 2, 1910 — 37 Killed (5)

At 11:30 p.m. the powder magazine on the 1,100-foot level of the Mexican mine exploded, killing 37 men and injuring 9. The magazine, containing a day's supply of 20 to 30 boxes, was a chamber cut in the rock and closed in front by boards; it was 25 to 50 feet from the shaft and separated from it by a pillar. Light was furnished by a 16-candlepower lamp a short distance inside the door. There was no wiring over the stored powder. The explosives had been thawed before delivery, therefore, no heat for thawing was introduced into the mine.

The explosion occurred just as the night shift workmen were waiting to go to the surface to eat. The men on the 990-foot station reported two explosions. The first extinguished their candles, but was of no great violence. As the men relit their candles before proceeding to another shaft, a second explosion of greater violence knocked them over, seriously injuring one and slightly injuring three. Men loading the skips only 45 feet below the 1,100-foot level, were uninjured, as were those on the 1,200-foot and 1,300-foot stations. The posts on the 1,100-foot station were knocked out and, with the lagging and other timbers, formed a mass of debris that closed the shaft. From the debris, 22 bodies were recovered; 5 injured also were rescued. The doors across the skip compartments were closed, as ore was being hoisted from the level; one body was found on these doors. The mancage compartment was open, and eight bodies were recovered from below in this compartment. The light board shed used for a stable was entirely demolished; two bodies were found there; one of the two horses was killed, and the other was injured. This stable was about 100 feet from the shaft, down the main drift. Two bodies were found along the drift, and the fragments of at least one body were found in the magazine itself. As is usually the case with an explosives accident, the cause could not be determined. As is always frequently the case, no great damage was done to the mine. A rescue party reached the scene within 35 minutes after the explosion, and the cage was in operation in about 11 hours. The position of the magazine near the shaft, but beyond it, considered in reference to the main drift precluded the possibility of any man being cut off from escape in case of accident, and also aided in the rapid dissipation of the gas; no one was asphyxiated.

Richard Mine
Thomas Iron Co.
Dover, New Jersey
June 7, 1910 — 5 Killed (2)

The No. 6 slope or shaft of this mine is carried down on the deposit at an average dip of about 52 degrees. Men were hoisted from this shaft by means of the ore core or skip and were required to ride in the bottom of the conveyance. Five men violated this rule, rode on the bail, and were killed. At a point about 100 feet below the surface, the angle of the shaft changes sharply, and in passing this point the weight of the five men on the bail upset the conveyance, all five being spilled down the shaft and killed.

Keating Gold Mine
Keating Gold Mining Co.
Radersburg, Montana
January 18, 1911 — 6 Killed (5)

Six men died of asphyxiation as a result of the detonation underground of approximately 600 pounds of 40-percent dynamite. The exact cause of the detonation was undetermined. However, two factors presented possibilities: (1) It was the practice to leave explosives at the 200-foot level station. Men were working in the inclined shaft above the station at the time of the explosion and could have caused the detonation of the explosives by dropping some tools or by loosening rock, which subsequently fell on the explosives. There was evidence that explosives had been at this station just prior to the explosion. (2) Explosives were often stored in a thawer magazine (80 feet south of the 200-foot level station) to be thawed before they were sent to the working faces. Although the thawing device had been used for some time, it was so constructed that if the explosives had been placed too close to the heating element, the temperature might have become high enough to detonate them.

Belmont Mine
Tonopah, Nevada
February 23, 1911 — 17 Killed (5)

In a fire at this mine, 17 men lost their lives. The fire should not have been a serious one; little damage to the mine resulted. It was discovered while it was still small and was attacked for some time at close quarters, yet the unfamiliarity of the men with fire-fighting methods, together with a reversal of the air currents, permitted an insignificant blaze to develop into an appalling disaster.

The Belmont mine had two shafts – the Belmont, normally upcast, and the Desert Queen, normally downcast. Smoke was first noted by the cager about 5:50 a.m. An hour or two of searching was required before the fire was discovered at the bottom of a winze on an intermediate level, which did not open into either shaft; communication was by means of the winze and two raises to the level above. The fire was burning some mine timber that had been piled at the winze bottom for distribution in the stopes. It seems reasonably sure that the fire was caused by a lighted candle or a snuff left in the timber by a man of the night shift, which had quit work at 3:30 a.m. It was decided to build a brattice in the drift and close the winze above the fire. Up to this time, dense smoke was present in only a few parts of the mine, and although the smoke issuing from the Belmont shaft prevented the descent of the men, many of them, including the timberman, entered the mine through the Desert Queen shaft. When the fire was discovered, men were detailed to withdrew everyone from the mine except those fighting the fire. The men were scattered and did not obey orders promptly; so when the disaster occurred, a good many men were underground in various parts of the mine. It is uncertain as to exactly what happened, but apparently some reversal of the air currents forced the smoke into parts of the mine that had previously been safe. The men who died were trapped at different points, several in the shaft stations, whither they had crawled but from which they were unable to signal. According to one report, four men were overcome and fell off the cage while being hoisted. The fire was put out that same night by an organized party, and the bodies of the men were recovered the next morning.

Norman Mine
Oliver Iron Mining Co.
Virginia, Minnesota
March 11, 1911 — 14 Killed (5)

A number of men were engaged in raising and lining up the track in the approach to the large open pit when a landslide of a great quantity of ore from the north side occurred so suddenly that the men had no time to escape, and 14 were caught and killed. A the place where the accident occurred the pit was 358 feet wide from crest to crest of the ore body and 51 feet wide at the bottom; its depth was 205 feet. The bank thus had some slope, but the dip of the ore was toward the south, providing greater opportunity for sliding. It is assumed that the bank had been loosened by alternate thawing and freezing. It appears that the men had no idea that the place was dangerous, because it was used as a place of refuge when blasting was being done.

Hartford Mine
Republic Iron & Steel Co.
Negaunee, Michigan
May 5, 1911 — 7 Killed (5)

A fire was discovered in shaft No. 2 by the electrician and pumpman, who saw a burning brand drop down the shaft. It had originated in the shaft at or near the 4th level. Seventy-four men were in the mine at the time; 50 escaped unassisted by climbing to the Cambria Mine; 18 were hoisted out through shaft No. 1, and 6 were trapped in the mine.

Within 1 hour after the discovery of the fire, an attempt was made to begin rescue operations without the aid of breathing apparatus. Three bodies were discovered. However, because of the reversal of the air current while erecting a stopping, the smoke became so dense that the shift boss ordered the men to return to the surface. One man attempted to remain and finish the stopping but was overcome. It was several hours before rescuers reached him, but he was dead. Three of the others attempted to go out to the Cambria shaft but were overcome and were revived with great difficulty. After several hours, the remaining three bodies were recovered in apparently good air by men without respiratory protection; they were accompanied by others wearing oxygen breathing apparatus. After removal of all the bodies, water was turned into the No. 2 shaft and the fire was extinguished quickly. It was definitely determined that the reversal of the air had caused the loss of several lives, if not all. The cause of origin of the fire was not determined, but three possibilities were considered – electric wires, candle snuff, or incendiarism.

Giroux Mine
Giroux Consolidated Mines Co.
Ely, Nevada
August 23, 1911 — 7 Killed (5)

A fire in the Giroux shaft was disastrous in the loss of life which it caused and unusual in that the seven deaths occurred at widely separated points and at considerable intervals. As is often the case, the cause of

the fire remains unknown. It was at first thought that a dynamite explosion set fire on the timbering, but the fire originated in the station of the 1,000-foot level, where no work was supposed to be in progress. It is believed that the two men passing from the 770-foot level to 1,400-foot level had stopped at the 1,000-foot level and must have left a lighted candle snuff there, and that the flame from it ignited the timbering. The greatest damage occurred at the 1,000-foot level, where the station and most of the ore pocket were destroyed. It extended, however, to the 770-foot and the 1,200-foot levels. The mine was flooded, and the water was not finally removed until February 1912, more than 6 months later.

One of the victims was the cage tender, who attempted to come up the shaft on the cage but fell off 15 feet below the cellar. One man on a cage loaded with the men from the 1,400-foot level was pulled off the cage during hoisting presumably by a manila bell cord. The cord probably had been burned where the fire was hottest and broke when pulled for the hoisting signal, so that it fell down the shaft and entangled the man who was killed. Two men were killed from inhaling gas or flame as they were being pulled through the fire zone on the cage. Finally, three men attempted to climb out on the ladders of the other shaft, the Alpha, and were overcome by gas. It was thought that turning on the sprinkling system may have reversed the air currents and thus driven the products of combustion out through the Alpha shaft. Three other men were burned but recovered.

Fire doors might have proved a means of safety in this case, also. Although the reversal of the air current was not proved, it is possible that the sprinkling water may have caused reversal of air flow.

Butte Superior Mine
Butte, Montana
September 3, 1911 — 6 Killed (5)

It was customary at this mine for the station tender to collect the dull drill steel on the various levels about 15 minutes before the end of the shift and have it hoisted through Black Rock Shaft to the surface in what was called the "drill boat." Only the station tenders were allowed to ride with this steel, but on the night of the accident five men, desirous of getting out early, took the chance of quitting shortly before the end of the shift to ride up with the steel.

The cage started at the 1,300 level, where drill steel was loaded and one victim got on there. At the 1,200 level station two more men got on, and two others at the 900 level. When the cage left the 900 level it contained about 250 pieces of steel in the drill boat and six men, including the cage tender. The cage was so crowded that the station tender, who stayed behind, had trouble in closing the cage gate.

It is not known exactly what happened; either the drill steel got disarranged or, more probably, one of the men got caught by a wall place of the shaft timbering; at any rate, both steel and men were dragged from the upper deck of the cage where they were riding. The hosting engineer felt a slight tremor in the rope and stopped the hoist, which was running slowly because of hoisting drill steel. One of the men was found on the lower deck of the cage and the other five in the shaft sump; all six were dead.

Wharton Mine
Wharton Steel Co.
Hibernia, New Jersey
October 19, 1911 — 12 Killed (24)

In October 1911, the New Langdon shaft was being sunk and had reached a depth of about 1,500 feet on the variable dip of the ore. At the same time a drift, several levels above the shaft bottom, was being driven to tap some old workings supposed to be about 250 feet from the shaft. Those workings had been abandoned and filled with water, so that their exact extent could not be determined. On October 19, the drift was thought to be over 100 feet from the old workings, but blasting of a round in the face broke through, allowing water to enter and flood the drift and the shaft below its level. Miners working in the drift and adjacent levels escaped, but 12 men in and near the bottom of the shaft were drowned.

No accurate maps of the area were available, and estimates of the distances involved underground were obtained by measurements between surface openings. No test holes were drilled ahead of the drift face, and men were allowed to remain on the lower levels while the drift round was blasted, because it was estimated that the drift still had more than 100 feet to go to the water-filled old workings. After the mine was unwatered, a drift was driven safely on a lower level to tap the flooded workings. Test holes were kept ahead, and the unwatering was done through boreholes.

Norrie Mine
Oliver Iron Mining Co.
May 13, 1912 — 7 Killed (5)

A party of 10 miners and 3 trammers on the night shift was walking home from the boundary of the property above the twentieth level of the mine. Hearing ground dropping, they retreated to what they thought was a safe place, the main drift, which was securely timbered and had 35 to 40 feet of solid ore above it. The cave, however, did not occur at the place where the men had been working, but in the very place of refuse to which they had retreated, crushing in the drift timbers over a length of about 80 feet. Six men were rescued alive after about 24 hours, but one died about a week later.

Eureka Pit
Nevada Consolidated Copper Co.
Ely, Nevada
July 7, 1912 — 10 Killed (5)

While loading a surface drill hole, 10 men were killed by a premature explosion. The cause was not determined, because all evidence was destroyed by the explosion. The known facts were as follows: A group of men were engaged in charging the hole, which was in the capping on what was called the Berry High Line level. Holes of this type held a relatively large quantity of powder and were usually loaded by five or six men, who dropped the powder into the hole. In this case, Trojan powder had been first charged, and there remained, it is believed, five boxes of Hercules Special reported to contain 20 percent nitroglycerin and 20 percent ammonium nitrate. Two boxes were unexploded. The reason for believing that three boxes exploded is that three craters were blown out in the ground; but it might have happened that the boxes were piled one on another, in which case each crater would represent more than one box. What actually caused the dynamite to explode remained unknown.

Miami Mine
Miami Copper Co.
Miami, Arizona
April 17, 1913 — 5 Killed (5)

The combination method of mining in this mine involved the caving of the capping. The capping over what was known as the northwest ore body, which was about ready for caving, had given warning on April 16 that a collapse was imminent by the increased amount of cracking and slabbing off of ground. For this reason the men were kept out of that part of the mine which was expected to be affected by caving. When the fall came on the following day, a tremendous compressive force was exerted throughout the mine workings. It was estimated that 3,500,000 cubic feet of air was displaced. The air pressure was irresistible; men and equipment were thrown about, and in the open workings, where the rush of air was greatest, the effect was especially disastrous. Five men were killed and 16 were injured, but nobody was caught directly under the cave.

Leonard Mine
Butte, Montana
April 23, 1913 — 5 Killed (5)

The engineer started to lower the east cage from the surface to the 60-foot level using the hoisting-engine brake with the reel unclutched; it is believed that the rod connecting the steam brake-operating device with the controlling lever broke, and the brake failed to grip. The loose reel gained such speed that when the engineer attempted to stop it by throwing in the clutch, the latter broke, and the reel continued to accelerate until it burst. Flying pieces broke the connections on the west brake, and the west cage at the 1,400-foot level began to drop just as the east cage crashed past. Four men on the east cage were killed instantly when the cage hit the shaft bulkhead at the 2,200-foot level. The bursting reel wrecked the hoist room, and one man at the surface was killed by flying fragments. Eight men on the west cage were injured seriously, but, remarkably enough, none were killed.

Balkan Mine
Verona Mining Co.
Palatka, Michigan
July 14, 1914 — 7 Killed (2)

The system of mining was to remove all overburden down to the ore, sink a shaft outside the stripped area, and extend drifts and crosscuts under the ore body. Raises were then put up through the ore. The surface had been removed to a depth of 20 feet, and No. 3 raise in No. 3 crosscut was up 23 feet within 2 feet of the end of the ore. Approximately 3 hours after two 10-inch holes had been blasted in No. 3 raise, a rush of sand and water occurred, flooding the mine and drowning seven men. Five escaped unharmed.

Granite Mountain Shaft
North Butte Mining Co.
Butte, Montana
October 19, 1915 — 16 Killed (1 and 9)

Thirteen boxes of 40-percent gelatin dynamite exploded at the collar of the Granite Mountain shaft. Fourteen miners were killed instantly; two were fatally injured, dying within a few hours, and three others were more or less seriously injured.

The dynamite was loaded in a steel mine car preparatory to being lowered into the mine. The car was standing on the gallows-frame turnsheet, approximately 20 feet northwest of the collar of the shaft. Although the cause of the detonation of the explosives is unknown, one supposition is that it was caused by a rifle bullet.

Pennsylvania Mine
Anaconda Copper Mining Co.
Butte, Montana
February 14, 1916 — 21 Killed (2)

A fire was discovered between the 800- and 1,400-foot levels in the vicinity of the downcast air shaft of the Pennsylvania Mine on February 14, 1916. The alarm was given, and it is thought that all of the 220 men in the mine, except possibly those working on the 300-foot level, were warned. Cages were substituted for the main-shaft ore skips, and approximately 195 men were hoisted to the surface in less than 45 minutes after the discovery of the fire. Six men escaped through the 1,000-foot level to the Tramway mine. Subsequently, two men lost their lives while wearing Draeger apparatus during rescue and recovery work. It is thought that 19 men who were unable to escape died from suffocation.

North Star Mine
Federal Mining & Smelting Co.
near Hailey, Idaho
February 25, 1917 — 16 Killed (2)

A snowslide at the north star mine, 12 miles northeast of Hailey, struck the compressor house and bunkhouse and killed 16 men.

Mountain King Mine
Mountain King Mining Co.
Mariposa County, California
April 28, 1917 — 7 Killed (22 and 25)

On the day of the accident, the electric power plant was shut down, and, as a result, there was no compressed air for ventilation. However, the superintendent gave the foreman permission to do repair work on the 1,200-foot level, but it was agreed by both that no work could be done on the 1,400-foot level because of powder smoke and lack of natural ventilation at that depth.

When the shift entered the mine, two men obtained permission from the mine foreman to investigate the results of blasting on the 1,400-foot level. When they did not return, the foreman went to investigate, returned, and with two others climbed down to the 1,400-foot level, where all three were overcome. Before proper supervision could be obtained and rescue work begun, three others had attempted to help by going to the 1,400 foot level (all at different times). Only one was able to return to safety. Seven men lost their lives from asphyxiation.

Granite Mountain Mine
North Butte Mining Co.
Butte, Montana
June 8, 1917 — 163 Killed (9 and 23)

During the night shift the flame of a carbide lamp accidentally set fire to the uncovered and frayed insulation of an armored power cable near the 2,400-foot level of the Granite Mountain shaft. The highly flammable oiled fabric set fire to the shaft timbers, and inasmuch as this was a downcast shaft, the fire spread rapidly and soon filled the mine workings with smoke and gas. At the time, 410 men were working underground, 247 of whom escaped by various means, but most of the 163 remaining probably were overcome soon after the fire began and perished. Only two men actually were burned. The immediate effect of the fire was the reversal of air currents in the shaft; the ultimate effect was great loss of life and the destruction of the main hoisting shaft, putting it temporarily out of service. The work of rescue and fire fighting continued 8 days.

Quarry of Three Forks
Portland Cement Co.
Trident, Montana
July 17, 1917 — 8 Killed (22)

An accidental explosion of 41 kegs of black blasting powder occurred on the track bench at the quarry. One man was killed instantly, and seven others died from severe burns.

The men were opening kegs of black blasting powder (supposedly with sharpened wooden pick handles and a machinist's hammer) and emptying the contents into cement sacks. The sacks of powder were then carried into a small tunnel, which was being loaded preparatory to blasting the quarry face. No one was able to give any definite reason for the accident, and evidence adduced was not sufficient to determine definitely the cause of the explosion.

Amasa-Porter Mine
Nevada Mining Co.
Crystal Falls, Michigan
February 21, 1918 — 17 Killed (24)

Fearing a cave-in or wash-out from the surface into the stopes on the old first level, concrete bulkheads were constructed on the 200-, 300-, and 400-foot levels.

On February 14, a cave-in through to the surface occurred, following which there were some inrushes of water and air underground. All men except two pump tenders were withdrawn from the mine, and all work was suspended until February 18. During this time pumps were placed in the surface pit or cave to remove water, and the mine was inspected daily, with particular attention to the bulkheads described above.

On February 18, all inrushes of water and air stopped, and the bulkheads were in good condition. Because of these circumstances, and especially as a cave-in had occurred, it was thought safe to resume operations.

On February 21, while lowering the second cageload of men after the dinner hour, there was a rush of water and sand into the shaft from the 200 level, and eventually the mine was flooded to nearly the 400 level. Seventeen men lost their lives, and four escaped, one of whom was found unconscious and was saved by a rescue party. The main hoisting shaft provided the only escapeway from the mine, and it was believed that the entombed men might have survived if another escapeway had been provided. It was the following July before the mine was dewatered and bodies were recovered.

Silver Mine
Virginia, Minnesota
June 27, 1918 — 18 Killed (2)

Thirty-four charges of mixed 40-percent dynamite and black blasting powder had been placed in underground workings to break about 100,000 tons of iron ore from an ore bank in the Silver open pit. The charges, averaging 425 pounds of 40-percent dynamite and 1,102 pounds of black blasting powder, were wired in series and connected to a point of the surface 1,000 feet from the ore bank where it was planned to explode them from a 110-volt circuit the following day. Adequate protection was provided to prevent premature detonation from all sources other than lightning. Forty-six men were in the underground workings, 41 were tamping the charges and generally cleaning up the workings, and 5 were seeking shelter from a storm when lightning struck the face of the ore bank and caused the premature detonation of an estimated 20 out of the 34 charges. Twenty-eight men escaped from the upper levels without assistance, but the remaining 18 were killed.

Jefferson Island Salt Mining Co.'s Shaft
Delcambre, Louisiana
April 15, 1920 — 6 Killed (22)

An explosion of flammable gases given off by asphalt paint, which was being applied to the inside of an unventilated and enclosed shaft (in the process of being sunk), caused the death of six men. The ignition was caused by a lighted match. Tests conducted by the Bureau of Mines proved that gases given off by the paint are highly flammable. Approximately 25 gallons of the paint had been applied to a timber deck in the concrete drop shaft during the morning before the explosion occurred.

Lehigh Portland Cement Co.'s Limestone Quarry
Ormrod, Pennsylvania
April 19, 1920 — 6 Killed (22)

A fatal explosion occurred in a limestone quarry during charging of six 5-5/8-inch churn-drill holes in a single row preparatory to blasting.

A line of Cordeau detonating fuse was placed in hole No. 2, but electric detonators were used in the

hole. After 12 or 13 cases of loose 40-percent nitrostarch powder had been poured into the hole, it was found that a space of 17 feet remained for stemming. It was then decided that space for an additional case of powder might be obtained by tamping the charge. Accordingly, tamping was done with a plunger weighing 30 or 40 pounds, about 3 inches in diameter, and 10 inches long. The plunger was made of lead, with an iron core; it had an iron eye in the top, and a 3/4-inch rope was attached to it. This weight was ordinarily used for sinking explosives in wet holes, but not for tamping. It is estimated that the tamping had continued at least 10 minutes. The quarry superintendent went a considerable distance for a box of powder, returned, and reached a point about 10 feet from the hole when the charge exploded, instantly killing the man who was tamping and injuring the superintendent and the shovel runner, who was also nearby. The flying rock killed five and injured one in another group, who were cleaning holes on the lower edge. The explosion apparently was caused by hard tamping with the heavy metal plunger.

Argonaut Mine
Argonaut Mining Co.
Jackson, Amador County, California
August 27, 1922 — 47 Killed (10 and 23)

A fire discovered at midnight in the main shaft caused the death of 47 miners. Rescue workers recovered 46 of the bodies; the forty-seventh was found a year later under fallen rock. The definite cause of the fire is unknown. Two causes are possible — a short circuit in the 2,300-volt power line in the shaft and incendiarism. Public investigators strongly contended that electricity was the probable cause, but the officials of the Argonaut mine strongly maintained that the origin was incendiary. The Governor's investigating committee confined its investigation to interviewing witnesses. The committee stated that it believed the fire started in the manway; it was unable to arrive at a definite conclusion as to origin but believed the origin to be either incendiarism or defective wiring. Another possible cause of the fire was that a cigarette or match might have been thrown in the hanging-wall sets as the miners were being lowered.

Sloss No. 1 Mine
Sloss Sheffield Steel & Iron Co.
Bessemer, Alabama
July 12, 1923 — 5 Killed (2)

A man-trip carrying 41 men broke loose about 1,400 feet from the slope portal. Five men were killed instantly and 35 were injured.

Milford Mine
Whitmarsh Mining Co.
Crosby, Minnesota
February 5, 1924 — 41 Killed (2)

Water from an adjoining lake entered the workings of the Milford Mine as a result of a cave and entombed 41 men; 7 men barely escaped by climbing the shaft. The mine was completely filled with water in 13 to 15 minutes. The bodies were not recovered until after the mine was dewatered; the last body was recovered on November 4, 1924.

Barnes-Hecker Mine
Cleveland-Cliffs Iron Co.
Ishpeming, Michigan
November 3, 1926 — 51 Killed (24)

The back of one of the stopes in this iron mine caved to the overlying glacial drift material and the mine was filled with water and quicksand. Within approximately 15 minutes of the time that the cave started, all the workings of the mine were completely filled; water rose in the shaft to within 185 feet of the surface, later receding to about the 540-foot level. Of the 52 men in the mine, only one escaped by climbing 800 feet of ladders in the shaft. The stope that caved had been worked by top slicing, starting 220 feet below the top of the ore body. Above this unmined thickness of ore was about 210 feet of glacial surface material, water-soaked and containing small ponds. Although the mine workings were wet when opened, mining operations had drained most of the water from the ore stratum; the stope that caved had become dry enough to permit use of scrapers. The amount of water handled by the mine pumps had dropped from over 3,000 to about 700 gallons per minute.

The only intimation of anything wrong noted by the man who escaped was a rush of air that blew out his light. He was on the second level and rushed to the shaft, calling to others to follow. The rush of water wrecked the shaft manway below the 200-foot level and carried out many of the timbers dividing the

compartments; but the wall and end plates and lagging, which were embedded in concrete, were not disturbed. The sudden flow of water prevented use of prepared bulkheads and water doors, and although emergency escapeways, including a low-level connection to a neighboring mine, were provided, men were engulfed before they could reach safety. Sand came through the connection to the adjoining mine for 3,000 feet, from the connecting raise to a point where the flow gradually decreased to nothing. Very little water came through here. A large depression formed in the overburden above the caved stope; the fine, sandy material was water-soaked, and the banks of the depression at one point reached the edge of a small muskeg swamp. The mine was sealed and was not recovered. Seven bodies were found in the connecting escape drift, and three others were recovered from the shaft when it was cleared to the first level. The conclusion of officials was that the cavity over the stope gradually enlarged as slicing progressed downward; this resulted in a sudden failure of the block of ore that had been left to support the overburden.

Quincy Mine
Quincy Mining Co.
Hancock, Michigan
October 29, 1927 — 7 Killed (2)

Seven men retimbering the No. 2 shaft, which had been damaged by a fire in July 1927, were killed when an air blast caused a fall of rock in the shaft. It is believed that the explosions of rock or air blasts were caused by contraction of the rock, which had been heated and expanded by the fire during the month of July.

Magma Mine
Magma Copper Co.
Superior, Arizona
November 24, 1927 — 7 Killed (23)

A fire in the No. 2 shaft caused the death of 7 men. There were 49 in the mine at the time of the fire. The mine was developed by 5 shafts, of which the No. 2 was 2,700 feet in depth and Nos. 3 and 5 were 2,550 feet. Shafts 2, 3, and 5 are connected on the 2,550-foot and other levels. The No. 2 shaft had three compartments, two for hoisting and one used as a manway; it also contained electric power and light lines.

Ventilation of the Magma Mine at the time of the fire was directed by three surface and three underground fans and various small blowers. A fan that ordinarily exhausted about 95,000 cubic feet per minute from No. 4 shaft had been shut down a few minutes before the fire. Another exhaust fan at No. 1 shaft induced ventilation in the upper levels of the mine. Shafts 2, 3 and 5 were intakes.

About 3:30 a.m. the fire in No. 2 shaft was discovered by the shift boss, who was investigating the continued steady ringing of the electric bells in both hoisting compartments of the shaft. He found smoke at the 1,200-foot level and, by signaling with the pull bell, was returned to the 500 level. The shift boss carried the cage tender, who had been overcome by gas, through the ventilation doors on the 500 level and reported the fire. Shortly afterward, a cage with one man on it was lowered; he died, presumable from burns and suffocation, and the hoisting cable was burned off. The men in the mine smelled smoke, and most of them proceeded to No. 3 shaft, where they were quickly hoisted. Some men came to the 2,200 station and saw the fire roaring up the shaft, but no smoke was coming out into the station. They were unable to attach a hose to the fire connection, because it was at the shaft and in the fire zone.

The fire in the No. 2 shaft was controlled and eventually extinguished by streams of water turned down the shaft from two upper levels.

The No. 2 shaft had been gunited and concreted in part, but from the 1,600 level to the bottom it was timbered without fire protection, except at stations, which were gunited to the 2,000 level. Guniting had been discontinued, because it was thought to promote and conceal timber decay. Gunited station timbering was ignited during the shaft conflagration and continued to burn for days within the concrete shell after the main fire had been extinguished. It was determined that the gunite definitely acted as a fire retardant. It appeared that, even when the fire burned the gunited timbered regions, the process of burning was retarded to such an extent that there was a minimum of caving as compared with the large amount in the ungunited timbered regions.

The fire evidently originated at or near the shaft at the 2,250 station, which was dry and timbered; the shaft timber also was dry. Oily waste at the car-repair station near the shaft ignited by a carbide lamp or a cigarette butt was considered as the probable origin of the fire. Other possible origins of the fire were a trans-

former, a motor-driven fan, and light and power wiring, all at the 2,250 station.

Three days after the fire in No. 2 shaft started, and when it was virtually under control, No. 1 shaft caught fire; however, there was no possibility of fire being transmitted from the No. 2 shaft to the No. 1 shaft. The second fire apparently started from embers dropping down No. 1 shaft from a surface fire built near the shaft by a watchman. It was possible to turn water into the shaft from a surface tank and from the fifth level, so that the second fire was controlled in a few hours.

Calaveras Copper Mine
Copperopolis, California
September 4, 1929 — 5 Killed (22)

A cave on the 1,550 stope resulted in the loss of five lives and serious injury to a sixth miner. The stope had not been worked for approximately 27 months. Normal blasting in adjacent stopes probably loosened the ore and the walls more than would have been the case if water had not been seeping through for so long an idle period. A combination of the two conditions probably reduced the friction between the walls and the ore until the latter dropped.

Glenn Mine
Capital Glenn Mining Co.
Lost Chance, California
July 14, 1930 — 5 Killed (23)

A fire originated in some unknown manner in the wooden surface structures near the portal of the mine at about 10:15 a.m. This mine is an underground placer property operated through adits driven into the hillside to recover the auriferous gravel from an old stream bed. The uppermost adit, the part of the mine then working, had been driven 1,121 feet from the portal and connected with the middle or Moss adit at about 758 feet from the portal by means of an incline dipping about 15 degrees. The Moss adit was part of some old similar workings but was not kept in good condition.

Ventilation was natural; fresh air entered the top adit at a velocity of almost 200 feet per minute, followed down an incline, and left through the Moss adit and its connections.

The surface compressor house and shop building was about 25 feet from the portal of the upper adit, to which it was connected by a snowshed. The snowshed extended to the edge of the dump, connecting with the powder house about 75 feet from the end of this shed.

When the fire started, no one was near the portal of the adit on the surface, and five men were at the faces; these men tried to escape by going down the incline and out the Moss edit but were overcome and died in the attempt.

The fire burned all the structures on the surface near the portal and about 70 feet of timbered adit inside the portal, jumped an untimbered gap of 63 feet, and ignited other timber sets, but because of the wetness of the latter sets, the fire died out when the timber at the portal was consumed.

Mountain City Mine
Mountain City Copper Co.
Mountain City, Nevada
August 13, 1936 — 6 Killed (2 and 22)

The 600-foot level was shut down and had not been ventilated for approximately 2 months prior to the accident; its only connection to the 500-foot level was by the 541 winze. The winze was divided into two compartments – one for hoisting by bucket and the other for a manway – and was equipped with staggered ladders and platforms.

No one was permitted to descend the winze because of dangerous atmospheric conditions on the 600-foot level. Regardless of the danger, two men persuaded a third to lower them in the bucket to the 600-foot level and evidently fell from the bucket before it reached the bottom. The third man evidently realized the seriousness of the situation but gave little or no thought to the atmospheric conditions. He proceeded down the manway until he was overcome and fell to the bottom. A fourth man, in a solitary attempt to rescue the third, was overcome and also fell to within 5 feet of the bottom. All men were wearing electric cap lamps, which gave no warming of oxygen deficiency. When the shift boss and four others arrived at the 514 winze, they attempted to recover the bodies. Two men were lowered slowly in the bucket, having been instructed to light matches to test the atmosphere for oxygen deficiency. Approximately 30 feet below the collar of the winze both men were overcome. When attempts were made to raise the bucket, it was found that the leg of one of men was wedged in the timbers of the winze, and all efforts to save these men failed. By the use of a pipe, the man's leg was finally freed, and the bodies were brought to the 500-foot level. After oxygen breathing apparatus was obtained and ventilation was restored at the foot of the winze, the other four bodies were recovered.

Morning Mine
Federal Smelting & Mining Co.
Mullan, Idaho
October 6, 1936 — 10 Killed (22)

Ten men were killed when a man-cage fell 900 feet. Immediately prior to the accident, 5 men, including the cager, got on the lower deck of the 2-deck cage at the 3,450-foot level. They were hoisted to the 3,050-foot level to complete loading on both decks. The cager permitted 6 men to get on the lower deck, making a total of 10 men. The cage doors were then closed and fastened. The engineer was signaled, and the cage was lowered until the upper deck was flush with the station floor. While the cager was opening the cage doors to the upper deck, the rope broke about 1,200 feet above the cage. No evidence was on the cage guides to indicate that the safety catches contacted them. The cage was used exclusively for hoisting and lowering men and material.

Boyd Mine
Tennessee Copper Co.
Ducktown, Tennessee
January 5, 1943 — 9 Killed (23)

A sulfide-dust explosion occurred in this mine where instantaneous and 1 to 10 delay detonators were used for blasting. A dust cloud was created by the blasting of the first shots and ignited by the subsequent shots in a round of 35 holes in the 10 North No. 1 stope. The main ventilating fan on the surface was stopped by the explosion, and the air currents in the mine reversed themselves.

Forty-two men were in the mine at the time of the explosion, 25 of whom were in the vicinity of the stope. Owing to the reversal of the air currents, 8 men were killed and 17 were injured by fumes on the level below the stope where normally fresh air entered this section of the mine. One of the injured died several days later, making a total of 9 killed.

The 17 men who worked at some distance from the 10 North No. 1 stope were able to save themselves by stopping a blower fan and opening a compressed air line near the face of the crosscut in which they were working. These men were rescued by crews working in fresh air after the mine ventilation was restored.

C. F. & H. (Mulcaby) Mine
Shullsburg, Wisconsin
February 10, 1943 — 8 Killed (2)

Eight men were killed in the worst mine accident in the long history of the Platteville lead-zinc mining district when the back of a low slope in the C. F. & H. Mine collapsed, burying the men.

Two of the victims were buried in an initial collapse, which occurred while they were preparing to shoot down a section of the rock suspected of being weak. Six others were buried in a second cave-in, which occurred while they were attempting to dig out the bodies of the first two men.

TABLE 1. - List of accidents at metal and nonmetal mines and quarries (except coal mines) in the United States in which five or more lives were lost

DATE	PRODUCT	NAME OF MINE	LOCATION	KILLED	NATURE OF ACCIDENT	REFERS.[1/]
1869 - Apr. 7	Gold	Kentucky – Yellow Jacket – Crown Point	Gold Hill, NV	37	Fire in timbers, probably from candle.	1, 7
1873 - Sept. 20	do.	Yellow Jacket	do.	6	Fire from blacksmith forge on 1,300-foot level.	1, 7
1874 - Feb. 13	Copper	Phoenix	Phoenix, MI	6	Explosion of dynamite caused by candle held by miner.	2
1874 - May 30	Gold	Amador	Amador, CA	5	All on cage; night shift coming to surface; 5 men in cage; when within 5 feet of surface cage suddenly fell to bottom, 1,640 feet.	2, 11, 27
1879 - Oct. 3	do.	Tioga	Bodie, CA	6	Cage accident.	2
1881 - Feb. 16	Copper	Belmont	Belmont, MT	6	Fire from blacksmith shop spread to magazine of powder and then to shaft.	1, 7
1884 - May 3	Marble	Gouverneur	Gouverneur, NY	6	Explosion of boiler after repairs.	6, 22
1885 - Nov. 3	Silver Gold	Bull Domingo	Silver Cliff, CO	10	Explosives; box of dynamite exploded in boiler room; headframe burned; men in mine suffocated.	2, 7
1887 - June 24	Gold Silver	Gould & Curry	Virginia City, NV	11	Fire in shaft station 1,500 level; cause unknown.	1, 7
1889 - Nov. 23	Copper	Neversweat - St. Lawrence	Butte, MT	6	Mine fire; candle in chute on 400 level	1, 7
1893 - Feb. 11	Marble	Sheldon quarry	West Rutland, VT	5	Roof fall in underground quarry.	22
1893 - Apr. 21	Copper	Silver Bow No. 2	Butte, MT	9	Mine fire; probably from candle at pump station.	2, 7
1893 - May 14	do.	Red Jacket Shaft	Calumet, MI	10	Hoisting cage overwinding.	2
1893 - Sept. 28	Iron	Mansfield	Crystal Falls, MI	28	Inrush of water.	2, 24
1895 - Mar. 10	Gold	Old Abe	White Oaks, NM	8	Mine fire; burning shaft house and shaft timbers.	2, 7

DATE	PRODUCT	NAME OF MINE	LOCATION	KILLED	NATURE OF ACCIDENT	REFERS.[1/]
1895 - Aug. 29	do.	Sleepy Hollow	Sleepy Hollow, CO	12	Mine flooded.	2
1895 - Sept. 7	Copper	Osceolo	Calumet, MI	30	Mine fire on 27th level; cause unknown.	2, 7
1895 - Sept. 26	Gold	Belgian	Leadville, CO	6	Dynamite explosion from unknown cause.	2, 26
1896 - Jan. 4	do.	Anna Lee	Cripple Creek Dist. El Paso Co., CO	8	Cave-in of shaft.	2
1896 - Apr. 8	do.	Hope	Basin, MT	7	Mine fire.	2, 7
1896 - Apr. 11	Copper	St. Lawrence	Butte, MT	6	Powder explosion.	11
1901 - June 4	Iron	Chapin	Iron Mountain, MI	8	Explosion of dynamite; asphyxiation by fumes; cause unknown.	3, 11
1901 - Nov. 20	Gold Silver	Smuggler-Union	Pandora, CO	31	Fire in bunk house at mine entrance.	2, 7
1902 - July 15	Lead Zinc Copper Silver	Park - Utah	Park City, UT	34	Night shift powder man ate lunch in stub drift powder magazine 1,200 level near Daly-West shaft. Candle or cigarette, air was downcast. Powder smoke circulated in mine but did not get much above the 1,000 at any time. Fumes killed a mule in stable off snowsheds at portal of Ontario No. 2 drain tunnel, 4 miles away.	2
1903 - Nov. 6	Gold	Kearsarge	Virginia City, MT	9	Mine fire; cause unknown.	2, 7
1904 - Jan. 26	Gold	Stratton's Independence	Victor, CO	14	Cage accident; overwinding of engine.	2
1905 - May 12	Copper	Cora	Butte, MT	7	Explosion of explosives.	2
1907 - Nov. 30	Gold	Fremont Consolidated	Drytown, CA	11	Fire at foot of shaft; cause unknown.	2, 7
1907 - Dec. 7	Iron	Rolling Mill Mine	Negaunee, MI	10	Fall of skip from surface to bottom	2
1909 - Feb. 26	Lead	Keystone	Joplin, MO	5	Fall of rock.	3
1909 - Apr. 13	Slate	Slate quarry	Granville, NY	5	Cave-in.	3
1910 - Mar. 2	Gold	Alaska-Mexican	Treadwell, AK	37	Explosion of powder magazine in mine.	2, 5
1910 - Apr. 13	Limestone	Limestone quarry	Nazareth, PA	11	Quarry explosion.	3

DATE	PRODUCT	NAME OF MINE	LOCATION	KILLED	NATURE OF ACCIDENT	REFERS.[1/]
1910 - June 1	do.	Union quarry	Devils Slide, UT	25	Premature quarry explosion.	3
1910 - June 2	do.	Lehigh quarry	West Coplay, PA	8	do.	3
1910 - June 7	Iron	Richard	Dover, NJ	5	Falling from man-car.	5
1910 - Nov. 28	Asphalt	Jumbo	Durant, OK	13	Explosion of gas.	3
1911 - Jan. 18	Gold	Keating	Radersburg, MT	6	Powder explosion in shaft.	3, 5
1911 - Feb. 23	Gold Silver	Belmont	Tonopah, NV	17	Fire, asphyxiation.	2, 5, 7
1911 - Mar. 11	Iron	Norman mine (open pit)	Virginia, MN	14	Slide of bank.	5
1911 - May 5	do.	Hartford-Cambria No. 2	Negaunee, MI	7	Mine fire; men overcome by gas and smoke.	2, 5, 7
1911 - Aug 23.	Copper	Giroux	Ely, NV	7	Mine fire; men overcome by gas and smoke.	2, 5
1911 - Sept. 3	Zinc	Black Rock shaft Butte & Superior	Butte, MT	6	Cage accident.	5
1911 - Sept. 28	Gold	Shakespeare Placer	Dome Creek, AK	14	Cave-in of shaft.	3
1911 - Oct. 19	Iron	Wharton	Hibernia, NJ	12	Shaft flooded.	3, 5
1912 - May 13	Iron	Norrie	Ironwood, MI	7	Cave-in.	5
1912 - July 7	Copper	Eureka Pit	Ely, NV	10	Dynamite explosion.	3, 5
1912 - Dec. 9	Gold	Great Northern Development Co.	Cordova, AK	9	Snowslide.	3
1913 - Apr. 17	Copper	Miami	Miami, AZ	5	Air blast; resulting from cave-in; threw men against walls and timbers.	2, 5
1913 - Apr. 23	do.	Leonard	Butte, MT	5	Hoisting accident in shaft.	5
1913 - Aug. 13	do.	Coronado Incline	Clifton, AZ	9	Breaking of drawbar of a car on incline.	3, 5
1914 - Jan. 21	do.	Boston	Bingham, UT	5	Mine fire; cause unknown.	7
1914 - July 14	Iron	Balkan	Palatka, MI	7	Men drowned by rush of sand and water into raise.	11
1914 - Aug. 4	Copper	Copper Flat (Steam-shovel pit)	McGill, NV	5	Premature blast.	11

DATE	PRODUCT	NAME OF MINE	LOCATION	KILLED	NATURE OF ACCIDENT	REFERS.[1/]
1914 - Sept. 17	Gold	Centennial-Eureka	Eureka, UT	11	Cave-in.	11
1914 - Nov. 9	Iron	Sibley No. 9 Shaft	Ely, MN	5	Shaft cave-in.	11
1915 - Oct. 19	Copper	Granite Mountain Shaft	Butte, MT	16	Dynamite explosion at shaft collar.	11
1916 - Feb. 14	Copper	Pennsylvania	Butte, MT	21	Mine fire; asphyxiation.	7
1917 - Feb. 25	Gold Lead Silver Zinc	North Star	Hailey, ID	16	Snowslide struck compressor and bunkhouse.	11
1917 - Apr. 28	Gold	Mountain King	Mariposa County, CA	7	Asphyxiation by powder fumes.	11
1917 - June 8	Copper	Granite Mountain	Butte, MT	163	Mine fire.	8
1917 - July 17	Gypsum	Three Forks quarry	Trident, MT	8	Powder explosion.	11
1918 - Feb. 21	Iron	Amasa-Porter	Crystal Falls, MI	17	Cave-in caused by inrush of water.	24
1918 - June 27	Iron	Silver (open pit)	Virginia, MN	18	Premature powder explosion caused by lightning.	11
1919 - July 25	Lead	Hecla	Burke, ID	5	Cage accident; power applied in wrong direction.	11
1920 - Apr. 15	Salt	Jefferson Island	Delcambre, LA	6	Gas explosion.	11
1920 - Apr. 19	Limestone	Lehigh quarry	Ormrod, PA	6	Explosives accident caused by hard tamping with heavy plunger.	8, 22
1920 - Aug. 13	Rock	Pounding Mills quarry	Pounding Mills, VA	9	Spark from steam shovel entered loaded drill hole.	22
1922 - June 27	Marble	Holston quarry	Strawplains, TN	9	Explosion during loading operations.	22
1922 - Aug. 27	Gold	Argonaut	Jackson, CA	47	Mine fire, cause unknown.	10
1923 - July 12	Iron	Sloss No. 1	Bessemer, AL	5	Haulage; man-trip broke loose.	11
1924 - Feb. 5	Manganiferious Iron Ore	Milford	Crosby, MN	41	Inrush of water.	11
1926 - Nov. 3	Iron	Barnes Hecker	Ishpoming, MI	51	Mine flood.	14
1927 - Oct. 29	Copper	Quincy Mine No. 2 Shaft	Hencock, MI	7	Fall of rock in shaft following air blast.	14

DATE	PRODUCT	NAME OF MINE	LOCATION	KILLED	NATURE OF ACCIDENT	REFERS.[1/]
1927 - Nov. 24	do.	Magma	Superior, AZ	7	Shaft fire.	14
1929 - Feb. 28	Granite	Stone Mountain quarry	Decature, GA	7	Explosion of air receiver at quarry.	12, 13
1929 - Sept. 4	Copper	Calaveras	Copperapolis, CA	5	Cave in stope.	14
1930 - May 17	Rock	Terry and Butterskill quarry	Union, WV	6	Premature explosion while preparing primers.	22
1930 - June 7	Moly-bdenum	Climax mine	Fremont Pass, Lake County, CO	5	Cave-in.	14
1930 - July 14	Gold	Glenn	Lost Chance, Placer County, CA	5	Mine fire in surface building. Fumes entered mine.	14
1933 - Feb. 8	Limestone	B & C quarry	Fletcher, NC	7	Fall and slide in quarry.	12, 15
1934 - Nov. 12	Granite	Rohl Connolly quarry	Avalon, CA	9	Explosives accident.	12, 16
1936 - Aug. 13	Copper	Mountain City Copper Company	Mountain City, Elko County, NV	6	Suffocation.	16
1936 - Oct. 6	Lead	Morning mine	Mullan, ID	10	Shaft accident.	18
1936 - Nov. 30	Slate	Funkhouser quarry	Delta, PA	9	Explosives accident.	12, 17
1937 - Feb. 19	Copper	Walker	Walkermine, CA	6	Explosion of dynamite in transit with trolley locomotive.	22
1938 - Aug. 31	Granite	Ashville quarry	Ashville, NC	5	Dynamite explosion.	12, 19
1939 - Jan. 31	Zinc	Southern	Treece, KS	5	Roof fall.	21
1942 - Jan. 9	Copper Zinc/Lead Gold/Silver	Pride	Silverton, CO	8	Fumes from surface fire at tunnel portal suffocated men in mine.	21
1942 - Mar. 26	Limestone	Sandts Eddy quarry	Allentown, PA	31	Quarry blast.	20
1943 - Jan. 5	Copper	Boyd Mine	Ducktown, TN	9	Asphyxiation by fumes from explosion of sulphide dust in stope.	23
1943 - Feb. 10	Lead Zinc	C. F. & H.	Shullsburg, WI	8	Two men buried by cave-in. Six others buried by second cave-in during recovery work.	22
1943 - Mar. 15	Rock	Atkinson quarry	Excursion Inlet, AK	5	Men not evacuated from danger zone during coyote hole blast.	22
1945 - Feb. 20	Lead/Zinc	St. Anthony	Tiger, AZ	5	Fire in company-owned bunkhouse.	22

TABLE 2. Major disasters in metal and nonmetal mines and quarries in the United States (excluding coal mines) showing number and fatalities by States

STATE	DISASTERS	TOTAL FATALITIES
Montana	14	275
Michigan	12	188
California	9	101
Nevada	8	99
Colorado	8	94
Pennsylvania	5	65
Minnesota	4	78
Utah	4	75
Alaska	4	65
Arizona	4	26
Idaho	3	31
Tennessee	2	18
New Jersey	2	17
North Carolina	2	12
New York	2	11
Oklahoma	1	13
Virginia	1	9
New Mexico	1	8
Wisconsin	1	8
Georgia	1	7
Louisiana	1	6
West Virginia	1	6
Alabama	1	5
Kansas	1	5
Missouri	1	5
Vermont	1	5
TOTAL	**94**	**1,232**

TABLE 3. - Major disasters in metal and monmetal mines and quarries in the United States (excluding coal mines) showing number and fatalities by principal products mined

Copper		Gold, Silver and Miscellaneous		Iron		Lead and Zinc		Nonmetallic Minerals	
No.	Fatalities	No.	Fatalities	No.	Fatalities	No.	Fatalities	No.	Fatalities
24	366	25	339	15	235	10	102	20	190

TABLE 4. - Major disasters in metal and monmetal mines and quarries in the United States (excluding coal mines) showing number and fatalities during 10-year intervals prior to 1945.

Years	Disasters	Fatalities
1869-1875	4	54
1876-1885	4	28
1886-1895	9	120
1896-1905	10	129
1906-1915	30	307
1916-1925	15	378
1926-1935	10	109
1936-1945	12	107
TOTAL	**94**	**1,232**

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