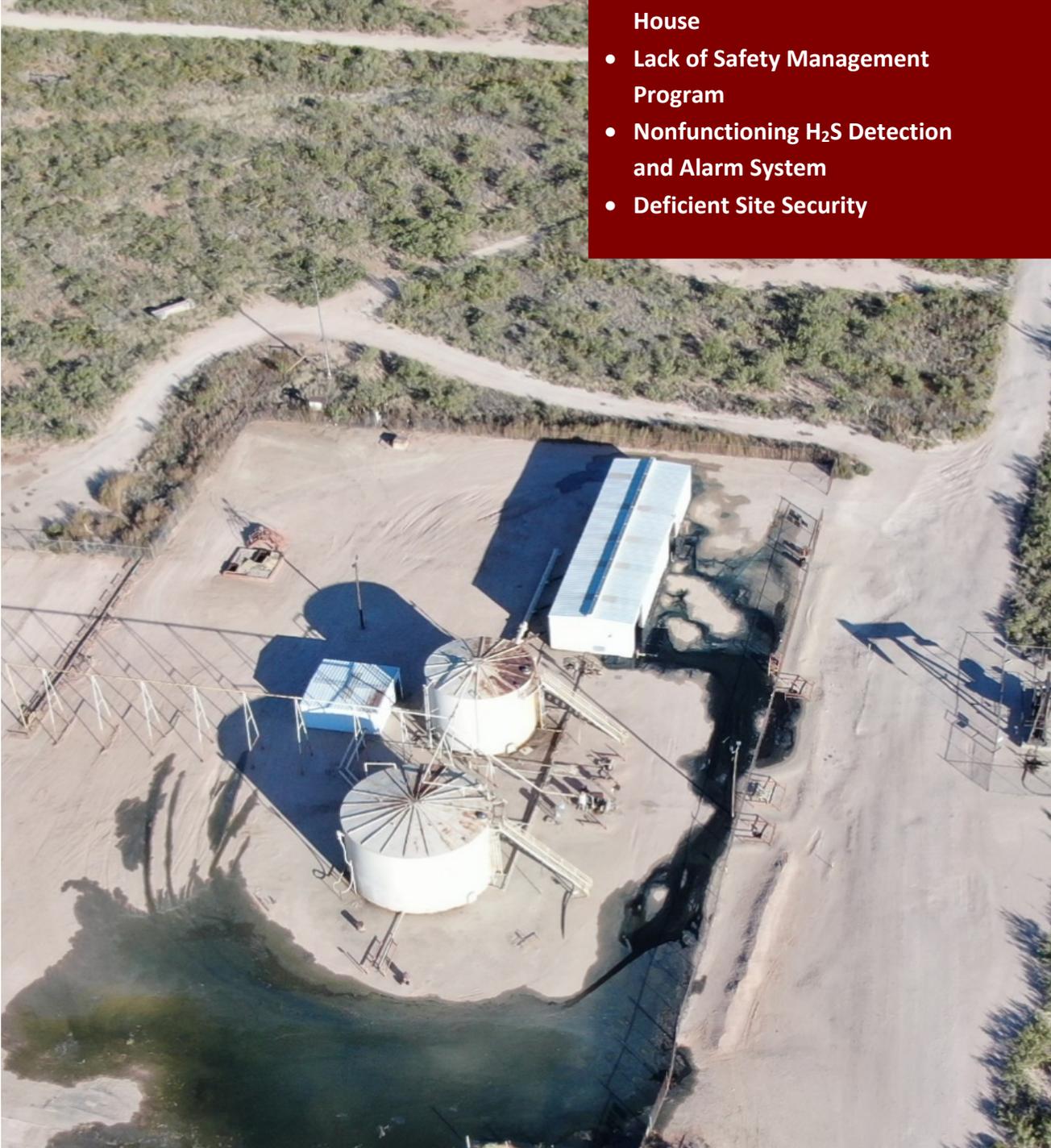


Executive Summary From Final Report

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SAFETY ISSUES:

- Nonuse of Personal H₂S Detector
- Nonperformance of Lockout / Tagout
- Confinement of H₂S Inside Pump House
- Lack of Safety Management Program
- Nonfunctioning H₂S Detection and Alarm System
- Deficient Site Security



Executive Summary from Final Report

On October 26, 2019, an Aghorn Operating Inc. (Aghorn) employee, Pumper A, responded to a pump oil level alarm at Aghorn's Foster D waterflood station in Odessa, Texas. The pump (called Pump #1) was located in a building called a *pump house*. In response to the alarm, Pumper A worked to isolate the pump from the process by closing the pump's discharge valve and partially closing the pump's suction valve. Pumper A did not first perform Lockout / Tagout to isolate Pump #1 from energy sources before performing work on the pump. At some point on the night of the incident, the pump automatically turned on, and water containing hydrogen sulfide (H₂S), a toxic gas, released from the pump. The CSB found post-incident that the pump had a broken plunger from which the water and H₂S released. Due to the limitations of the available evidence, the CSB was unable to determine whether the pump failure and loss of containment of the produced water (1) occurred before Pumper A arrived at the facility, or (2) occurred when the pump energized while Pumper A was closing valves to isolate the pump.

Pumper A was fatally injured from his exposure to the released H₂S.

Subsequently, the spouse of Pumper A gained access to the waterflood station and searched for Pumper A. During her search efforts, she also was exposed to the released H₂S and was fatally injured.

Odessa Fire Rescue and the Ector County Sheriff's Office responded to the incident. Federal agencies that investigated the incident include the Occupational Safety and Health Administration (OSHA) and the U.S. Chemical Safety and Hazard Investigation Board (CSB).

The CSB's investigation identified the safety issues below.

Safety Issues

The investigation evaluated the following safety issues:

- **Nonuse of Personal H₂S Detector.** Pumper A was not wearing his personal H₂S detection device upon entering the waterflood station on the night of the incident, and there is no evidence that Aghorn management required the use of these devices. ([Section 3.1](#))
- **Nonperformance of Lockout / Tagout.** At the time of the incident, Aghorn did not have any written Lockout / Tagout policies or procedures. Pumper A did not perform Lockout / Tagout to deenergize Pump #1 before performing work on it. The automatic activation of the pump allowed water containing H₂S to release from the pump. ([Section 3.2](#))
- **Confinement of H₂S Inside Pump House.** The pump house could be ventilated by two bay doors on the east side of the pump house, exhaust fans on the west wall opposite of the bay doors, and natural vents on each of the four outside walls. Due to the limitations of the available evidence, the CSB was unable to confirm whether the exhaust fans were operational at the time of the incident. On the night of the incident, the bay doors were approximately 60% open. The available ventilation methods did not adequately ventilate toxic H₂S gas from the building during the incident, contributing to the high H₂S levels to which Pumper A and his spouse were exposed. ([Section 3.3](#))

- **Lack of Safety Management Program.** The CSB requested from Aghorn “all written policies and procedures used by Aghorn Operating.” Aghorn’s response included: 1) a cell phone use policy, 2) an alarm call out procedure, 3) a Lockout / Tagout policy and procedure that was created post-incident, and 4) a pamphlet on H₂S hazards. Aghorn had no additional formal company safety or operational policies or procedures. ([Section 3.4](#))
- **Nonfunctioning H₂S Detection and Alarm System.** The pump house was equipped with an H₂S detection and alarm system. However, the H₂S control panel did not receive signals from the internal and external detection sensors at the facility, and, therefore, did not trigger either of the two H₂S alarms on the night of the incident. ([Section 3.5](#))
- **Deficient Site Security.** As per Aghorn’s informal policy, when an Aghorn employee is working at the facility, the access gates are normally left unlocked. The unlocked gates allowed Pumper A’s spouse to drive directly to the waterflood station and enter the pump house, where she was exposed to toxic H₂S gas. ([Section 3.6](#))

Probable Cause

The CSB determined that the probable cause of the incident was Aghorn’s failure to enforce operator use of personal H₂S detectors when in the vicinity of equipment or facilities with the potential to release H₂S, and Aghorn’s failure to develop, train on, and enforce Lockout / Tagout procedures that led to Pumper A performing work on a pump while it was still energized. Contributing to the incident was Aghorn’s facility physical and operational design, which did not allow for adequate ventilation of the toxic H₂S gas inside the pump house, and Aghorn’s deficient safety management program. Likely also contributing to the incident was Aghorn’s failure to maintain and properly configure the site H₂S detection and alarm system. Contributing to the severity of the incident was Aghorn’s poor site security that allowed Pumper A’s spouse to gain access to the facility.

Recommendations

To Aghorn Operating Inc.

For all waterflood stations where the potential exists to expose workers or non-employees to H₂S concentrations at or above 10 ppm, mandate the use of personal H₂S detection devices as an integral part of every employee or visitor personal protective equipment (PPE) kit prior to entering the vicinity of the facility. Ensure detector use is in accordance with manufacturer specifications.

For all Aghorn facilities, develop a site-specific, formalized and comprehensive Lockout / Tagout program, to include policies, procedures, and training, to protect workers from energized equipment hazards, such as exposure to H₂S. Ensure the program meets the requirements outlined in 29 CFR 1910.147 and includes energy control procedures, training, and periodic inspections.

For all waterflood stations where the potential exists to expose workers to H₂S concentrations at or above 10 ppm, commission an independent and comprehensive analysis of each facility design vis-à-vis ventilation and mitigation systems to ensure that, in the event of an accidental release, workers are protected from exposure to toxic gas levels.

For all waterflood stations where the potential exists to expose workers or non-employees to H₂S concentrations at or above 10 ppm, develop and demonstrate the use of a safety management program that includes a focus on

protecting workers and non-employees from H₂S. This program should include risk identification, assessment, mitigation, and monitoring of design, procedures, maintenance and training related to H₂S. This program must be in compliance with 29 CFR 1910.1000 – *Air Contaminants* and 29 CFR 1910.147 – *The Control of Hazardous Energy (Lockout / Tagout)*.

For all waterflood stations where the potential exists to expose workers to H₂S concentrations at or above 10 ppm, ensure the H₂S detection and alarm systems are properly maintained and configured, and develop site-specific detection and alarm programs and associated procedures based on manufacturer specifications, current codes, standards, and industry good practice guidance. The program must address installation, calibration, inspection, maintenance, training and routine operations.

For all waterflood stations where the potential exists to expose workers or non-employees within the perimeter of the facility to H₂S concentrations at or above 10 ppm, ensure that the H₂S detection and alarm system designs employ multiple layers of alerts unique to H₂S, such as with the use of both audible and visual mediums, so that workers and non-employees within the perimeter of the facility would be alerted to a significant release. The system design must meet manufacturer specifications, current codes, standards, and industry good practice guidance.

For all waterflood stations where the potential exists to expose non-employees to H₂S concentrations at or above 10 ppm, develop and implement a formal, written, site-specific security program to prevent unknown and unplanned entrance of those not employed by Aghorn, starting with a requirement for employees to lock access gates upon entering and departing the facility.

Occupational Safety and Health Administration (OSHA)

Issue a safety information product (such as a safety bulletin or safety alert) that addresses the requirements for protecting workers from hazardous air contaminants and from hazardous energy.

Railroad Commission of Texas

Develop and send a Notice to Operators to all oil and gas operators that fall under the jurisdiction of the Railroad Commission of Texas that describes the safety issues described in this report, including:

1. Nonuse of Personal H₂S Detector
2. Nonperformance of Lockout / Tagout
3. Confinement of H₂S Inside Pump House
4. Lack of Safety Management Program
5. Nonfunctioning H₂S Detection and Alarm System
6. Deficient Site Security



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