UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
Metal and Nonmetal Mine Safety and Health

REPORT OF INVESTIGATION

Underground Nonmetal Mine
(Salt)

Fatal Falling Material Accident

March 24, 2010

Cayuga Crushed Stone
Lansing, Tompkins County, New York
Contractor I.D. No. WNK

at

Cayuga Mine
Cargill Deicing Technology
Lansing, Tompkins County, New York
Mine I.D. No. 30-00663

Investigators

Gary C. Merwine
Mine Safety and Health Inspector

Anthony M. Fortino
Mine Safety and Health Inspector

Darren J. Blank, P.E.
Civil Engineer

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Civil Engineer

Originating Office
Mine Safety and Health Administration
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Donald J. Foster, Jr., District Manager

OVERVIEW

Rolland F. Clark, Contract Truck Driver, age 63, was fatally injured on March 24, 2010. Clark was loading his truck under a 150-ton-capacity salt bin when the bin's supporting structure collapsed and the bin fell onto the cab of the truck. David R. Costley, Bin Operator, age 50, was injured in the accident when the operator's booth that was located on the west side of the structure fell to the ground. The accident occurred because management failed to ensure that adequate inspections to properly evaluate the structure were conducted. Preventative measures were not addressed that would maintain the integrity of the steel supporting structure for the bin.

GENERAL INFORMATION

The Cayuga Mine, an underground salt mine, owned and operated by Cargill Deicing Technology, was located in Lansing, Tompkins County, New York. The principal operating officials were Thomas Hayes, Corporate Vice-President of Operations, and Doug Johnson, Operations Manager. The mine operated three eight-hour shifts, seven days per week. Total employment was 194 persons.

Salt was extracted by the room and pillar mining method. The salt was drilled, blasted and transported by Load Haul Dump (LHD) loaders to a belt conveyor system and then processed. The processed salt was conveyed to the surface and stored. The salt was sold for a variety of commercial uses.

The last regular inspection at this operation was completed on February 24, 2010.

Cayuga Crushed Stone, an independent contract trucking service, was located in Lansing, Tompkins County, New York. The principal operating official was Thomas Besemer, Owner. Cayuga Crushed Stone was contracted by the mine operator to transport salt from the surface bin to stockpiles located at the mine.

DESCRIPTION OF THE ACCIDENT

On the day of the accident, Rolland F. Clark (victim) reported for work at 12:00 p.m. David R. Costley (injured miner) reported for work at 2:00 p.m. Both persons reported at their normal starting times. Clark was to haul salt from the salt bin to a stockpile area. Costley worked from the operator's booth located on an elevated deck of the salt bin support structure. At about 6:00 p.m., Clark positioned his tri-axle dump truck under the bin to be loaded. When Costley opened the hydraulic gates to load the truck, the steel connections on the southeast corner of the bin failed and the bin fell on top of the truck, trapping him inside of the truck's cab. The control booth fell to the ground, trapping Costley. Craig Card, Front-end Loader Operator, and Vincent Poole, Production Supervisor, pulled Costley from the debris and placed him on the ground at the north/west side of the structure.

Adam S. Leonard, Contract Truck Driver, observed the collapse and immediately radioed for help. Card and Poole responded and called for emergency medical assistance. Card and Poole aided Costley until emergency medical assistance arrived; however, they did not approach Clark because the structure was unstable. They

attempted to communicate with Clark but did not receive a response. At 6:25 p.m., emergency medical assistance arrived. Costley was life-flight to a near by hospital. Efforts to contact Clark were unsuccessful.

The unstable, collapsed bin and related structures prevented immediate rescue. Efforts continued to reach Clark until they were halted on the evening of March 25, 2010, due to darkness and weather conditions. The next morning, front-end loaders were used to attempt removing the belt conveyor. This method was unsuccessful so a 60 ton and 90 ton crane were used to finish removing the structure and the salt bin.

After the conveyor system and bin support structure were removed, the salt had to be removed from the bin. Approximately 116 tons of salt were removed by vacuum truck. Once the bin was emptied, lifting beams were installed to lift the bin and it was removed from the truck. The recovery efforts were completed on March 28, 2010, when Clark was removed from the truck. At 1:54 p.m., he was pronounced dead by the county medical examiner. Death was attributed to trauma.

INVESTIGATION OF THE ACCIDENT

The Mine Safety and Health Administration (MSHA) was notified of the accident at 6:24 p.m. on March 24, 2010, by a telephone call from Patrick Elston, Hoist Operator, to MSHA's emergency call center. Donald J. Foster, District Manager, was notified and an investigation was started the same day. An order was issued under the provisions of Section 103(j) of the Mine Act to ensure the safety of the miners. At the time of the accident, Charles Schoonover, Mine Safety and Health Inspector, was conducting an inspection when the accident occurred. Schoonover then modified the 103(j) order to a 103(k) order.

MSHA's investigators traveled to the mine, conducted a physical inspection of the accident scene, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine and contractor management and employees.

DISCUSSION

Location of Accident

The accident occurred at the 150-ton-capacity salt storage bin. Salt was conveyed from a 750-ton bin by belt conveyor into the salt bin. Haul trucks transported the salt to one of three adjacent storage areas. The truck involved in the accident was a Mack Model RD600 tri-axle dump truck.

Weather

The weather conditions on the day of the accident were partly cloudy with winds between 5 to10 miles per hour and a temperature of 51 degrees Fahrenheit. Weather was not considered a factor in the accident.

Bin

The bin structure involved in the accident was reportedly constructed in 1989. As shown in Appendix C, the bin and cone portion of the structure were supported by four 14-inch-deep (W14x99) steel columns positioned at each of the four corners of a 25-foot-4-inch by 25-foot-4-inch square frame. Each column extended vertically 29 feet 4 inches above its base, and was supported by a reinforced concrete foundation and anchor bolts. The columns were braced at mid-height by horizontal (W6x25) and diagonal (6 x 4 x ½ back-to-back angles) steel members. The square frame located at the tops of the columns consisted of 24-inch-deep (W24x68) perimeter beams. These perimeter beams were bolted to the support columns.

An octagonal support frame was constructed within the square area outlined by the exterior perimeter beams. The octagonal support frame was positioned between the top and bottom flanges of the exterior beams. Four of the eight structural members of the octagonal support frame were 24-inch-deep (W24x68) beams that spanned approximately 12 feet. These beams connected directly to the exterior perimeter beams. Each of these connections consisted of a single steel shear tab plate, nominally $^{3}/_{8}$ inches thick by 17½ inches high, which was welded to the interior side of the exterior perimeter beam web and bolted to the web end of the 24-inch octagonal support frame beam. The weld of the tab to the exterior perimeter beam extended the full perimeter of the contact surface. Two rows of six bolts were employed to bolt the shear tab to the octagonal frame. The remaining four members of the octagonal support frame were 21-inch-deep (W21x50) beams that spanned approximately 9 feet. These 21-inch beams were oriented parallel to the exterior perimeter beams and were not connected directly to the exterior perimeter beams. They were connected to the web of the 24-inch beams of the octagon with a $^{3}/_{8}$-inch thick steel tab which was connected to the 21-inch beam web with two rows of five bolts and welded to the 24-inch beam web.

The bin's wall was 16 feet 2 inches high. The bin wall extended 9 feet above the hopper connection. Below the hopper connection, the wall extended 7 feet 2 inches to the octagonal support frame below. The full weight of the bin and its contents were transmitted through the 7 feet 2 inches section of the bin wall onto the octagonal support frame and subsequently across the shear tabs to the exterior perimeter beams of the frame. The recessed hopper was 14 feet 8 inches high, with the bottom of the chute approximately 14 feet above the ground. The hopper and bin were constructed of $^{1}/_{8}$ inch thick steel plate with bolted connections at the plate seams. The hopper and bin diameter were approximately 20 feet. A roof was placed on the bin to limit the salt's exposure to water.

The salt bin's structure included the head and drive of the transfer belt conveyor that fed the bin. The belt conveyor was supported at the bin end by two columns that attached to the top of the south exterior perimeter beam of the support frame. A hoist frame for maintenance operations was attached by four columns (two on the east and two on the west exterior perimeter beams). The bin operator's booth and work platforms were positioned approximately 15 feet above the ground and accessed by stairs located on the west side of the structure. A 24-inch diameter screw conveyor, which was not part of the original design, was added to the structure. The bin also contained several vibrators to induce flow.

In 2006, management hired a consulting firm to conduct an inspection of the salt bin structure. A structural evaluation was provided at that time. After the evaluation, the bin and structure were found to be generally sound. However, recommendations were made to management that the structure and bin should be inspected annually and aggressively maintained due to the corrosive nature of the salt. The report recommended specific actions to address existing corrosion and measures to prevent further corrosion.

Inspection of Bin

Investigators inspected the bin after the accident. The support columns did not exhibit significant corrosion or impact damage from trucks.

While relatively minor corrosion was observed at locations throughout the structure, severe corrosion damage was apparent in several of the shear tab connections between the octagon frame beams and the exterior perimeter beams. The shear tabs closest to the southeast support column were in the worst condition. Measurements were taken on all tabs to obtain the effective connective length and average thickness of each failed cross-section. The tab plate at the south end of the east exterior perimeter beam had only 10 percent of its initial cross-sectional area remaining. The shear tab connection at the east side of the south exterior perimeter beam had a similar degree of section loss. The bin weight, including its roof and accessories, was as 28,000 pounds as listed on the design drawings. By direct measurement, management determined the weight of salt in the bin at the time of the accident to be 233,000 pounds. Calculations of the stress on the shear tabs adjacent to the southeast column demonstrated that, at the time of the accident, they were loaded well beyond their capacity.

Failure of the tabs in the southeast corner of the structure led to a redistribution of the bin load, causing higher stresses on the remaining tabs. The redistribution of the load, as well as the introduction of dynamic effects, led to failure of less corroded tabs and the catastrophic collapse of the entire bin. This sequence was further supported by other observations made at the site. The west beam experienced significant torsional deformation during the bin collapse. The octagonal support frame exerted a large torsional force on the west beam as the bin moved and the shear tab connections were strong enough to deform the beam before failing. The scrape marks on the east face of the bin wall and the deformations of the roof on the east side of the bin indicated impact with the east-side exterior beam and possibly the beam in the lower east bay. This was consistent with a failure that initiated at the shear tabs nearest the southeast column. The cause of the collapse was the overloading of the severely corroded shear tab connections between the diagonal beams in the octagon framework and the main exterior perimeter beams adjacent to the southeast column.

Training and Experience

Rolland F. Clark, victim, had 15 years of experience, all with Cayuga Crushed Stone. David R. Costley had 30 years and 26 weeks of mining experience, all at this mine. Both persons had received training in accordance with 30 CFR Part 48.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following root cause was identified.

Root Cause: Management did not ensure that adequate procedures were in place to properly evaluate and maintain the steel supporting structure for the bin.

Corrective Action: Management had consultant engineers conduct detailed evaluations of the existing surface structures to ensure the prompt corrective action of potential safety hazards.

CONCLUSION

The accident occurred because management failed to ensure that adequate inspections to properly evaluate the structure were conducted. The bin and structure collapsed because the overloaded and severely corroded shear tab connections failed. Preventative measures were not addressed that would maintain the integrity of the steel supporting structure for the bin.

ENFORCEMENT ACTIONS

Issued to Cargill Deicing Technology

Order No. 8572533 was issued on March 24, 2010, under the provisions of Section 103(j) of the Mine Act:

A structural failure occurred on the surface of the mine site at the 150-ton salt bin area. One contract miner was trapped inside of a dump truck and one mine employee was seriously injured. The structural failure resulted in the 150-ton bin collapsing onto a tri-axle dump truck underneath, trapping the contract miner inside of the cab. The structural failure also caused the operator's booth for the bin to collapse and fall to the ground causing serious injury to the mine employee. This order is issued to ensure the safety of persons at this operation and prohibits any work in the affected area. The mine operator shall obtain approval from an Authorized Representative for all actions to recover the contract employee and restore operations in the affected area.

The order was subsequently modified to a Section 103(k) order and was terminated on April 1, 2010. Conditions that contributed to the accident no longer exist.

Citation No. 8574822 was issued on May 3, 2010, under the provisions of Section 104(d)(1) of the Mine Act for a violation of 30 CFR 57.14100(c):

An accident occurred at this operation on March 24, 2010, when a 150-ton salt bin and its supporting structure collapsed, fatally injuring a contract truck driver and seriously injuring the miner who operated the bin. The contract truck driver had stopped his truck under the bin for a load when it collapsed. In 2006, the mine operator hired an engineering consultant to evaluate the structural integrity of the bin and supporting structure. The mine operator received the report on the condition of facility. The report stated that annual inspections and preventative measures were necessary to ensure the integrity of the structure. The mine operator engaged in aggravated conduct constituting

more than ordinary negligence by failing to take necessary actions knowing the safety of the structure depended upon effective inspections and implementing preventative measures to ensure the safety of miners. This violation is an unwarrantable failure to comply with a mandatory standard.

The citation was terminated on May 3, 2010. The 150-ton bin and its supporting structure has been dismantled and placed on ground level.

Approved: _____ Date: _____

Donald J. Foster, Jr.
District Manager

APPENDICES

A. Persons Participating in the Investigation
B. Victim Data Sheet
C. Schematic of Accident Scene

APPENDIX A

Persons participating in the investigation.

Cargill Deicing Technology

Craig Bush	Surface Maintenance Supervisor
Barry Carlson	Health & Safety Coordinator
Doug Johnson	Operations Manager
Ryan Weese	Surface Superintendent
Shawn Willynski	Mine Superintendent
Russell Givens	Mine Manager

JPW Structural Contracting, Inc.

Richard Hillenbrand	Field Superintendent

Tompkins County Sheriff's Department

Jody Coombs	Senior Criminal Investigator
Timothy Rumsey	Criminal Investigator
Brad Covert	Sergeant

Mine Safety and Health Administration

Gary C. Merwine	Mine Safety and Health Inspector
Anthony M. Fortino	Mine Safety and Health Inspector
Darren J. Blank, P.E.	Civil Engineer
Michael J. Murawski, P.E.	Civil Engineer

APPENDIX B

Victim Data Sheet

Accident Investigation Data - Victim Information

Event Number: 0 9 1 1 9 5 6

U.S. Department of Labor
Mine Safety and Health Administration

Victim Information: 1

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:
Rolland F. Clark	*M*	*63*	*01 Fatal*

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:	6. Date and Time Started:
a. Date: 03/28/2010 b.Time: 13:54	*a. Date: 03/24/2010 b.Time: 12:00*

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
076 Truck driver	*028 Transporting material from salt bin*	Yes X No

10. Experience	Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days
a. This Work Activity:	*15*	*0*	*0*	b. Regular Job Title:	*15*	*0*	*0*	c: This Mine:	*15*	*0*	*0*	d. Total Mining:	*15*	*0*	*0*

11. What Directly Inflicted Injury or Illness?	12. Nature of Injury or Illness:
013 150 ton salt bin collapsed	*170 Crushing Injuries*

13. Training Deficiencies:
Hazard: | New/Newly-Employed Experienced Miner: | Annual: | Task:

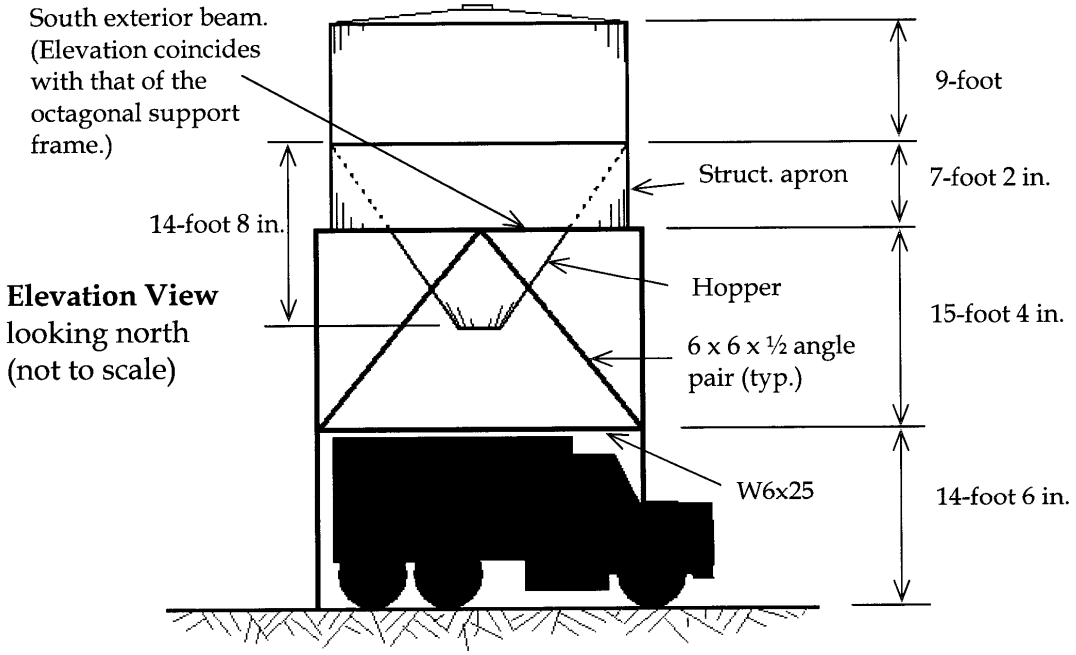
14. Company of Employment: (If different from production operator)
Cayuga Crushed Stone
Independent Contractor ID: (if applicable) *WNK*

15. On-site Emergency Medical Treatment:
Not Applicable: X | First-Aid: | CPR: | EMT: | Medical Professional: | None:

16. Part 50 Document Control Number: (form 7000-1) *220100970016*
17. Union Affiliation of Victim: *9999* *None (No Union Affiliation)*

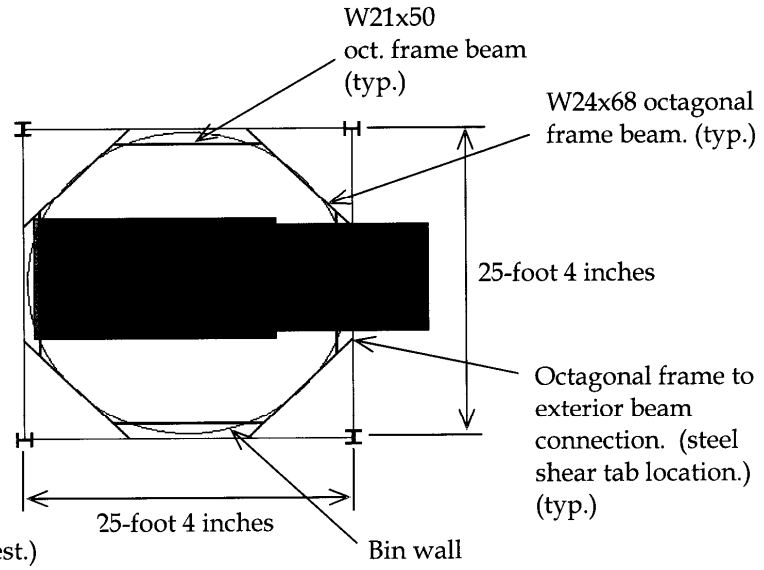
APPENDIX C

Schematic of Accident Scene



Elevation View
looking north
(not to scale)

"X" indicates the victim's location when the accident occurred.



Plan View
(not to scale)

N

(Cayuga Lake lies to the west.)