Investigation Update

July 2026

This document provides an update on the CSB's investigation of the January 27, 2026, incident at the Woodland Pulp mill in Baileyville, Maine.

Figure 1. Woodland Pulp, LLC, mill. (Credit: Woodland Pulp, LLC)

Incident Summary

- Two employees of Woodland Pulp were fatally injured after highly toxic hydrogen sulfide (also known as "H_2S") gas was released from holes and process openings in equipment into a process building at the mill where a number of employees were present. Hydrogen sulfide gas is considered "immediately dangerous to life and health" ("IDLH") at a concentration of 100 parts per million ("ppm"). The toxic hydrogen sulfide gas was produced by a chemical reaction between sulfuric acid and high-pH sulfur-containing process fluids in a process piping system at the mill called an "acid sewer." The sulfuric acid and high-pH process fluids were added to the acid sewer during a plant shutdown. Twelve employees, including the two fatally injured, were exposed to toxic hydrogen sulfide gas. The two fatally injured employees, a 20-year-old co-op chemical engineering student and a 26-year-old chemical engineer with less than five months of experience at the facility, were inside the process building during the shutdown operations and were near the process equipment openings from which the toxic hydrogen sulfide gas entered their work area. The two employees were likely

working on an equipment drawing project unrelated to the shutdown. Both employees were likely exposed to over 500 ppm of the toxic hydrogen sulfide gas.

Background Information

- Woodland Pulp, LLC ("Woodland Pulp"), located in Baileyville, Maine, has had a series of owners since its founding in 1904. The current owner is the International Grand Investment Corporation, which purchased the facility in 2010.
- The Woodland Pulp mill chemically processes wood chips into material called "pulp," which is a key ingredient in papermaking. Some of Woodland Pulp's chemical processes at the facility, including an area called the "Bleach Plant" where the pulp is whitened, are housed in a four-story building called the "Kraft Mill."
- Prior to 2018, the only process in the facility subject to the Occupational Safety and Health Administration ("OSHA") Process Safety Management ("PSM") regulation was a process that created chlorine dioxide. In 2018, however, Woodland Pulp and OSHA reached an agreement that the mill was not covered by the PSM regulation because it did not store or utilize regulated chemicals at or above a concentration of one percent.[a] Although Woodland Pulp continued to apply some of the PSM regulations' requirements to the chlorine dioxide process, the company did not do so for the portion of the mill involved in the January 2026 incident.
- The pulp mill is equipped with an acid sewer pipe, over 1,000-feet-long, that flows by gravity from the Bleach Plant to the pulp mill's Wastewater Treatment Plant (**Figure 2**). The acid sewer collects discharges from multiple sources as it travels to the Wastewater Treatment Plant, including liquid overflow from the Bleach Plant's scrubber and from another unit called the "Lime Kiln". These discharges can be high in various alkaline (also called "basic" or "high-pH") process fluids, such as solutions of sodium hydroxide, sodium sulfide, sodium carbonate, calcium carbonate, and calcium oxides, as well as other compounds and organics used or produced in the pulping process. Sulfuric acid is added to the acid sewer to control the pH of the total plant effluent before it is pumped to the secondary treatment lagoon, located approximately one and a half miles from the Wastewater Treatment Plant.

[a] Per an OSHA July 18, 2016 interpretation memorandum, "In determining whether a process involves a chemical (whether pure or in a mixture) at or above the specified threshold quantities listed in Appendix A, the employer shall calculate: (a) the total weight of any chemical in the process at a concentration that meets or exceeds the concentration listed for that chemical in Appendix A, and (b) with respect to chemicals for which no concentration is specified in Appendix A, the total weight of the chemical in the process at a concentration of one percent or greater." Process Safety Management of Highly Hazardous Chemicals and Covered Concentrations of Listed Appendix A Chemicals | Occupational Safety and Health Administration

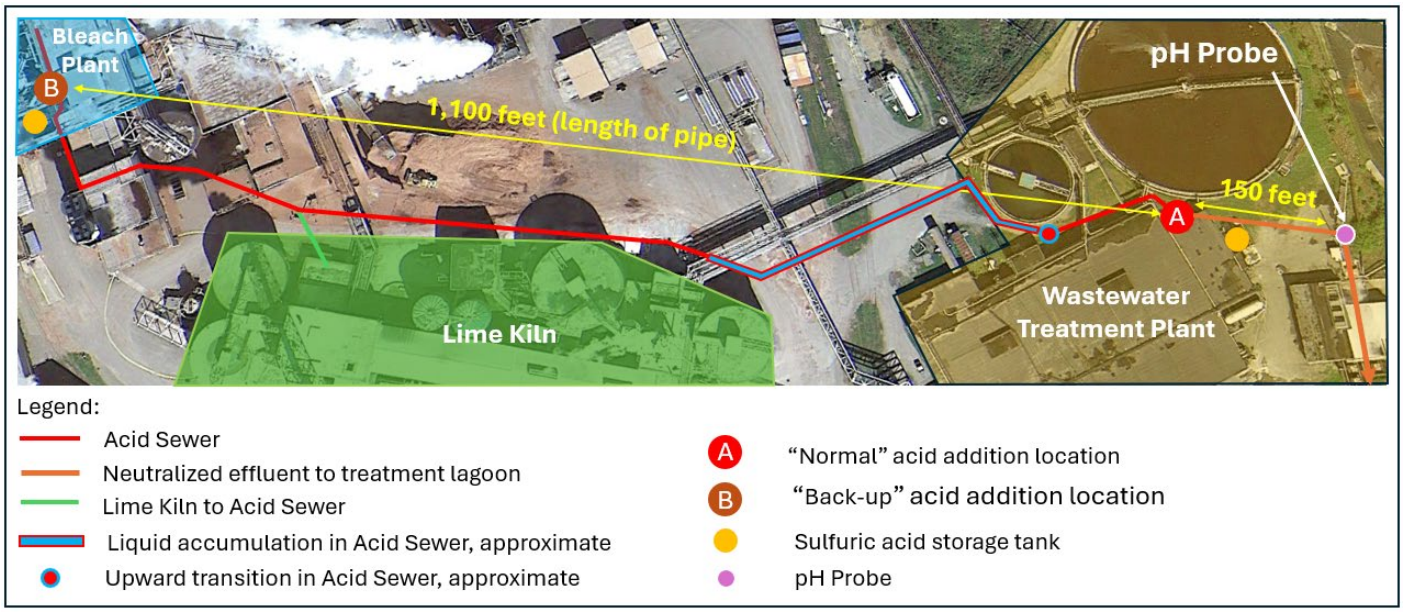

Figure 2. Acid sewer with locations of acid addition points from the Bleach Plant. (Credit: CSB)

- The acid sewer was installed in the mid-1960s and underwent numerous modifications, including in the mid-1970s, when a portion of upward-flowing piping (an "upward transition") was added (**Figure 2**). The upward transition spans about five feet vertically and 35 feet horizontally. The upward transition causes the upstream portion of the acid sewer, consisting of greater than 300 feet of piping, to accumulate liquid (**Figure 3**).

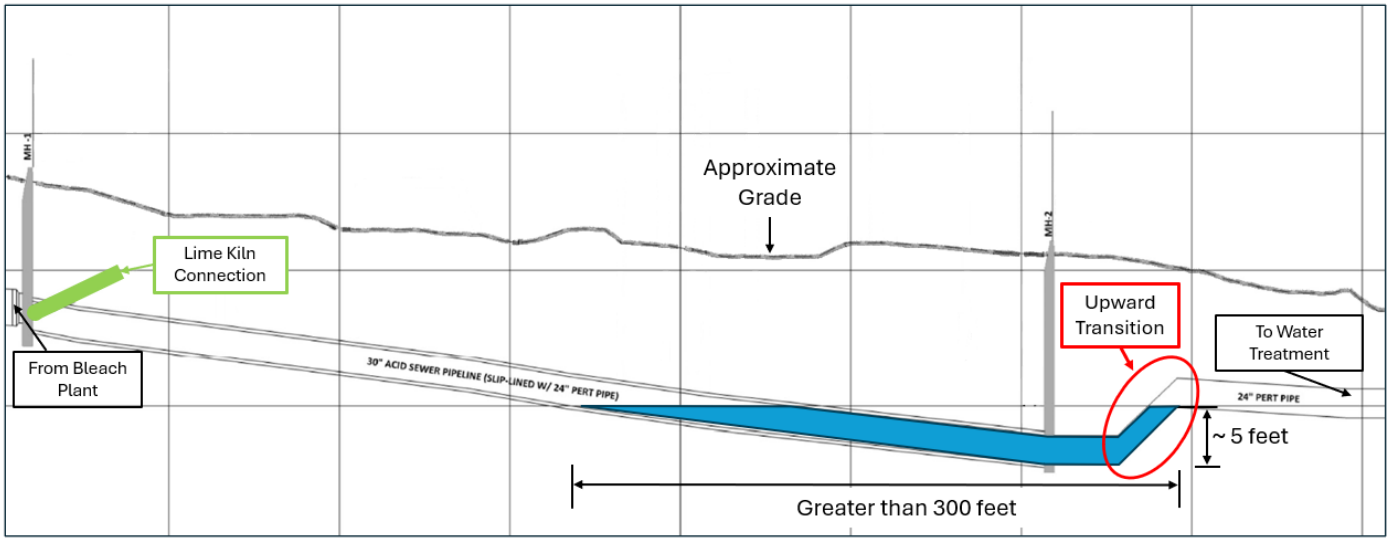

Figure 3. Upward transition and portion of acid sewer piping where liquid accumulates. (Credit: CSB)

- When sulfuric acid combines with high-pH sulfur-containing process fluids, such as sodium sulfide, in the acid sewer, the substances react to produce hydrogen sulfide gas.[a] A Woodland Pulp safety data sheet for a high-

[a] An excess of sulfuric acid reacts with sodium sulfide and other sulfur compounds to form hydrogen sulfide, among other products [4].

pH sulfur-containing process fluid warns about this, stating, “Do not permit contact with acidic materials due to potential to release toxic hydrogen sulfide.”

- Hydrogen sulfide is a colorless gas under normal temperatures and pressure and is heavier than air [1]. Hydrogen sulfide has a characteristic rotten egg odor and can be detected by most people at concentrations of 0.01 to 1.5 parts per million in air [2]. The concentration of hydrogen sulfide that is immediately dangerous to life and health is 100 parts per million.

- As shown in **Table 1** exposure to hydrogen sulfide can cause a range of symptoms and consequences, from mild irritation to death, depending upon on the concentration and length of exposure.

Table 1. Short-term (acute) symptoms and effects of hydrogen sulfide [3]

Inhalation of Hydrogen Sulfide

Concentration (ppm)	Health Effects
0.05	Rotten egg odor detectable by most humans
0.13–30	Obvious and unpleasant odor
50–150	Olfactory fatigue (temporary loss of smell) and marked dryness and irritation of nose and throat. Prolonged exposure may cause runny nose, cough, hoarseness, headache, nausea, shortness of breath, and severe lung damage (pulmonary edema).
200–250	Worsening and more rapid onset of the above health effects; possible death in 4 to 8 hours.
300–500	Excitement, severe headache and dizziness, staggering, unconsciousness, and respiratory failure likely in 5 minutes to 1 hour; possible death in 30 minutes to 4 hours.
500+	Rapid onset of severe toxicity, respiratory paralysis, and death. If not fatal, may cause long-term effects such as memory loss, paralysis of facial muscles, or nerve tissue damage.
800–1,000	May be immediately fatal after one or more breaths, resulting in an instant unconsciousness or “knock-down” effect.

- The Bleach Plant’s scrubber creates a vacuum on equipment in the Bleach Plant, including the portion of the acid sewer in the Bleach Plant (**Figure 4**). The vacuum is created by a fan connected to the scrubber outlet that pulls the gas through the scrubber. The scrubber removes contaminants from the gas streams before discharging to the atmosphere.

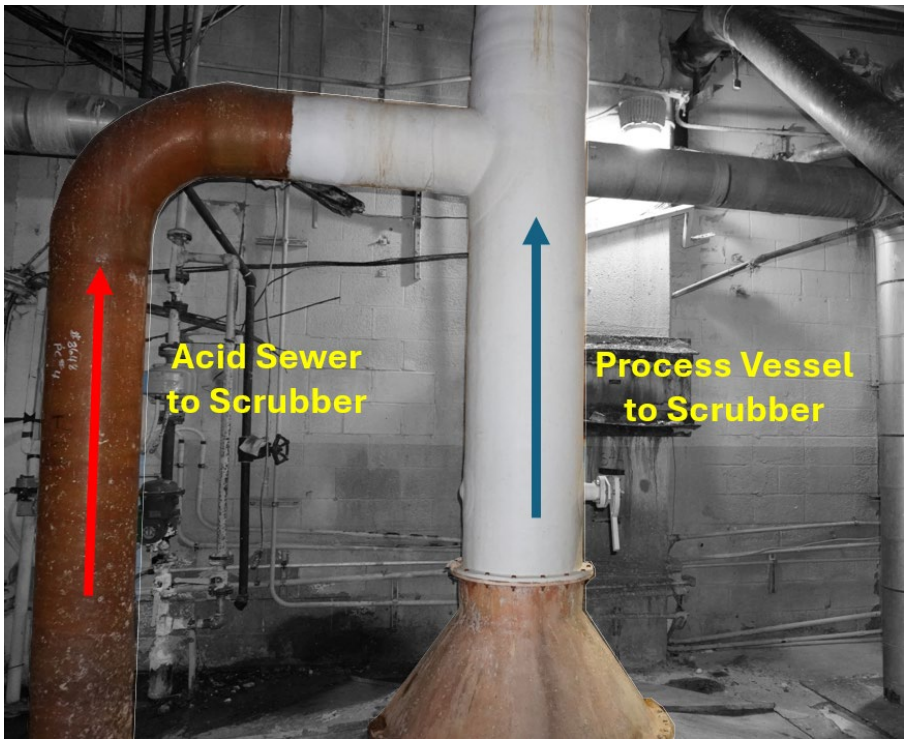

Figure 4. Connections to the Bleach Plant Scrubber from the acid sewer and from a process vessel. (Credit: CSB)

- About six months before the incident, the acid injection system, which feeds sulfuric acid to the acid sewer at the Wastewater Treatment Plant (see **Point A** in above **Figure 2**), was damaged, and subsequent maintenance efforts failed to repair the acid injection system in a timely manner. As a result, Woodland Pulp began using a backup sulfuric acid feed system, located over 1,000 feet upstream of the original feed location (see **Point B** in above **Figure 2**), to reduce the pH of the total plant effluent before it was pumped to the secondary treatment lagoon. About a month before the incident, the acid addition controls at this back-up location were modified to automatically add sulfuric acid to the acid sewer based on the pH measurements from a pH probe at the Wastewater Treatment Plant (above **Figure 2**).

Incident Description

- On January 26, 2026, Woodland Pulp management decided to shut down most of the mill due to a large increase in the price of natural gas, which caused significantly higher operating expenses. Woodland Pulp began shutting down most of the mill on the morning of January 27, 2026.

- Between about 12:30 a.m. and 2:30 a.m. on January 27, 2026, operators began shutting down and draining equipment in the Bleach Plant. Process fluids with a high pH and containing sulfur compounds flowed into the acid sewer from the scrubber and from the Lime Kiln. The pH probe at the Wastewater Treatment Plant detected a high pH, triggering an automatic increase in sulfuric acid addition to the acid sewer beginning at around 4:00 a.m.

- Both the sulfuric acid and the high-pH process fluids accumulated upstream of the acid sewer piping's upward transition. Some of the accumulated materials reacted and formed hydrogen sulfide gas.[a]

- The sulfuric acid that combined with the high-pH process fluids lowered the mixture's pH. However, during the shutdown and draining operations, a relatively small amount of process fluid was fed to the acid sewer, increasing the time it took for the liquid to flow past the upward transition and reach the pH meter, which was located a significant distance downstream (**Figure 2**). As a result, the pH probe near the Wastewater Treatment Plant continued to detect a high pH in the fluid and called for additional automatic sulfuric acid feed, which reacted with the sulfur compounds flowing into the acid sewer piping, generating toxic hydrogen sulfide gas.

- At approximately 11:40 a.m., the Bleach Plant's scrubber fan was turned off as part of the shutdown operations. As a result, the toxic hydrogen sulfide gas that was formed inside the acid sewer was not removed from the piping in the Bleach Plant. Instead, the toxic hydrogen sulfide gas accumulated in the acid sewer at the Bleach Plant, the gas collection piping that fed to the scrubber, and the connected process vessels.

- On the first floor of the Kraft Mill, valves were opened between 10:30 a.m. and noon to empty liquid from two process vessels to a drain on the floor. The process vessels were connected at the top to the scrubber's gas collection system and at the bottom to the acid sewer. Due to this configuration, once the two vessels emptied of liquid, they began to fill with toxic hydrogen sulfide gas when the scrubber fan shut down. The toxic hydrogen sulfide gas flowed out through the open drain valves into the Kraft Mill building. Eight employees on the first floor were exposed to the toxic hydrogen sulfide gas. One of these employees fell to the floor unconscious before reviving and escaping from the building, where he recovered when he was able to reach fresh air. The other seven employees on the first floor experienced minor symptoms from exposure to the toxic hydrogen sulfide gas release, including burning eyes, burning throat, and headache. Two other employees, one on the second floor[b] and one on the third floor, were also exposed to non-fatal concentrations of toxic hydrogen sulfide. None of these ten employees (eight on the first floor, one on the second floor, and one on the third floor) was hospitalized after the incident. These ten exposed employees were not wearing personal monitors that would alarm when in the presence of hydrogen sulfide, as the company did not provide them. In addition, there were no stationary hydrogen sulfide detectors installed in the Bleach Plant to alert personnel of a hydrogen sulfide release.

- On the second floor of the Kraft Mill, multiple holes and process openings in the equipment allowed toxic hydrogen sulfide gas to enter that floor of the building, including (A) an irregularly shaped, roughly six-inch by two-inch hole in a fiberglass gas collection pipe, likely caused by unintentional impact during maintenance work in the area, (B) a tank vent pipe with two one-inch diameter holes drilled, which in 2006 were used for gas flow measurements but were never plugged, and (C) a two-inch diameter, open drain pipe that, by design, was typically used to remove condensation from the gas collection piping (**Figure 5**). These process openings were all in close proximity in one area on the second floor of the Kraft Mill, referred to herein as the "hydrogen sulfide release zone" (**Figure 6**).

[a] An excess of sulfuric acid reacts with sodium sulfide, and other sulfur compounds to form hydrogen sulfide, among other products [4].

[b] **Figure 7** shows the location of this employee on the second floor, in a different area away from where the two fatally injured employees were.

Figure 5. Process openings on the second floor of the Kraft Mill (Credit: CSB)

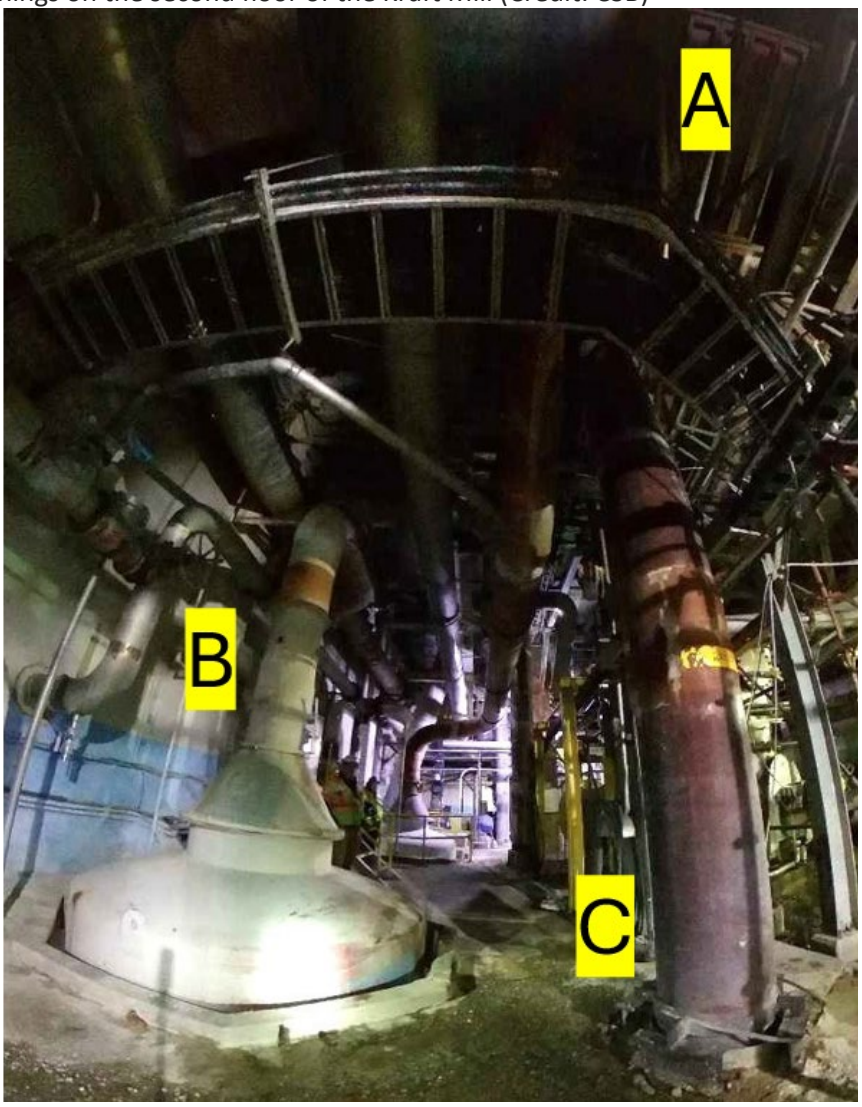

Figure 6. Locations of the three process openings on the second floor of the Kraft Mill, which created the "hydrogen sulfide release zone." (Credit: CSB)

- The two fatally injured employees were on the second floor of the Kraft Mill building during the shutdown operations, likely working on an equipment drawing project unrelated to the shutdown. The equipment to be assessed for their project was located about 15 to 20 feet from the hydrogen sulfide release zone. They were

later found collapsed on the floor in the hydrogen sulfide release zone, where they had been exposed to toxic hydrogen sulfide gas, likely in excess of 500 ppm. The two fatally injured employees were not wearing personal monitors that would alarm when in the presence of hydrogen sulfide, as they were not provided by the company. In addition, there were no stationary hydrogen sulfide detectors installed in the Bleach Plant to alert personnel of a hydrogen sulfide release.

- When Woodland Pulp employees discovered the high hydrogen sulfide levels in the building, they began an emergency response. Employees closed the manual emergency shut-off valve at the sulfuric acid supply tank and opened a manual water flush valve to the acid sewer, which flushed the accumulated chemicals past the upward transition. The remaining toxic hydrogen sulfide gas in the building dissipated by 3:00 p.m., roughly three hours after the Bleach Plant's scrubber fan was turned off and the gas began accumulating in the acid sewer at the Bleach Plant, the gas collection piping that fed to the scrubber, and the connected process vessels.

- At approximately 6:15 p.m., more than three hours after the remaining toxic hydrogen sulfide gas had dissipated in the building, the two employees were found collapsed on the second floor of the Kraft Mill in the hydrogen sulfide release zone. They were transported by ambulance to Calais Community Hospital and then were life-flighted to the Northern Light Eastern Medical Center, a trauma center in Bangor, Maine. The co-op chemical engineering student died on January 28, 2026, and the chemical engineer passed away on February 16, 2026, after he was taken off life support.

- **Figure 7** shows the locations of toxic hydrogen sulfide releases into the Kraft Mill and the locations of employees who were exposed to the toxic hydrogen sulfide gas.

- In addition to the fatalities and injuries, the property damage from the incident, which includes loss of use, exceeded $16 million.

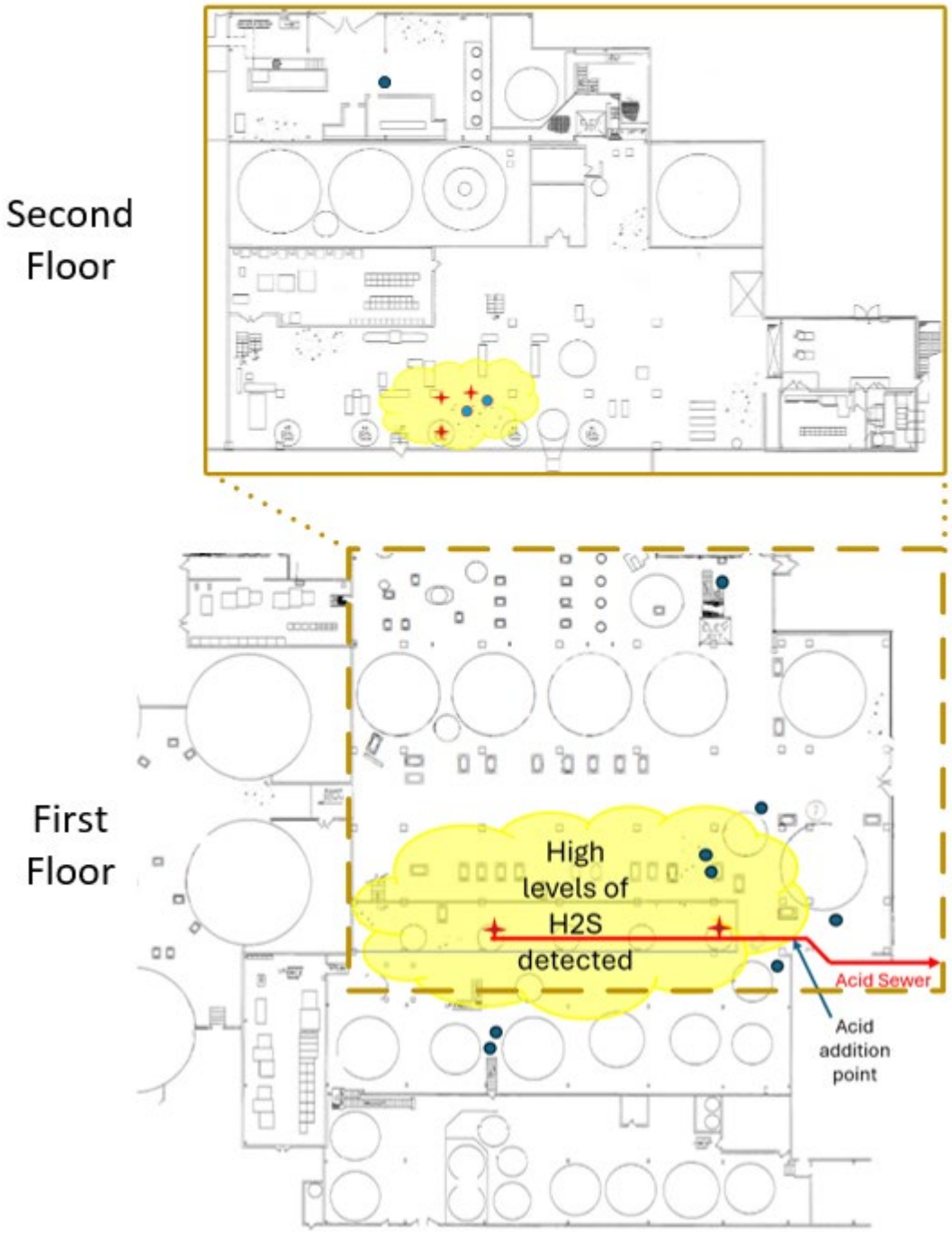

Figure 7. Dark blue dots indicate approximate locations of the employees exposed to non-fatal concentrations of toxic hydrogen sulfide gas, and light blue dots indicate the location of the two fatally injured employees on the second floor. The red "+" indicates the approximate locations of the open drain valves on the first floor and the holes and process openings in the equipment on the second floor. An additional exposure (not shown) was on the third floor. (Credit: CSB)

Additional Information

- There was no system for controlling or accounting for personnel present in the Kraft Mill building, or their locations, during the unit shutdown.
- There was no system providing Kraft Mill building ventilation during either normal operations or shutdowns.
- There were no stationary hydrogen sulfide detectors or alarms in the Bleach Plant area of the Kraft Mill, and the company did not provide or require personnel to wear clip-on type hydrogen sulfide monitors.

Path Forward

- The CSB is continuing to gather facts and analyze several key areas, including:
    - Hydrogen sulfide detection, alarms, and response
    - Kraft Mill access control
    - The site's process safety practices, including operating procedures, identification and control of hazards, management of change, maintenance practices, and investigation of process incidents
- The investigation is ongoing. Complete findings, analyses, and recommendations, if appropriate, will be detailed in CSB's final investigation report.

References

[1] CAMEO Chemicals, "Hydrogen Sulfide," [Online]. Available: https://cameochemicals.noaa.gov/chemical/3625. [Accessed 24 March 2026].

[2] Occupational Safety and Health Administration, "Hydrogen Sulfide," [Online]. Available: https://www.osha.gov/hydrogen-sulfide/hazards. [Accessed 2026 March 2026].

[3] U.S. Chemical Safety and Hazard Investigation Board, "FINAL REPORT: Safety Bulletin - Sodium Hydrosulfide: Preventing Harm," 15 July 2004. [Online]. Available: https://www.csb.gov/file.aspx?DocumentId=5643. [Accessed 30 June 2026].

[4] C. Aid, "https://www.chemicalaid.com/tools/equationbalancer.php," ChemcialAid, Unknown Unknown 2026. [Online]. Available: https://www.chemicalaid.com/tools/equationbalancer.php. [Accessed 3 June 2026].