

Belle Isle Mine
Cargill, Inc
Franklin, St. Mary Parish, Louisiana
June 8, 1979

FINAL REPORT OF MINE EXPLOSION DISASTER
BELLE ISLE MINE
CARGILL, INC.
FRANKLIN, ST. MARY PARISH, LOUISIANA

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SHOP TRUCK

A pick-up type truck used by maintenance personnel for supply and repair purposes.

SKIP

A conveyance attached to a wire rope (cable) and hoisting mechanism used for removal of rock or ore from an incline or vertical shaft mine.

SKIP POCKETS

An underground storage bin in which ore or waste rock is placed prior to being hoisted to the surface.

STOPE

An underground excavation resulting from actual mining of ore as distinguished from other excavations.

TUNNEL

Term used at the Belle Isle Mine to differentiate lower level entries from upper level entries. The upper level entries and tunnels are vertically separated by a 40-foot salt pillar.

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INTRODUCTION

This is an investigation report of a mine explosion disaster that occurred June 8, 1979, at the Belle Isle Mine, Cargill, Inc., near Franklin, St. Mary Parish, Louisiana, MSHA mine I.D. Number 16-00246. The investigation is made pursuant to the provisions of the Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164 (30 USC 801 et. seq.).

The investigation was authorized by Thomas J. Shepich, Administrator, Metal and Nonmetal Mine Safety and Health, Mine Safety and Health Administration. The purposes of this investigation were: to determine the location and cause of the explosion, including conditions and practices at the Belle Isle Mine that resulted in the explosion; to make recommendations to prevent a similar occurrence; and, to examine the MSHA's related policies and practices.

Briefly, for the reasons set forth in this report, the investigators believe that the underground explosion was initiated in 8 Main Entry East near Room 10 where an explosive mixture of flammable gas was ignited by burning electrical conductor insulation, or arcing electrical wires, or both.

SUMMARY

On Friday, June 8, 1979, an outburst of flammable gases and salt occurred following a face blast in 8 Main Entry East at about 2300 hours, and a gas explosion occurred in the mine approximately 10 minutes later. At the time of the explosion, 22 persons were in the mine. Ten persons were on the upper level and twelve persons were on the lower level. Seventeen persons were rescued and five persons died as a result of the explosion.

A few minutes before 2300 hours, near the end of the shift, all employees left their working places with the exception of two men who were designated to initiate blasts in three working places charged with explosives. Twelve of the employees attended a scheduled meeting and eight employees were enroute to the No. 1 Shaft to be hoisted to the surface. The blasts were initiated from 7 Main Entry East at Room 13 by the two designated employees, and approximately 10 minutes later the explosion occurred. According to the autopsy reports, four of the fatalities occurred as a result of acute pulmonary hemorrhage secondary to alveolar rupture due to the air blast in the mine explosion. The fifth victim apparently died from a combination of acute pulmonary hemorrhage and carbon monoxide poisoning (See Appendixes C and D). The autopsy report on the fifth victim showed a carboxhemoglobin saturation of 75 percent. Three victims were found within 300 feet of the No. 1 Shaft Station. The fourth and fifth victims were found about 1,400 feet and 1,800 feet, respectively, from the No. 1 Shaft Station. All victims were recovered by mine rescue teams within 41 hours after the explosion. The rescue effort involved 73 dedicated mine rescue team members who assembled from local mines and from around the Nation and involved a total of 14 team entries into the mine in that period of time.

From a position of hindsight, there were a number of significant events which in combination should have established the forewarning of the potential disaster. However, when the events were considered one at a time, on a mine-by-mine basis, the overall significance was overlooked or lost. The multiple indicators of significant gas problems explained hereinafter in this report in the Belle Isle Mine were not adequately correlated by either MSHA or Cargill management.

MSHA'S INITIAL RESPONSE

Charles von Dreusche, Mine Manager, notified Wayne D. Kanack, District Manager, South Central District, Mine Safety and Health Administration (MSHA), Dallas, Texas, at 0030 hours on June 9, 1979,

that an explosion had occurred at the Belle Isle Mine. Mr. Kanack was contacted moments before by James Hebert, Belle Isle Office Manager, who was at the Calumet Landing. Jay Durfee, Metal and Nonmetal Supervisory Mining Engineer, Baton Rouge, Louisiana, was informed of the explosion by Kanack at 0045 hours June 9, 1979. Mr. Kanack made contact with Roy Bernard, Deputy Administrator, Metal and Nonmetal Mine Safety and Health, MSHA, Arlington, Virginia, at 0145 hours on June 9, 1979, and he requested the assistance of the National Mine Rescue Team and the Mine Emergency Operations (MEO) Team for the disaster at Belle Isle (See Appendix S). Mr. Kanack then ordered the members of the MSHA Mine Rescue Team, Rolla, Missouri, to proceed to Belle Isle. Mr. Bernard immediately contacted Thomas Shepich, Administrator, John Waxvik, Acting Chief, Division of Safety, and J. D. Pitts, Safety Specialist, and the four of them arrived at MSHA's Headquarters Office by 0230 hours. They notified MSHA headquarters personnel who were on the Disaster Notification List. Mr. Waxvik and J. D. Pitts proceeded to notify the twenty-one National Mine Rescue Team members and ordered them to proceed to the Belle Isle Mine by the fastest available means (See Appendix R).

Jay Durfee and Jerry Millard, Metal and Nonmetal Mine Inspector, Baton Rouge, Louisiana, arrived at the mine office, Calumet Landing, Louisiana at 0315 hours on June 9, 1979. To control the mine recovery, a 103(k) order was issued to Roy Granger, Mine Foreman, by Jay Durfee at 0320 hours on June 9, 1979. Jay Durfee, Jerry Millard and a mine rescue team from International Salt Company arrived at the mine at 0430 hours on June 9, 1979, after being transported by helicopter from Calumet Landing. At that time, seventeen persons had been safety evacuated from the mine and sent to a hospital for treatment and observation. Five men were still underground, three of whom were known to be fatalities. At 0445 hours on June 9, 1979, Jerry Millard monitored the mine exhaust air at the collar of No. 1 Shaft and reported 0.8 percent methane and 700 ppm carbon monoxide.

MSHA's MEO Team, Pittsburgh Technical Support Center (PTSC) and Denver Technical Support Center (DTSC) were placed on alert by Donald P. Schlick, Director, Technical Support, for possible support of rescue efforts at the Belle Isle Mine about 0330 hours Saturday, June 9, 1979. At 0400 hours Jeff Kravits, Chief, MEO, directed deployment of the Communication/Control (C/C) van with two members of the Mine Emergency Operations Team and requested airlift service for MSHA personnel. The C/C van driven by John Hartman, Westinghouse, departed the staging facility, Pittsburgh, Pennsylvania, about 0515 hours on June 9, 1979, and arrived in the vicinity of the mine about 0800 hours on June 10, 1979.

Five chartered air flights were obtained on June 9, 1979, to airlift MSHA personnel and equipment from Pittsburgh, Pennsylvania and Denver, Colorado to the Patterson, Louisiana Airport which is located near the mine site.

On June 9, a plane left Pittsburgh at 0732 hours with Jeff Kravitz, MEO. James Banfield and Edward Miller, PTSC, aboard. J. D. Pitts boarded the plane en route, which arrived at the Patterson, Louisiana airport at 1050 hours. The personnel were transported to the mine by helicopter. MSHA personnel started installation of equipment for monitoring the exhaust air from the No. 1 Shaft.

A plane left Denver, Colorado, at 0830 on June 9, carrying Richard Kline and Ralph Foster, DTSC, plus self-contained breathing apparatus, 6 spare oxygen cylinders and gas detection equipment. The plane arrived at Patterson, Louisiana at 1410 hours and the passengers and equipment were transported by helicopter along with members of a rescue team to the mine site. The last flight arrived at Patterson at 0035 hours on June 10, 1979.

MEO activities on June 10 were directed toward setting up a base of operation at Cargill's Calumet Landing and in establishing radio communication between the mine site and the landing. MSHA's mine recovery efforts continued through July 19, when the C/C van and MEO support personnel were released. The C/C van returned to the staging facility on July 22, 1979.

GENERAL INFORMATION

The Belle Isle Mine is located along the Gulf Coast in St. Mary Parish, 19 miles southeast of Franklin, Louisiana. Belle Isle is one of a group of 5 underground salt mines located in similar domes in the area, each of which is operated by a separate company. The domes are known as Jefferson Island, Avery Island, Weeks Island, Cote Blanche Island, and Belle Isle. Although the surface elevation of the domes is not high, they came to be known as the Five Islands because they are mound-shaped and rise abruptly above the flat marsh lands. The locations are shown in Appendix A.

The land-side base of the Belle Isle Mine is known as Calumet Landing, which is located along U.S. Highway 90 on Wax Lake Outlet about 13 miles due north of the mine. Personnel and supplies were transported to the mine by boat. Salt shipments from Belle Isle were handled by an affiliated barge line.

The mine, which went into production late in 1962, was owned and operated by Cargill, Inc. The principal officers associated with Cargill, Inc., were headquartered in Minneapolis, Minnesota (See Appendix E).

Total employment was 89 persons, 75 of whom worked underground. The mine was operated 2 shifts a day, 5 days a week.

Access into the mine was through the No. 1 and 2 Shafts, which were 1,253 feet and 1,225 feet deep, respectively. These shafts were located near the north boundary of the mine.

The last regular Federal inspection of the mine was completed on April 12, 1979. A subsequent compliance follow-up inspection was completed on May 31, 1979. The mine was not classed gassy at the time of the explosion.

GAS OUTBURST PHENOMENON IN LOUISIANA SALT MINES

Outbursts of high-pressure gases with salt out of pressure pockets in Louisiana salt mines have been documented for many years. The phenomenon has been documented in every conventionally mined Louisiana salt dome except Avery Island. The mine in the Avery Island dome has been mined at more shallow depths than the other domes until recently. It has been postulated that outbursts, at least down to the deepest depths now being mined, are more likely to be experienced with increased depth. In the Louisiana salt domes, outbursts of noteworthy size occur when salt with high-pressure gases entrained in the rock structure is penetrated by mine openings. The gas-stressed salt is oriented vertically and can extend several hundred feet in elevation. These gaseous entrainments are commonly referred to as "pressure pockets". The rather smooth-walled symmetrical shaft-like opening left in the back by outbursts are often referred to in Louisiana as "blowouts". One blowout cavity at another mine has been measured to be about 80 feet across and 280 feet high into the back. Mine blowout cavities which cannot be safely approached for detailed examination may exceed 280 feet in height. Of the five conventionally-mined domes in Louisiana today, the Belle Isle Salt Dome probably has released the greatest number of outbursts that have produced blowout cavities of noteworthy size. In Louisiana, reliably documented outbursts have always been triggered by blasting.

The salt and gases during an outburst can release with explosive force. It has been reported^{1/} that 15,000 tons of salt was expelled from a blowout by entrained gas pressures estimated at 80 atmospheres in the Belle Isle Mine. The gas was thought to have expanded to more than 1 million cubic feet in the mine. Ten outbursts that produced blowout cavities of significant size have occurred in Belle Isle. The blowout locations are shown in Appendix F. Six outbursts in Belle Isle, including the one on June 8, 1979, have occurred in an East-West zone that parallels the 8 Main Entry East.

^{1/} MSHA Storage Task Force. "Fact Finding Investigation of Southern Louisiana Salt Domes", p. 27, Golder Associates, "Geotechnical Study of Cote Blanche Island Salt Mine", Consultant Geotechnical Engineers, Vancouver, B.C., Canada, October, 1977.

The latest outburst, which fueled the mine explosion, occurred in the east face heading of 8 Main Entry East, inby Room 13.

INTENSIVE SAMPLING PROGRAM

On June 18, 1979, as one result of the disaster at Belle Isle, an intensive sampling program began at the other salt dome mines along the Louisiana coast to establish with certainty the exact presence of flammable gas in each mine. This intensive sampling program confirmed that three of the other four mines had similar flammable gas problems, and they were classed as gassy. One mine, Avery Island, was not found to have a concentration of flammable gas over 0.25 percent. (See Standard 57.21-1, see below).

The explosion has obviously affected that part of the underground salt mining industry which is now required to comply with the gassy mine standards, and in some instances, petitions for modification have been filed under Section 101 (c) of the Act. Some companies have alleged that certain standards are inappropriate for salt mining. In the event a mine operator desires a modification from the application of any safety standard, Section 101 (c) of the Act provides a special procedure for obtaining a modification from the specific requirements of a safety standard where the modification would provide at least as safe conditions as compliance with the standard.

GASSY MINES

Based on the information available at the time this report was written, MSHA's (formerly the Bureau of Mines and MESA) National policy for classifying mines gassy prior to and on June 8, 1979, was based on the four criteria contained in standard 30 CFR 57.21-1. Standard 57.21-1 states that:

57.21-1 Mandatory. A mine shall be deemed gassy, and thereafter operated as a gassy mine, if:

- (a) The State in which the mine is located classifies the mine as gassy; or
- (b) Flammable gas emanating from the ore-body or the strata surrounding the ore-body has been ignited in the mine; or
- (c) A concentration of 0.25 percent or more, by air analysis, of flammable gas emanating only from the ore-body or the strata surrounding the ore-body has been detected not less than 12 inches from the back, face, or ribs in any open workings; or
- (d) The mine is connected to a gassy mine.

This mandatory standard was derived from recommendations made by an Underground Advisory Committee (UAC) to the Secretary of the Interior. The recommendations were based on criteria used in the Federal coal mine safety program for classification of coal mines. The standard was promulgated on July 31, 1969 (34 FR 12526) after being published as a proposed rule on January 16, 1969 (34 FR 691).

In response to a request for comments on the proposed rule, The American Mining Congress indicated by a letter of April 30, 1969 that the UAC:

". . . recognized that a gassy metal or nonmetal mine was distinctly different from a gassy coal mine. This difference was in two basic characteristics: (1) The potential emanation rate of methane in a gassy metal or nonmetallic mine may be much lower than in most gassy coal mines; and (2) The product being mined is noncombustible in most metal and nonmetallic mines. Safety standards of gassy metal and nonmetal mines need not be the same as those applicable to gassy coal mines."

The Salt Institute also commented in a letter of April 28, 1969, that:

"Another major item of concern involves the Paragraph 57.22-1 (renumbered 57.21-1), which outlines criteria for deeming a mine 'gassy'. Salt mines have not been considered 'gassy' nor should they be. However, mines are considered gassy according to sub-paragraph (b) if: 'Flammable gas emanating from the ore-body or the strata surrounding the ore-body has been ignited in the mine'."

"Rarely is gas encountered in rock salt deposits and then only in minute amounts. The quantity of gas has never approached explosive proportions, nor is it at all likely to. The large volumes of air in salt mines preclude this. To classify salt mines as 'gassy' would unduly penalize the salt industry, and we respectfully request clarification of the definition, or a ruling that salt mines are not considered 'gassy'."

After considering these comments and others, the Secretary of the Interior issued the standard without change in the proposed wording.

Generally, the reason for classifying a mine as "gassy" is to warn everyone in the mine, e.g., the mine operators, workers, and inspectors that a dangerous condition may arise if certain precautionary measures are not followed. Gassy mines must be operated in accordance with all the mandatory standards issued in Part 57 including the 63 standards in Section 57.21 which apply specifically to such mines. Section 57.21 has a classification standard and 5 categories of mandatory safety standards which are fire prevention and control, ventilation, equipment, illumination and explosives.

Among the added safeguards are: a prohibition against smoking or carrying smoking materials, matches, or lighters underground; main fans must be installed on the surface; daily inspections of main fans and keeping logs of these inspections and of fan maintenance; main intake and return air currents in mines must be in separate shafts; slopes, or drifts except during shaft or slope development when a curtain wall or partition must be used; withdrawal of persons and power de-energized in affected active workings when there is a failure of mine ventilation; volume and velocity of the current of air coursed through all active areas must be sufficient to dilute, render harmless, and carry away methane, smoke, fumes, and dust; the quantity of air coursed through the last open crosscut in pairs or sets of entries, or through other ventilation openings nearest the face must be at least 6,000 cubic feet per minute, or 9,000 cubic feet per minute in longwall and continuous miner sections; withdrawal of persons if 1.5 percent or higher concentration of methane is present in air returning from an underground working place or places, or is present in air not less than 12 inches from the back, face, or rib of an underground working place; only permissible equipment maintained in permissible condition must be used beyond the last open crosscut, or in places where dangerous quantities of flammable gases are present or may enter the air current; and, only permissible explosives, as designated permissible by the Bureau of Mines or MSHA, may be used in any gassy underground mines, except that non-permissible explosives may be used only when MSHA and the State Inspector of Mines have given their written approval for each non-permissible explosive to be used.

It should also be noted that Congressional concern regarding excessive liberations of methane or other explosive gases was reflected in the Federal Mine Safety and Health Amendment Act of 1977 (Public Law 95-164) in modifications of Section 103(i) of the Federal Coal Mine Health and Safety Act of 1969 (Public Law 91-173). 2/

2/ Section 103(i) of the Act requires:

Whenever the Secretary finds that a coal or other mine liberates excessive quantities of methane or other explosive gases during its operations, or that a methane or other gas ignition or explosion has occurred in such mine which resulted in death or serious injury at any time during the previous five years, or that there exists in such mine some other especially hazardous condition, he shall provide a minimum of one spot inspection by his authorized representative of all or part of such mine during every five working days at irregular intervals. For purposes of this subsection, "liberation of excessive quantities of methane or other explosive gases" shall mean liberation of more than one million cubic feet of methane or other explosive gases during a 24 hour period. When the Secretary finds that a coal or other mine liberates more than five hundred thousand cubic feet of methane or other explosive gases during a

