

# How do you know your safety devices are working?

OCTOBER 2021

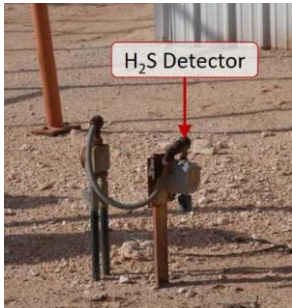
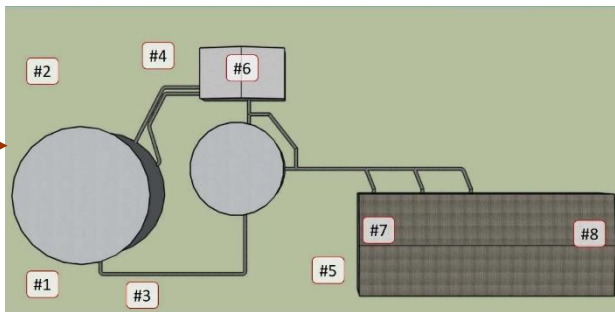


Fig. 1: One of the H<sub>2</sub>S detectors



Fig. 2: H<sub>2</sub>S alarm warning light

Fig. 3: H<sub>2</sub>S detector location  
(Figures 1-3 from US CSB report – see reference)



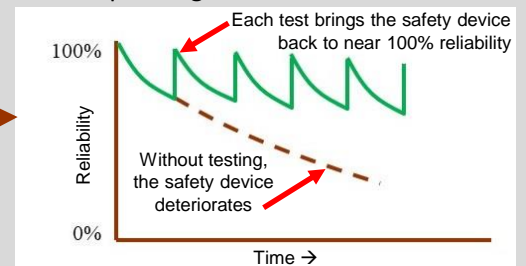
In October 2019, a lone-worker employee responded to a pump oil level alarm at an unmanned waterflood station in Texas. A waterflood station pumps water separated from crude oil back into the underground oil formation to improve extraction. The employee isolated the pump by closing valves but did not perform Lockout / Tagout. At some point, the pump automatically started, and water known to contain hydrogen sulfide (H<sub>2</sub>S), a toxic gas, was released. The employee died from exposure to H<sub>2</sub>S. The tragedy was compounded when the employee's wife searched for him and went into the waterflood station. She was also exposed to H<sub>2</sub>S and died.

There were many failures in process safety management systems which contributed to this incident. This Beacon will focus on one of the contributing causes – the failure of the H<sub>2</sub>S alarm system. The waterflood station was equipped with an H<sub>2</sub>S detection and alarm system. However, the alarm panel did not receive a signal from the indoor or outside detectors (Fig. 1 and Fig. 3). Therefore, the H<sub>2</sub>S alarm warning light (Fig. 2) was not activated. Some detectors were set in test mode, which prevented them from sending an alarm signal. Other detectors were correctly set up, but the signals were not received by the alarm panel. Investigators were unable to find any maintenance, testing, or calibration records for the H<sub>2</sub>S detection and alarm system.

## Did You Know?

- Active safety devices such as alarms, interlocks, or shutdown systems must be tested on a schedule, or reliability deteriorates over time (Fig. 4). This is particularly true of gas detectors which are sensitive instruments that require regular calibration.

Fig. 4: Safety device (H<sub>2</sub>S alarm) reliability



- Most safety devices are not called on to function during normal operation of your plant. If they are not working because of component failure or an operational error such as disabling them, the failure is hidden.
- A robust reliability program tests all components as a system to confirm that the entire system will work when needed. Inspection, testing, and maintenance frequency and procedures are established by your plant engineers based on reliability calculations and failure data.
- Results of inspection, testing, and maintenance activities for safety devices must be documented.
- Test results should be reviewed to identify chronic failure issues, and to confirm that component failure rates are consistent with the designer's assumptions.

## What Can You Do?

- If you are involved in inspecting and testing safety alarms, interlocks, and other safety devices, always follow procedures rigorously, and document the results.
- Use written checklists and procedures to ensure that required tests are properly done.
- Always remember to put the safety device back online when inspection and testing are complete.
- Know where to find the results of safety device tests. If you find that the required tests have not been done or documented, report your observations to management.
- If you are aware of safety devices that do not have inspection and testing programs, report this to management.

Reference: <https://www.csb.gov/csb-releases-final-aghorn-investigation-report/>

**Inspect and test your safety systems to be sure they work!**