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

REPORT OF INVESTIGATION

Surface Metal Mill
(Alumina)

Fatal Other Accident
January 2, 2007

Alcoa World Alumina Atlantic
Bayer Alumina Plant
Point Comfort, Calhoun County, Texas
Mine ID No. 41-00320

Investigators

Brian P. Goepfert
Supervisory Mine Safety and Health Inspector

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Mine Safety and Health Inspector

Originating Office
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South Central District
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OVERVIEW

On January 2, 2007, John L. Dorton, instrumentation/electrical (IE) technician, age 37, was fatally injured when he opened a valve in the piping system of a vacuum monitoring line and hydrogen fluoride discharged onto his face. Dorton was not wearing a respirator or face shield when he opened the valve in preparation for unplugging the stem.

The accident occurred because management failed to establish procedures to ensure that IE technicians could safely work on vacuum monitoring lines. The procedures provided to IE technicians did not require them to wear a respirator or face shield to protect them from hydrogen fluoride exposure. Additionally, the established procedures did not require the IE technicians to use the special wash out tool designed to seal around the clean out drill bit and prevent pressure or hydrogen fluoride from

escaping during the clean out procedure.

GENERAL INFORMATION

Bayer Alumina Plant, a surface alumina mill, owned and operated by Alcoa World Alumina Atlantic, a division of Alcoa, Inc., was located in Point Comfort, Calhoun County, Texas. The principal operating official was John Ramos, operations manager. The mill operated multiple shifts, 24 hours a day, 7 days per week. Total employment was approximately 840 persons.

Bauxite ore was shipped to the mill from several foreign sources. The ore was conveyed to the mill where The Bayer process was used to extract alumina from the bauxite. The finished product was used to produce aluminum metal and other materials for a variety of industrial uses.

The last regular inspection at this operation was completed on August 31, 2006.

DESCRIPTION OF ACCIDENT

On the day of the accident, John L. Dorton (victim), reported for work at 7:00 a.m., his normal starting time. Dorton and Miguel Monroy, instrumentation/electrical technician, were assigned to check and clean the stems of the vacuum monitoring lines on the aluminum fluoride units. They worked together for a while then started working separately on the various units. This task was performed on a frequent basis at this operation. About 1:40 p.m., Dorton arrived at the vacuum monitoring line on the number 4 unit and removed a pipe-end plug from the outside valve of the pipe stem. When Dorton opened the valve, hydrogen fluoride discharged onto his face.

Dorton walked to the control room and told Albert Marek, control room operator, he had hydrogen fluoride on his face. Marek called for help and applied calcium gluconate gel, a neutralizing agent, to Dorton's face. The plant emergency response team arrived a short time later and escorted Dorton to a waiting ambulance. About 2:00 p.m., Dorton was taken to a hospital for medical treatment. About 6:00 p.m., he was taken to another hospital, via life flight helicopter, for advanced medical treatment. Dorton was pronounced dead at 8:07 p.m. by the attending physician. The cause of death was chemical inhalation.

INVESTIGATION OF ACCIDENT

On the day of the accident MSHA was notified at 5:10 p.m., by a telephone call from Gene Rek, safety specialist, to Ralph Rodriguez, supervisory mine safety and health inspector. 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 the miners' representatives.

DISCUSSION

Location of Accident

The accident occurred near one of ten hydrogen fluoride vacuum monitoring lines of the number 4 aluminum fluoride unit in the chemicals department.

Aluminum Fluoride Process

Aluminum fluoride was made by mixing sulfuric acid and fluorspar, a mined mineral. The mixture was heated in a rotary kiln to produce hydrogen fluoride gas. The hydrogen fluoride gas was moved through a condenser to a converter (via an 8-inch pipeline) where alumina tri-hydrate was added to make aluminum fluoride. The system typically operated under a vacuum of 1.0 to 1.5 inches water gauge.

Hydrogen Fluoride

The material safety data sheet (MSDS) for hydrogen fluoride was created by management on July 7,

1986 and last revised on July 8, 2003. The MSDS indicated that hydrogen fluoride, a colorless gas with a strong irritating odor, is normally found in a fuming liquid or gaseous state. Contact with hydrogen fluoride can cause severe burns to the eyes, mucous membranes, skin, and respiratory tract. Acute overexposures can cause coughing, shock, fluid in the lungs (pulmonary edema) and death with the effects possibly delayed up to 24 hours. The current ceiling threshold limit value (TLV) for hydrogen fluoride, as determined by the American Conference of Governmental Industrial Hygienists, was 3 parts per million (.0003 percent). It readily dissolves in water to form hydrofluoric acid.

Vacuum Monitoring System

The hydrogen fluoride vacuum monitoring system consisted of a 3/8-inch copper tube (monitoring line) that ran parallel to the vertical 8-inch hydrogen fluoride pipe from the condenser to the converter. The monitoring line extended 41 feet vertically to a vacuum sensor and rotometer used to pressurize the monitoring line during some repairs and maintenance. The monitoring line was connected to the 8-inch hydrogen fluoride pipe by a 15 inch long ½-inch diameter pipe (stem line) that was 64 inches above the adjacent walkway. Manual ball valves were installed on either side of the pipe tee connecting the monitoring line to the stem line. The valve between the monitoring line and the 8-inch hydrogen fluoride pipe was open during normal operation but had to be closed to isolate the monitoring line and pressurize it. The other valve was located on the other side of monitoring line at the end of the pipe and was normally closed and plugged. The outer valve had to be open for access to drill through it and remove any blockage in the ½-inch pipe.

The ½-inch pipe frequently filled with hydrogen fluoride condensate that formed when warm hydrogen fluoride moved from the 8-inch pipe to the smaller pipe and monitoring line with their greater cooling surfaces relative to the volume of gas. The ½-inch pipe was slightly declined from the 8 inch pipe, allowing most of the condensation to accumulate near the outer valve.

After the accident, the ball valve closest to the 8-inch pipeline was found closed and the outer ball valve was found slightly open with the pipe-end plug removed. The monitoring line and stem had apparently been pressurized, to check for blockage in the 3/8-inch monitoring line. When the outer valve was opened, the pressure released.

Standard Work Instruction for Instrumentation/Electrical Technicians

A standard work instruction (SWI) for instrumentation/electrical (IE) technicians performing stem cleaning was created on August 31, 2001 and updated in 2002. The SWI warned of possible pressure and hydrogen fluoride in the stem but did not require all the appropriate special protective equipment to protect persons properly from all potential hazards. The SWI required persons to wear a hardhat, safety glasses, safety toe boots, goggles, chemical gloves, and hearing protection. However, a respirator or face shield was not required to be worn. A step by step sequence for this clean out procedure was not addressed in the SWI. A special washout tool was available in other departments of the plant but was not provided to the IE technicians in the chemicals department. This tool prevents hydrogen fluoride discharge from the stem valve during the clean out procedure. The IE technicians were not provided with the same written procedure and policy (SWI) that the maintenance group had been using prior to a departmental reorganization.

Standard Work Instruction for Maintenance Employees

Prior to a departmental reorganization about five years ago, maintenance employees performed stem cleaning on a regular basis. A standard work instruction (SWI) for maintenance employees performing stem cleaning was created on January 9, 2002. The SWI warned of potential hydrogen fluoride drips, leaks, and sprays. It indicated that a hardhat, safety glasses, mono-goggles, safety shoes, hearing protection, hydrogen fluoride cartridge respirator, face shield, and rubber gloves should be worn. It also required the use of a special wash out tool designed to seal around the clean out drill bit and prevent pressure or hydrogen fluoride from escaping during the clean out procedure. The SWI provided a detailed step by step sequence for the clean out procedure and indicated that assistance should be used when performing the clean out task due to the potential hazards from the hydrogen fluoride.

Training and Experience

John Dorton had 2 years and 27 weeks of experience at this operation. He had worked one year and

nine weeks in the chemicals department and had cleared monitoring line stems periodically throughout that time. Dorton had received training in accordance with 30 CFR, Part 48.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following root causes were identified:

Root Cause: Management standards, controls, and policies were inadequate. They failed to require that the appropriate special protective equipment be used by IE technicians assigned to remove blockage within monitoring line stems.

Corrective Action: Management should review all standard work instructions related to possible exposure to chemicals or gases that pose health or safety risks to personnel. Standard work instructions should be modified as necessary to ensure that employees can safely complete the task of cleaning vacuum monitoring lines.

CONCLUSION

The accident occurred because management failed to establish procedures to ensure that IE technicians could safely work on vacuum monitoring lines. The procedures provided to IE technicians did not require them to wear a respirator or face shield to protect them from hydrogen fluoride exposure. Additionally, the established procedures did not require the IE technicians to use the special wash out tool designed to seal around the clean out drill bit and prevent pressure or hydrogen fluoride from escaping during the clean out procedure.

ENFORCEMENT ACTIONS

ORDER No. 7886311 was issued on January 2, 2007, under the provisions of Section 103(k) of the Mine Act.

> An accident occurred at this operation on January 2, 2007, when an instrument electrician was hit in the face with hydrogen fluoride from an open valve. A verbal 103(k) order was issued on January 2, 2007 at 5:20 p.m. to ensure the safety of all personnel at this operation. The order prohibits all activity at the accident site until MSHA has determined that it is safe to resume normal operations.

This order was terminated on February 2, 2007, after conditions that contributed to the accident no longer existed.

CITATION No. 6261414 was issued on January 23, 2007, under the provisions of Section 104(d)(1) of the Mine Act for a violation of 56.15006:

> On January 2, 2007, an instrumentation/electrical (IE) technician was fatally injured when he encountered hydrogen fluoride (HF) while not wearing a respirator or face shield. The victim had just opened a stem valve of a monitoring line, in preparation for unplugging the stem, when the HF discharged onto his face. The written procedures provided to IE technicians did not require a respirator or face shield to perform this work even though the operator was aware of the hazards associated with HF and the possibility of a discharge. The operator engaged in aggravated conduct constituting more than ordinary negligence. This was an unwarrantable failure to comply with a mandatory standard.

This citation was terminated on February 2, 2007, after management adopted new safe work procedures to check and clean the vacuum monitoring lines. All employees required to check and clean the vacuum monitoring lines have been trained in the new procedures and are required to wear appropriate special protective clothing and equipment including; steel toe rubber boots, goggles, chemical suit, chemical resistant gloves, hydrogen fluoride respirator, and face shield.

Related Fatal Alert Bulletin:

FAB07M01

Fatality Overview:

PowerPoint / PDF

APPENDIX A

Persons Participating in the Investigation

Alcoa World Alumina Atlantic

Benjamin J. Ferguson ..... senior health and safety engineer
Christopher M. Hill ..... production supervisor
Delano R. Kinsfather ..... production process leader
Miguel Monroy ..... instrumentation/electrical technician
Gene Rek ..... safety specialist
Shivajee Sinha ..... environment, health, safety-global products
Alex W. Toskovich ..... chemical/raw materials manager

United Steel Workers of America

Kenneth R. Custer ..... miners' representative
Peter G. Klassen ..... miners' representative
Jimmie J. Roznovsky ..... miners' representative

Mine Safety and Health Administration

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