UNITED STATES
DEPARTMENT OF THE INTERIOR
MINING ENFORCEMENT AND SAFETY ADMINISTRATION
HEALTH AND SAFETY ACTIVITY

HEALTH AND SAFETY REPORT

REPORT OF MULTIPLE FATAL-GAS EXPLOSION
STERLING "B" SHAFT
INTERNATIONAL SALT COMPANY
RETSOF, LIVINGSTON, NEW YORK

April 18-19, 1975

By

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METAL AND NONMETAL MINE SAFETY
NORTHEASTERN DISTRICT

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Date Issued : May 21, 1975

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REPORT OF MULTIPLE-FATAL GAS EXPLOSION

This report is based on an investigation made pursuant to clause (1) of Section 4 of the Federal Metal and Nonmetallic Mine Safety Act (80 Stat. 772).

A State Plan Agreement is in effect in New York which plan includes procedures for enforcement by the New York State Department of Labor, of State health and safety standards which are substantially as effective for the purpose of the protection of life, the promotion of health and safety, and the prevention of accidents as the mandatory standards promulgated by the Secretary of the Interior.

Company: International Salt Company, A Part of Akzona, Inc.

Mine Name: Sterling Shaft (abandoned) adjacent to Retsof Mine

Location: (City) Geneseo (County) Livingston (State) New York

Date(s) of Investigation: April 18-19, 1975

Name of Inspector(s): Edward Roberts, Supervisory Mining Engineer; Michael J. Music and James M. Salois, Metal and Nonmetal Mine Inspectors

Company Official(s): Jack Ryan, President; L. P. Theilgard, Vice President; Lewis Bush, Acting Plant Manager; Alex Cichelli, Production Superintendent; Charles Jacoby, Manager Mineral and Mines

Work Schedule: Shifts/day 2 Days/week 5 Hours/shift 8

No. of Employees: 250 Union Official(s): Richard Whitenack, President

Inspector(s) Accompanied by: Lewis Bush, Acting Plant Manager; Alex Cichelli, Production Superintendent; George Silfies, Maintenance Superintendent; Gerald Kane, NYS Construction Inspector

Type of Mine: Underground Mining Method: Room & Pillar Product: Salt

INTRODUCTION

About 11:58 am, April 18, 1975, a gas explosion in an abandoned mine shaft, the Sterling "B" Shaft, killed three and presumably a fourth (missing) employee of the Retsof Mine, International Salt Company, Retsof, New York; four other persons were injured, and the remainder examined and released. The 13 persons involved were attempting to seal the bottom of the mainly unlined shaft to prevent seepage of water from the rock strata to salt beds 1100 feet below the surface. This water, turning saline, constituted a pollution source when it was pumped to the surface. During the process of forming an impervious plug, material dumped from the surface, became lodged in the upper segments of the shaft, and efforts to dislodge this material resulted in the ignition of flammable gases discharged from gas-bearing rock strata in the shaft column. When the explosion occurred, the victims were peering down the shaft at the uppermost blockage 382 feet below or were in the immediate vicinity of the shaft collar.

Those killed by the blast were:

Joseph Bucci, engineering and maintenance superintendent, SSN [redacted], Retsof, New York. Mr. Bucci, age 54, is survived by his wife and three dependent children; he had 36 years of mine-related experience.

Robert J. Ackley, draftsman, SSN [redacted], Warsaw, New York. Mr. Ackley, age 30, is survived by his wife and two dependent children; he had 8 years of mine-related experience.

Angelo V. Giglio, (missing), surface maintenance foreman, SSN [redacted], Retsof, New York. Mr. Giglio, age 45, is survived by his wife and two dependent children, he had 28 years of mine-related experience.

David L. Buckley, plant manager, SSN [redacted], age 45, injured; died May 5, 1975, at 5:45 pm. He is survived by his wife and three dependent children; he had 18 years mining experience.

See Appendix 2 for personal data of those injured in the blast.

The MESA office, Albany, New York, was advised of this explosion about 1:15 pm, April 18, 1975, by a telephone call from Donald Yull, personnel and safety director, Retsof Mine of the International Salt Company. Personnel from MESA were dispatched immediately; Arne E. Nasi, metal and nonmetal mine inspector, Geneva, New York field office, arrived at the scene within 2 hours. Gerald Kane, New York State mine and construction inspector, who resides in Retsof, New York, was at the site within 45 minutes.

Information for this report was obtained from conferences with survivors of the explosion and company officials, perusal of pertinent maps and documents, and detailed examination of the explosion area. See Appendix 3.

GENERAL INFORMATION

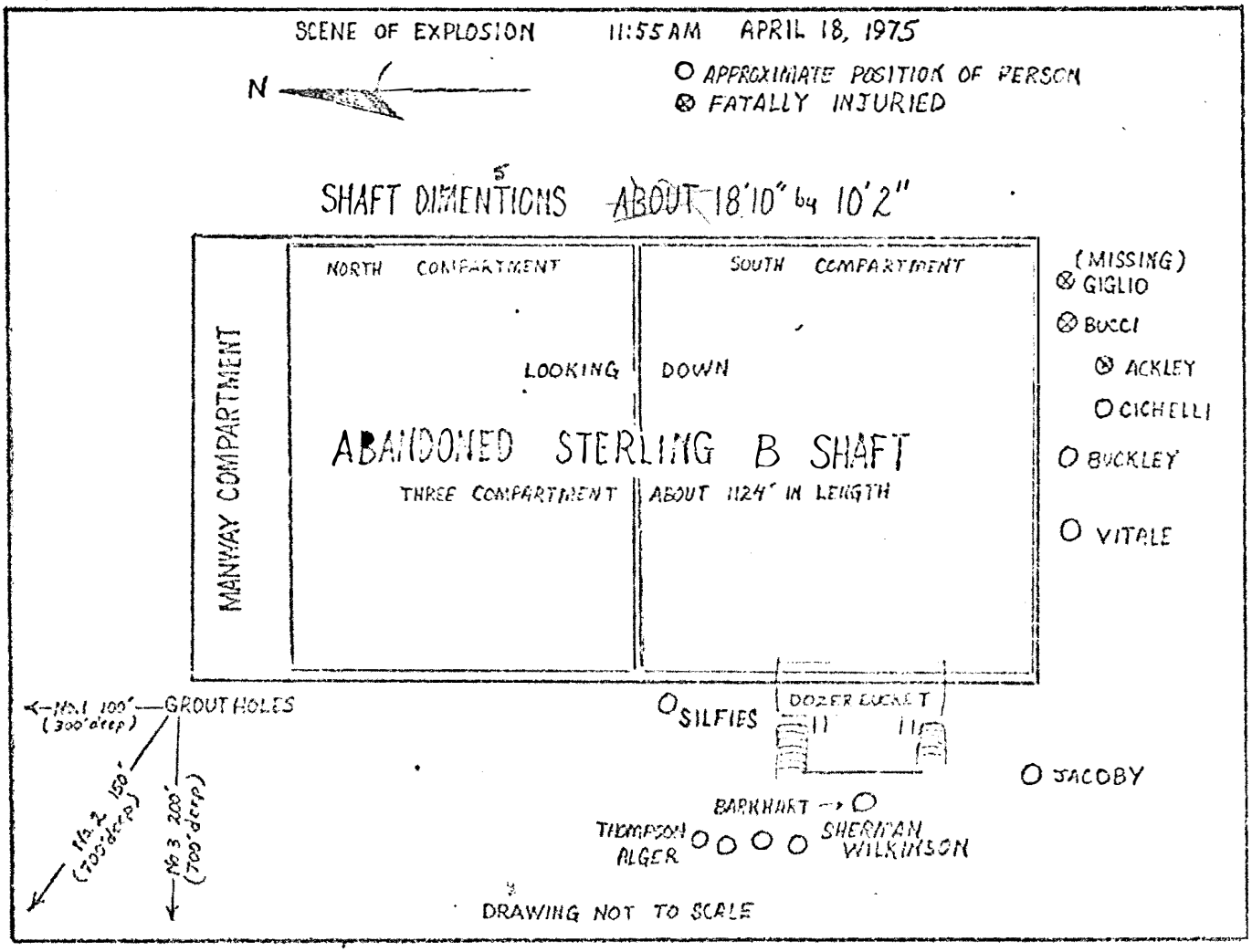
Sterling "B" Shaft, originally owned by the Sterling Salt Company, was sunk about 1905 and abandoned about 1929. Above the shaft was a 100-foot-high, reinforced concrete, head frame structure comprised of 4-foot-square, weight-bearing columns and beams with 6-inch-thick concrete wall panels; panels immediately above collar level (to 40 or 50 feet) approximated 20- by 30-foot in area. Inner structure of the building utilized heavy timber and planking. The shaft was an approximate 1100-foot-deep, three-compartment facility, measuring 10 feet by 19 feet in cross-section. When this was an active shaft, two compartments were used for hoisting; the third contained a ladder escapeway. A single 8-foot-high salt bed, approximately 1100 feet below the surface, was mined by the room and pillar method. Sterling Mine was ventilated by means of the Sterling "B" Shaft as the intake air course and the Sterling "C" Shaft 780 feet to the north as the exhaust opening; the operation was completely separated by a 300-foot-thick barrier pillar from the Retsof Mine.

The Sterling property was purchased in 1928 by the International Salt Company; Sterling "B" Shaft was sealed but Sterling "C" was fenced and maintained for subsequent use. In 1957, a drift was driven through the barrier pillar to utilize "C" Shaft as a return air course for the active Retsof Mine. At the present time, rooms interconnecting the Sterling "C" to Sterling "B" are impassable and are filled with water to the roof; it was calculated that water plugging the base of the abandoned "B" Shaft was 14 to 16 feet in depth. This plug of water effectively sealed any strata gas discharges from the abandoned shaft penetrating to the active workings of the Retsof Mine. Fresh ground water (75 gpm) emanating from the rock strata in upper sections of the abandoned shaft drained to the salt bed at the 1100 level where it became saline. This inflow of water also contained gas and petroleum products introduced primarily from the Oriskany Zone, a gas-bearing geologic strata. The level of mine water was maintained by an automatic pump to keep the water plug at the bottom of Sterling "B" Shaft; the pump forced water up the Sterling "C" Shaft and discharged on the surface.

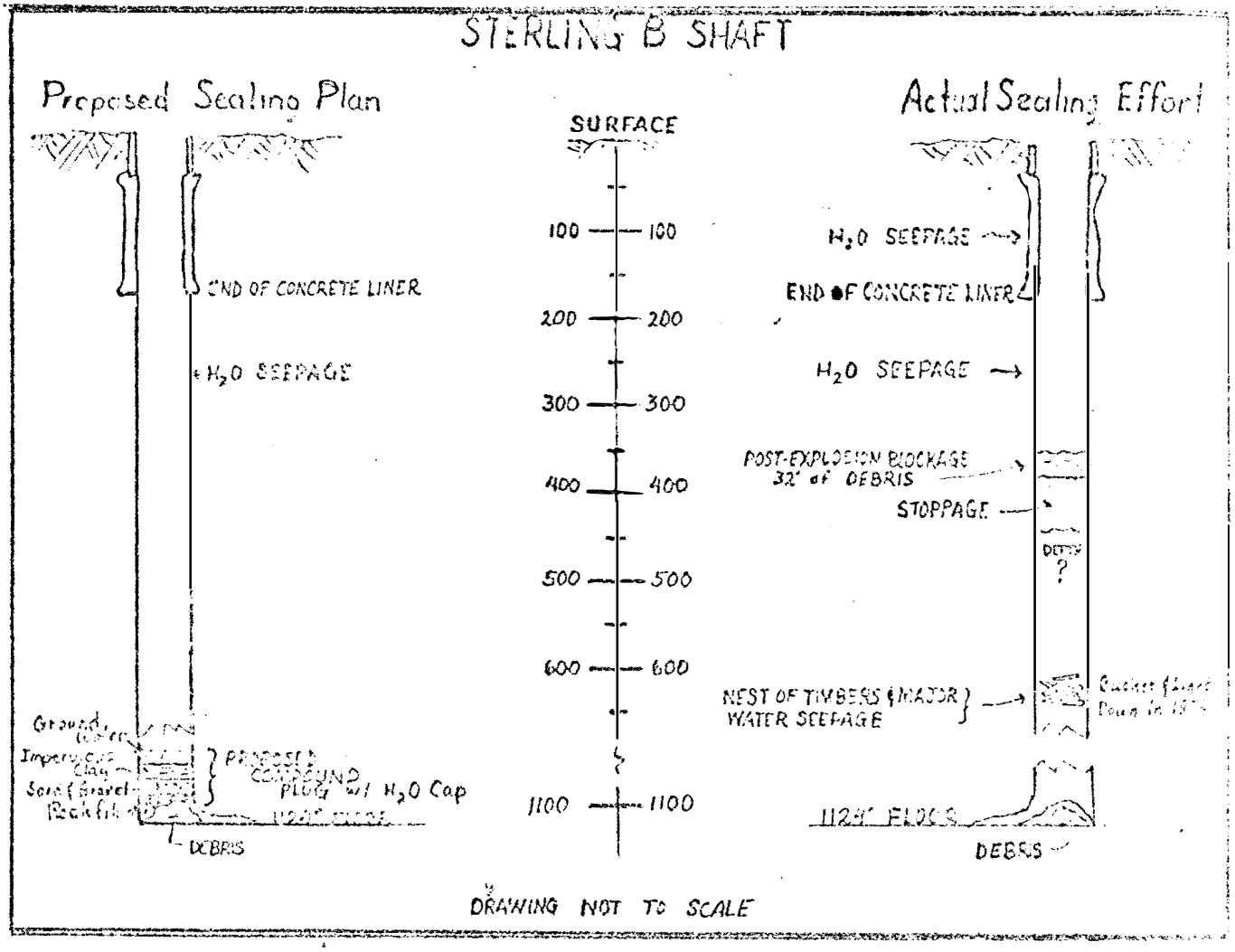
DETAILS OF THE ACCIDENT

Pursuant to an order from the New York State Department of Environmental Conservation dated November 22, 1974, the International Salt Company instituted a corrective program to properly dispose of brine wastes. (See Appendix 1) Ground water, which infiltrated from the rock strata at various points from the shaft collar to the 620 level, was to be sealed from the salt bed at the shaft bottom to the 700- to 800-foot elevation by impervious layers of stone, clay, and a concrete cap. It was expected that a column of water in the shaft to or slightly above the water table would effectively reverse the inflow of water and gas to the area. Excess brine water at the shaft bottom also was to be disposed of by discharge to the water column above the shaft plug.

Sketch 2


SCENE OF EXPLOSION 11:55 AM APRIL 18, 1975
N
O APPROXIMATE POSITION OF PERSON
⊗ FATALLY INJURIED
SHAFT DIMENTIONS ABOUT 18'10" by 10'2"
MANWAY COMPARTMENT
NORTH COMPARTMENT
SOUTH COMPARTMENT
LOOKING DOWN
ABANDONED STERLING B SHAFT
THREE COMPARTMENT ABOUT 1124' IN LENGTH
(MISSING)
⊗ GIGLIO
⊗ BUCCI
⊗ ACKLEY
O CICHELLI
O BUCKLEY
O VITALE
O SILFIES
DOZER BUCKET
O JACOBY
BARKHART O
THOMPSON ALGER
O O O O
SHERMAN WILKINSON
GROUT HOLES
NO.1 100' (300' deep)
NO.2 150' (700' deep)
NO.3 200' (700' deep)
DRAWING NOT TO SCALE

Sketch 1


STERLING B SHAFT
Proposed Sealing Plan
Actual Sealing Effort
SURFACE
100
200
300
400
500
600
1100
END OF CONCRETE LINER
+ H2O SEEPAGE
H2O SEEPAGE
END OF CONCRETE LINER
H2O SEEPAGE
POST-EXPLOSION BLOCKAGE
32' of DEBRIS
STOPPAGE
DEBRIS
?
NEST OF TIMBERS (MAJOR WATER SEEPAGE)
Ground Cover
Impervious Clay
Sand & Gravel Backfill
PROPOSED CONCRETE PLUG w/ H2O Cap
DEBRIS
112' FLOOR
DEBRIS
DRAWING NOT TO SCALE

In 1965 to 1966, the Cementation Company of America, Inc., Ontario, Canada, constructed a 3-foot-thick, concrete water seal from a point 24 feet below the collar to 174 feet below. Because the shaft was abandoned and there was no foreseeable reason to reenter, timber, approximately 12-inch by 14-inch by 20-foot, and other waste, was thrown down the shaft; this material lodged somewhere between the 600 and 750 level. See Sketch 1.

Further steps to stem the inflow of water included the pressure grouting July 29 through September 9, 1974, of the strata northwest of the shaft through three, 300-foot to 700-foot-deep, vertical boreholes located about 100 to 200 feet from the collar. During the course of this work, a television camera was lowered in the shaft to check the grouting operation and the blockage at the 620 level was discovered. In an effort to dislodge this plug, very heavy boulders (totalling about 25 tons) were dumped down the shaft; however, this material formed a second plug at the 380-foot level.

On the day of the explosion, two flood lamps were lowered to the upper blockage; an odor of petroleum was intermittently evident at the collar but no one suspected that the mixtures would be explosive. The gas-emitting strata was below the 380-foot blockage; however, the interlaced timber plug and subsequent large boulders would not have been a sufficient seal to contain the flammable gases. Methane, the light gas constituent probably rose to the surface as it was emitted; the heavier hydrocarbons gradually built to the collar in the unventilated shaft. A large rock, approximately 6 tons, was dropped down the shaft from the bucket of a tractor-mounted, front-end loader without incident but did not penetrate the upper blockage. About 11:58 am, a second boulder was dropped and the explosion occurred. At the time, the subsequent victims were standing along the south side of the shaft; Mr. Giglio was in a prone position peering down at the blockage through binoculars; safety belts and lines to various substantial anchorage points were worn by each man at the collar. Mr. Giglio, the missing man, reportedly, had tied himself in this manner; however, immediately before the rock was dropped, he released himself to perform some chore. It could not be determined with certainty that the safety belt had been refastened. See Sketch 2.

Timber probably was thrown upward by the force of the explosion but was contained within the shaft to some degree by two or three timber sets, which remained more or less intact immediately below the collar. Later, television observations of the shaft wall showed that the timber largely had been stripped and was piled on the blockage; the top level of the blockage had been altered by blast debris from a 380-foot to a 347-foot elevation below the collar. In the immediate shaft area, concrete panels in the building for 40 to 50 feet above ground level were blown out. Slabs of concrete and timber from the upper interior of the building appeared to have caused most of the injuries to personnel. Reportedly, Mr. Bucci and Mr. Ackley, both deceased, were close to one another and were buried under lighter material; others in the area received minor injuries from flying objects. See Sketch 2.

At 12:02 pm, a report of the explosion was telephoned by Clair Thompson, mechanic, to the Livingston County Sheriff's Department, Geneseo, New York, requesting three ambulances and the Cuylerville Volunteer Fire Department. All responded within 5 to 15 minutes and the victims were removed to various hospitals in the area. Messrs. Bucci and Ackley were pronounced dead-on-arrival at the Strong Memorial Hospital, Rochester, New York; Messrs. Buckley and Vitale were admitted to the same hospital; all others were treated at various medical facilities and released. See Appendix 2. County Medical Examiners attributed the immediate cause of Mr. Bucci's death to a crushed chest; Mr. Ackley succumbed to multiple viscral and skeletal injuries. Mr. Buckley died of his injuries on May 5, 1975.

CAUSE OF ACCIDENT

This accident was caused by a concentration of flammable hydrocarbon gases in an unventilated mine shaft, introduction of ignition sources (flood lamps) to the area, and the breaking of a light bulb in the gas mixture by dropped material. The inexperience of personnel regarding flammable mixtures or a disregard of same was contributory.

RECOMMENDATIONS

1. Areas containing flammable vapors should be thoroughly and safely vented to reduce the concentrations to acceptable safe limits before exposing personnel to possible explosive gas hazards. Such areas should be monitored during periods of exposure by qualified personnel to assure that established safe gas concentrations are not violated.

2. Nonpermissible electrical equipment should not be placed in an atmosphere containing possible explosive gases.

3. In any area containing possible explosive gases, all actions should be prohibited that might damage permissible or nonpermissible electrical equipment.

4. New York State, MESA, or other qualified persons familiar with the hazard of explosive atmospheres and having the equipment to detect and safely disperse flammable gases, should be contacted if a suspect gas is encountered. Reopening of abandoned shafts or mines should be considered in the suspect category and above agencies should be notified of the intent to reopen such facilities.

5. All shafts, operational or otherwise, that intercept the Oriskany sandstone or Marcellus shales shall be monitored at every regular inspection for methane, hydrogen sulfide, and other hydrocarbon gases.

/s/ Edward Roberts

Edward Roberts
Supervisory Mining Engineer

/s/ Michael J. Music

Michael J. Music
Metal and Nonmetal Mine Inpsector

/s/ James M. Salois

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Approved By:

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