



# Georgia-Pacific Hydrogen Sulfide Release

Pennington, Alabama January 16, 2002

On January 16, 2002, two workers were killed and eight others injured when they inhaled deadly hydrogen sulfide gas leaking from an underground process sewer at the Georgia-Pacific Naheola mill in Pennington, Alabama. Among the injured were workers who attempted to assist their colleagues from the deadly cloud. The gas was the product of a sudden, uncontrolled chemical reaction taking place in the sewer as the men worked above.

The accident occurred in the vicinity of a tank truck unloading station at the Naheola mill, which makes products like tissue paper, towels, and cardboard from wood pulp. Nine of the victims were employees of Burkes Construction Company, who were working on a maintenance project near the unloading station. The tenth victim was a driver from a local trucking company.

## STAGE SET FOR DEADLY REACTION

The plant's pulp-making process involves treating wood chips with chemicals such as sodium hydrosulfide (sometimes abbreviated by its chemical formula NaSH and pronounced NASH). NaSH solution was delivered to the mill periodically by tank truck. CSB determined that 15 trucks had delivered sodium hydrosulfide to the unloading station in the 24 hours leading up to the accident, losing up to five gallons of the liquid into a collection pit during each delivery.

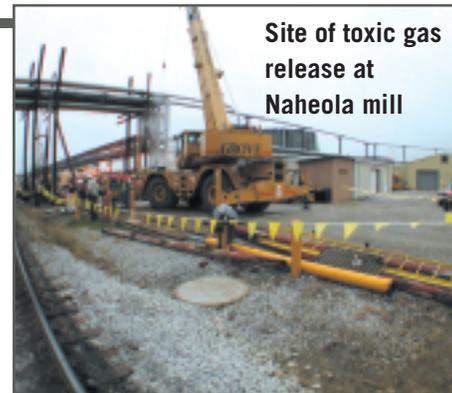
As the NaSH deliveries continued, several Burkes employees were working on a project which would require them to stand in the collection pit. To assist them, a mill operator opened a valve to drain the contents of the pit into the wastewater system.

Unknown to the operator, the collection pit drained directly into a sewer line where sulfuric acid was being added to treat

## DANGERS OF HYDROGEN SULFIDE

Hydrogen sulfide, or H<sub>2</sub>S, is a colorless, flammable, extremely toxic gas. A component of "sewer gas," hydrogen sulfide is found in industrial as well as municipal sewer systems. Hydrogen sulfide can be formed in various ways, such as the decomposition of organic matter or the reaction of sulfides with acid. It has a rotten egg odor that most people can smell at very low concentrations. However, exposure at higher concentrations deadens the sense of smell, resulting in an inability to detect the gas. Exposure to the gas at concentrations of 500 parts per million (ppm) causes unconsciousness. Concentrations as low as 700 ppm can cause immediate death.

the mill effluent. As soon as the sodium hydrosulfide from the collection pit contacted the acidic contents of the sewer, it began reacting to form hydrogen sulfide gas.



Site of toxic gas release at Naheola mill

The hydrogen sulfide gas leaked through the seal of a fiberglass manhole cover near the Burkes construction workers. All ten victims were exposed to the escaping gas. Three workers were overcome almost immediately and fell to the ground. Instead of evacuating the area, three of the remaining workers attempted to drag the fallen men to fresh air. Two of them passed out in the course of assisting the others. Mill workers farther away saw the victims collapsing and called in emergency help.

Two Burkes workers died rapidly of hydrogen sulfide poisoning. Seven other Burkes employees and one driver, a Davison Transport employee, were injured from exposure to the gas. Six county paramedics who transported the victims later reported symptoms consistent with hydrogen sulfide exposure — evidently due to gas released from the victims and their clothing — but none required hospitalization.

## INADEQUATE ENGINEERING & SAFETY PRACTICES

The immediate cause of the accident was the unexpected chemical reaction producing hydrogen sulfide gas. Looking into root causes, the CSB found the plant — then owned by James River Corporation — did not follow good engineering practices when in 1995 the drain from the collection pit was connected to the sewer line where acid was periodically added. There was no review of the potential hazards that might result when chemicals from the collection pit mixed with other materials in the sewer line. The plant did not identify the unloading station as a hydrogen sulfide risk area and did not install any gas warning devices.

There had been earlier indications of problems with the fiberglass manhole cover from which the hydrogen sulfide escaped. Employees reported previous occasions where another toxic gas, chlorine dioxide, leaked through the seal

of the manhole cover. However, these leaks were not reported or investigated as near-miss incidents. Maintenance personnel repaired the leaks but were unable to find a permanent solution to the problem. Had the earlier incidents been investigated, it is likely that management would have redesigned the sewer system opening, the CSB said.

#### SAFETY INFORMATION NOT CONSIDERED IN DESIGN

The material safety data sheet provided by the sodium hydrosulfide manufacturer states that the chemical will react with acids to generate hydrogen sulfide gas and should be prevented from entering potentially acidic sewers. Plant management did not incorporate this safety information in designing the truck unloading area and sewer system or in developing plant procedures and worker training.

Hydrogen sulfide is a known hazard at pulp mills. But not having identified the truck unloading station as a hydrogen sulfide hazard area, Georgia-Pacific did not require Burkes Construction to provide its workers with detailed hydrogen sulfide safety training. The CSB report said the contract workers involved in the incident had only a minimal awareness of the gas and its hazards. The victims did not know how to respond appropriately when the gas release occurred, and several attempted to aid injured coworkers without protective equipment, increasing their own exposure.



Collection drain next to tank truck unloading station

#### RECOMMENDATIONS

In approving the report on November 22, 2002, the U.S. Chemical Safety Board issued a number of safety recommendations designed to prevent similar accidents.

##### To the Georgia-Pacific Corporation:

The Board called on the parent company to conduct periodic safety audits of all of its pulp and paper mills. The company should evaluate sewers and identify potential hazards from chemical reactions, particularly when changes are made to sewer lines. The CSB said the company should identify mill areas where hydrogen sulfide gas could be present, provide warning devices, and train personnel to recog-

nize the presence of hydrogen sulfide. The company should ensure adherence to various other good safety and engineering practices.

##### To the Naheola Mill:

The Board issued additional recommendations to the Naheola Mill. The CSB said the mill should establish programs to prevent sodium hydrosulfide from entering potentially acidic sewers, as recommended by the chemical's manufacturers, and should also require the proper design and maintenance of manhole seals where hazardous materials are present.

The plant should require hydrogen sulfide emergency response training for company employees and contract workers, including training on rescue procedures. The Board also recommended that Burkes Construction provide similar training for its workers.

#### REACTIVE HAZARDS - A WIDESPREAD PROBLEM

The CSB defines a reactive incident as a sudden event involving an uncontrolled chemical reaction — with significant increases in temperature, pressure or gas evolution that causes, or has the potential to cause, serious harm to people, property or the environment. A CSB study released in 2002 identified 167 reactive incidents which caused 108 deaths over a twenty-year period. More than half involved chemicals like sodium hydrosulfide that are not covered by OSHA and EPA process safety regulations. The CSB recommended that the agencies expand regulations to reduce reactive hazards, saying they posed an ongoing danger to workers and the public.

##### To the Agency for Toxic Substances and Disease Registry (ATSDR):

The CSB recommended that ATSDR evaluate and amend its Medical Management Guidelines to consider the risk to responders handling victims exposed to high levels of hydrogen sulfide gas. ATSDR was urged to specify procedures for decontaminating victims. ATSDR should communicate guideline changes to organizations such as the American Association of Occupational Health Nurses.

The CSB called on several other organizations to communicate the report's findings and recommendations to their members: the American Forest and Paper Association; the Pulp and Paper Safety Association; and the Paper, Allied-Industrial, Chemical & Energy Workers International Union (PACE) and the International Brotherhood of Electrical Workers (IBEW), which represent employees at the mill.

#### NOTICE:

The CSB is an independent federal agency charged with investigating industrial chemical accidents and hazards. The CSB determines the root causes of accidents and issues safety recommendations to industry, labor, and other government agencies. CSB Investigation Digests are not intended to substitute for the official, Board-approved reports, which can be obtained from the agency's web site, [www.csb.gov](http://www.csb.gov). The web site also has complete, up-to-date information on the implementation status of all CSB safety recommendations. Comments or suggestions, please write to [info@csb.gov](mailto:info@csb.gov).