

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

REPORT OF INVESTIGATION

**Surface Metal Mine
(Alumina)**

**Fatal Machinery Accident
January 31, 2009**

**HydroChem Industrial Services, Inc.
Contractor ID No. WVT**

at

**Sherwin Alumina Company
Sherwin Alumina Company
Gregory, San Patricio County, Texas
Mine ID No. 41-00906**

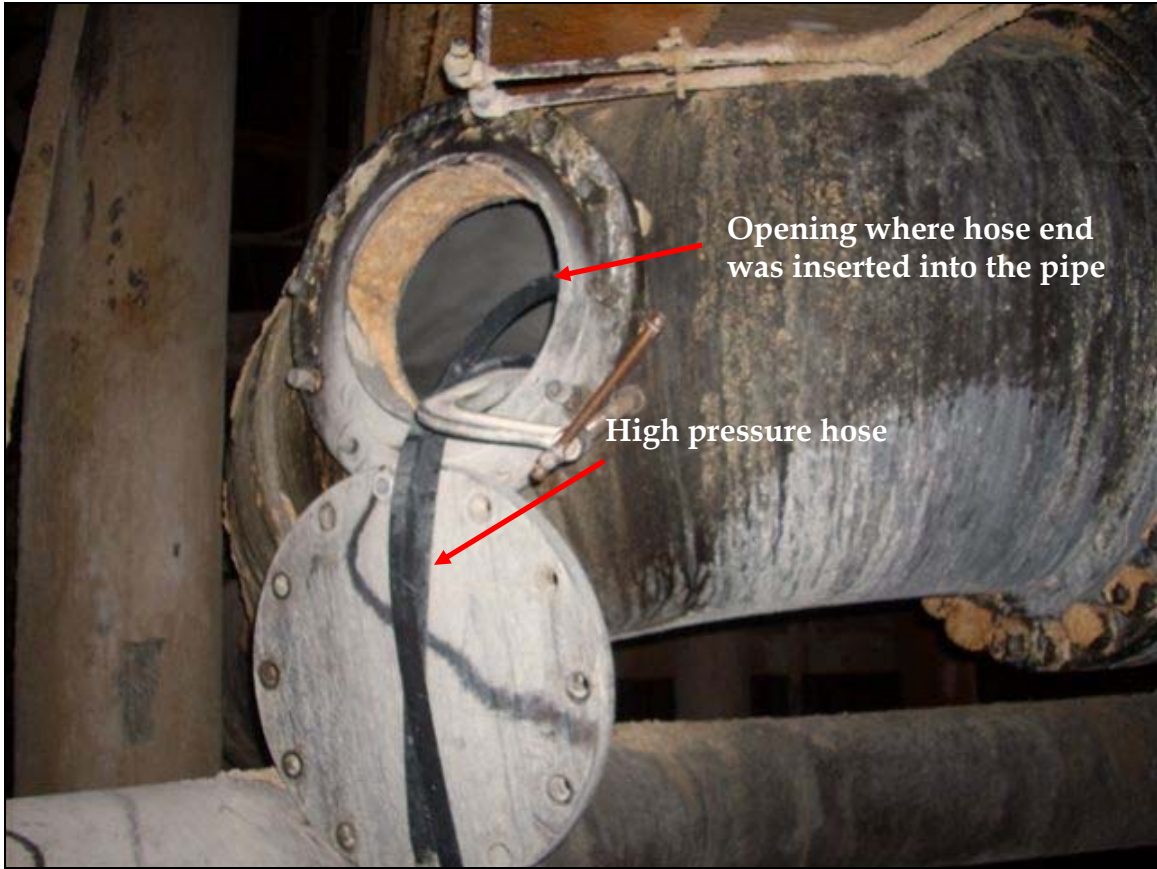
Investigators

**Maria C. Rich
Supervisory Mine Safety and Health Inspector**

**Kevin L. Busby
Mine Safety and Health Inspector**

**Eugene D. Hennen
Mechanical Engineer**

**Originating Office
Mine Safety and Health Administration
South Central District
1100 Commerce Street, Room 462
Dallas, TX 75242-0499
Edward E. Lopez, District Manager**



OVERVIEW

On January 31, 2009, Rodney R. Ballesteros, Sr., hydro-blasting technician, age 40, was fatally injured when he was struck by water from a high pressure hose. He was hydro-blasting the inside of a 30-inch diameter pipe when the hose end and attachments (stinger and nozzle) inadvertently turned and exited the pipe.

The accident occurred because contractor management policies and safe work procedures were not followed during hydro-blasting activities. The stinger was too short for the task and a deflector shield was not placed over the pipe opening. Additionally, the victim did not have access to the dump control valve to stop the flow of water from the high pressure hose.

GENERAL INFORMATION

Sherwin Alumina Company (Sherwin), a surface alumina mill, owned and operated by Sherwin Alumina Company, was located in Gregory, San Patricio County, Texas. The principal operating official was Thomas Russell, vice-president. The mine operated two 12-hour shifts per day, 7 days per week. Total employment was 653 persons.

Bauxite ore was shipped to the mine from various sources. The ore was conveyed to the mill where alumina was extracted from the bauxite by the Bayer process. The finished product was used to produce aluminum metal for a variety of industrial uses.

HydroChem Industrial Services, Inc. (HydroChem), located in Corpus Christi, Texas, was contracted to provide hydro-blasting services at Sherwin. The principal operating official was Randy Rodriguez, branch manager. HydroChem had 10 employees working at Sherwin at the time of the accident.

The last regular inspection at this operation was completed on September 5, 2008.

DESCRIPTION OF THE ACCIDENT

On the day of the accident, Rodney R. Ballesteros (victim) began his shift at 6:50 a.m., a few minutes before his usual starting time of 7:00 a.m. Ballesteros, Isidro Cruz, Jr., equipment technician, and Raymundo Dimas, crew leader, received work instructions from Daniel Lopez, field supervisor, and then went to the 45 precipitation area. Lopez met the crew at the 45 precipitation area and the crew started to work.

The crew was assigned to hydro-blast hydrate that had built up inside several pipes in the 45 precipitation area. They placed a mobile trailer that contained a diesel engine and a water pump on the ground level at the 45 precipitation area and stretched out about 75 feet of high pressure water hose to the mezzanine level. A hose coupling, a pipe coupling, an 8-inch stinger, and a line mole nozzle were added to the end of the hose to create a rigid section beyond the flexible portion of the high pressure water hose that was about 17 inches long.

Dimas was stationed at the trailer to start and stop the diesel engine and pump. Ballesteros attended a dump control valve located about mid-length along the high pressure water hose and Cruz handled the hose end. After Dimas started the engine and pump, Cruz positioned the hose end inside a 10-inch diameter pipe and motioned for Ballesteros to step on the dump control valve. The crew hydro-blasted the 10-inch pipe from 7:30 a.m. until 10:30 a.m.

About 11:00 a.m., the crew moved to the 112 tank in the 45 precipitation area to hydro-blast the inside of a 30-inch pipe using the same hose end attachments that had been used in the 10-inch pipe. They replaced the line mole nozzle with a T-type nozzle and hydro-blasted the 30-inch pipe until 12:00 p.m. when they broke for lunch.

About 12:30 p.m., the crew resumed hydro-blasting the 30-inch pipe. Ballesteros switched duties with Cruz, placing him at the hose end. They continued to work until about 3:15 p.m., when Ballesteros told the others that he wanted to replace the T-type nozzle with a 3-opening nozzle referred to as a “pineapple”.

The T-type nozzle was changed and work resumed on the 30-inch pipe about 3:45 p.m. Dimas started the pump then Cruz stepped on the dump valve. The hose end moved quickly into the pipe but turned 180 degrees and came out of the pipe toward Ballesteros. He was struck by the pressurized stream of water coming from the nozzle, walked several feet, and collapsed on the floor.

Neither Dimas nor Cruz had an unobstructed view of Ballesteros while he was hydro-blasting the inside of the 30-inch pipe but they heard him scream when the hose end came out of the pipe. Dimas rushed to the mezzanine level to Ballesteros while Cruz released the dump control valve and then shut off the water pump. Dimas called plant security for assistance at 3:53 p.m.

The Sherwin emergency response team was paged, went to the accident site, and administered cardio-pulmonary resuscitation. Ballesteros was transported to a local hospital where he was pronounced dead by Amada Cardenas, Justice of the Peace. The cause of death was attributed to penetrating wounds.

INVESTIGATION OF THE ACCIDENT

On the day of the accident, the Mine Safety and Health Administration (MSHA) was notified at 4:50 p.m. by a telephone call from Robert Glover, shift coordinator, to MSHA’s emergency hotline (A citation was issued for untimely reporting). Fred Gatewood, assistant district manager, was notified and an investigation was started the same day. An order was issued pursuant to section 103(k) of the Mine Act to ensure the safety of miners.

MSHA’s accident investigation team traveled to the mine, made a physical inspection of the accident scene, interviewed employees, and reviewed documents and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management, employees, and a miners’ representative.

DISCUSSION

Location of the Accident

The accident occurred 10 feet above ground on the mezzanine level of the 45 precipitation area of the plant. The area was outdoors where the temperature was 62 degrees Fahrenheit and the sky was overcast and cloudy. Weather was not considered to be a factor in the accident.

Hydro-blasting Process

At the time of the accident, a pipe cleaning process referred to as “line moleing” was being used. The process involved attaching a rigid stinger and nozzle to a hose end and inserting them into a pipe. High pressure water from the nozzle was used to clean the inside of the pipe and, with a properly designed nozzle, could propel the hose end into the pipe. Water pressure for cleaning during the line moleing process was controlled by the size and number of openings on the nozzle and the amount of water pumped to it.

The equipment used at the time of the accident included a hydro-blaster, high pressure water hoses, a dump control valve, hose end attachments, and an anti-withdrawal device. The hydro-blaster was located on the ground level of the 45 precipitation area. A ¾-inch water hose ran from the hydro-blaster pump about 39 feet to the dump control valve which was also located on ground level of the plant. From the dump control valve, a ½-inch water hose ran to the work area on the mezzanine level about 10 feet above and 15 feet further from the mobile trailer.

Hydro-blaster

The hydro-blaster involved in the accident consisted of a 300-hp diesel engine and a high pressure water pump mounted on a four-wheel trailer that could be moved from location to location. A 10-speed transmission delivered power from the diesel engine to the pump. The transmission had five speeds in both high and low ranges but only low range was used for this application.

The hydro-blaster operator could control the amount of water pumped through the high pressure water hoses by selecting various transmission gears and increasing or decreasing the engine rotations per minute (RPM).

The water pump was designed to deliver water pressures up to 12,500 pounds per square inch (psi). A rupture disc mounted on top of the pump protected it from higher pressures. The pump was designed to deliver about 52 gallons of water per minute (gpm) at a water pressure of 8,000 psi. This could be achieved by placing the transmission in low range gear 5 and operating the diesel engine at 2200 RPM.

The hydro-blasting crew reported the pressure from the water pump was in the 8,000 to 8,500 psi range at the time of the accident. The transmission was in low range gear 4, therefore the water flow was calculated to be about 43 gpm.

High Pressure Water Hoses

The water hose from the water pump to the dump control valve had a nominal ¾-inch inside diameter and the water hose from the dump control valve to the hose end had a nominal ½-inch inside diameter. Both hoses were high pressure hoses with a rated working pressure of 14,500 psi and a safety factor of 2.5 to 1.

Dump Control Valve

The dump control valve consisted of a foot valve which was covered to prevent accidental engagement. The hydro-blasting technician, or another designated person,

stepped on the dump control valve to allow water to go through the high pressure hose and the stinger. The water flow could be stopped by releasing foot pressure on the dump control valve.

At the time of the accident, the victim did not have access to the dump control valve because it had been placed about 25 feet away on ground level. The valve was being operated by another person whose view of the victim was almost completely obstructed by piping and other plant equipment. The investigators tested the dump control valve to determine if it was operating properly at the time of the accident and no defects were found.

Hose end Attachments

The ½-inch water hose involved in the accident had a 4-inch long rigid end. A hose coupling, a pipe coupling, a stinger, and a nozzle were added to the end of the hose. The total assembled length of the attachments to the hose end was about 13 inches. The total assembled length of the rigid section beyond the flexible portion of the high pressure water hose was about 17 inches.

The stinger was an 8-inch long stainless steel tube threaded on both ends. The 3½-inch long nozzle was referred to as a “pineapple”. The nozzle had one forward opening and two 45-degree backward openings to propel it into a pipe. The investigators tested the nozzle to determine if any of the openings were plugged and no defects were found.

Safety Devices

The safety devices to be used in line moleing included an anti-reversal device, a deflection shield, and an anti-withdrawal device. The anti-reversal device should prevent the hose end from turning 180 degrees inside a pipe. The deflection shield should prevent a hose end from exiting a pipe in the event it turns 180 degrees. The anti-withdrawal device should prevent the hydro-blasting technician from inadvertently pulling the hose end completely out of the pipe as the hose end moves forward and backward in the pipe.

The stinger typically served as the anti-reversal device. However, the stinger involved in the accident was improperly sized so the rigid section was able to turn 180 degrees and exit the pipe. The HydroChem safety manual stated that the combination of hose connections, stinger, and nozzle must be at least one and a half times the diameter of the pipe being cleaned. In situations where the pipe included an intersection, as it did in this case, the safety manual stated that the rigid section should be three times the diameter of the pipe. Accordingly, the total rigid section at the time of the accident should have been about 90 inches long rather than 17 inches long.

A deflection shield was not available on-site at the time of the accident and the hydro-blasting crew reported not using one for over a year. This shield should have been placed over the opening into the 30-inch pipe to prevent back-splash onto the hydro-blasting technician and to prevent the stinger from exiting the pipe if it turned 180 degrees.

The anti-withdrawal device in use at the time of the accident consisted of a 3¼-inch long section of 2-inch wide stainless steel pipe (2.062-inch inner diameter) welded to a 10-inch C-clamp attached to the mouth of the opening where the hose end was inserted into the 30-inch pipe. The high pressure water hose was passed through the 2-inch pipe section before the nozzle was attached. The “pineapple” had an outer diameter of 2 ¼ inches and could not easily slip through the 2-inch stainless steel pipe but the accident occurred when the hose end exited the pipe by going around the C-clamp where the deflection shield should have been installed.

Training and Experience

Rodney Ballesteros had 50 weeks of experience, all with HydroChem. He had received training in accordance with 30 CFR, Part 48.

Isidro Cruz, Jr. had 2 years and 40 weeks of experience, including 1 year and 14 weeks with HydroChem. He had received training in accordance with 30 CFR, Part 48.

Raymundo Dimas had 8 years of experience, including 1 year and 2 weeks with HydroChem. He 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: Contractor management did not ensure that established safe operating procedures were followed during all hydro-blasting activities.

Corrective Action: Contractor management should establish policies to ensure that established safe operating procedures are followed when hydro-blasting work is performed. Persons performing the task should be trained and monitored to ensure the procedures are being followed.

CONCLUSION

The accident occurred because contractor management policies and safe work procedures were not followed during hydro-blasting activities. The stinger was too short for the task and a deflector shield was not placed over the pipe opening. Additionally, the victim did not have access to the dump control valve to stop the flow of water from the high pressure hose.

ENFORCEMENT ACTIONS

Issued to Sherwin Alumina Company

ORDER No. 6461137 was issued on January 31, 2009, under the provisions of Section 103 (k) of the Mine Act:

A fatal accident occurred at this operation on January 31, 2009, when an employee was struck by water from a high pressure hose. This order is issued to assure the safety of all persons at this operation and prohibits all activity at the secondary feed manifold area until MSHA has determined that it is safe to resume normal operations. The mine operator shall obtain prior approval from an authorized representative for all actions to restore operations to the affected area.

This order was terminated on February 25, 2009, after conditions that contributed to the accident no longer existed.

Issued to HydroChem Industrial Services, Inc.

CITATION No.7893957 was issued on February 25, 2009, under the provisions of Section 104(d)(1) of the Mine Act for a violation of 30 CFR 56.14100(b):

A fatal accident occurred at this operation on January 31, 2009, when a contractor employee was struck by water from hydro-blasting equipment. Defects affecting safety were not corrected in a timely manner: the hose end attachment (stinger) used in the hydro-blasting was incorrectly sized, the guard intended to contain the hose end attachment within a pipe was not in place, and the equipment operator was not provided a cut-off valve. The operator engaged in aggravated conduct constituting more than ordinary negligence in that management was aware that the guard was missing and the equipment operator did not have a cut-off valve.

This citation was terminated on February 25, 2009, after management provided deflectors and a cut-off valve for the hydro-blasting technician. All persons were retrained to follow safe operating procedures and to use properly sized hose end attachments.

Approved: _____

Edward E. Lopez
District Manager

Date: _____

APPENDIX A

PERSONS PARTICIPATING IN THE INVESTIGATION

Sherwin Alumina Company

Chester Ingersoll..... hydrate director
Robert Andreas.....safety manager

United Steelworkers Local 235

Juan E. Soto.....miners' representative

HydroChem Industrial Services, Inc.

Richard J. Bellinghausen.....health, safety, environmental, and training manager
William Frederking.....general counsel
Randy J. Rodriguez.....branch manager
Jonathan Rushin.....safety coordinator

Mine Safety and Health Administration

Maria C. Rich.....supervisory mine safety and health inspector
Kevin L. Busby.....mine safety and health inspector
Eugene D. Hennen.....mechanical engineer

APPENDIX B

Accident Investigation Data - Victim Information										U.S. Department of Labor						
Event Number: 1 0 5 6 3 4 4										Mine Safety and Health Administration						
Victim Information: 1																
1. Name of Injured/Ill Employee: <i>Rodney R. Ballesteros</i>		2. Sex <i>M</i>	3. Victim's Age <i>40</i>	4. Degree of Injury: <i>01 Fatal</i>												
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: <i>a. Date: 01/31/2009 b. Time: 17:30</i>					6. Date and Time Started: <i>a. Date: 01/31/2009 b. Time: 6:50</i>											
7. Regular Job Title: <i>116 hydro-blasting technician</i>			8. Work Activity when Injured: <i>039 hydro-blasting the inside of a pipe</i>				9. Was this work activity part of regular job? <table style="margin-left: auto; margin-right: auto;"><tr><td>Yes</td><td><input checked="" type="checkbox"/></td><td>No</td><td><input type="checkbox"/></td></tr></table>					Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	
Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>													
10. Experience a. This		Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:		<i>0</i>	<i>50</i>	<i>0</i>	Job Title:	<i>0</i>	<i>50</i>	<i>0</i>	Mine:	<i>0</i>	<i>50</i>	<i>0</i>	Mining:	<i>0</i>	<i>50</i>	<i>0</i>
11. What Directly Inflicted Injury or Illness? <i>126 high pressure water stream</i>								12. Nature of Injury or Illness: <i>180 multiple lacerations</i>								
13. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:																
14. Company of Employment: (If different from production operator) <i>HydroChem Industrial Services, Inc.</i>										Independent Contractor ID: (if applicable) <i>WVT</i>						
15. On-site Emergency Medical Treatment: Not Applicable: First-Aid: CPR: <input checked="" type="checkbox"/> EMT: <input checked="" type="checkbox"/> Medical Professional: None:																
16. Part 50 Document Control Number: (form 7000-1)										17. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>						