Safety Alert

U. S. Department of the Interior
Bureau of Safety and Environmental Enforcement
Pacific OCS Region

BSEE

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Hydrogen Sulfide (H_2S) Gas Release from Piping Corrosion Failure Near a Weld

A hydrogen sulfide (H_2S) gas release occurred from a piping corrosion failure near a weld, on the 8-inch side of an 8-inch by 4-inch reducer on the blowdown line for a third-stage section compression scrubber. Multiple H_2S sensors detected the release and initiated a platform shutdown. Platform personnel were directed to muster to the safe briefing areas. Response personnel using breathing apparatus isolated the leak. No injuries to any personnel occurred from the incident. Prior to the platform being restarted, the failed spool was removed and saved for testing, and a new spool was installed. The H_2S concentration at the release point was estimated to be 40,000 ppm.

A BSEE investigation revealed the following:

- The cause of the H_2S release was a weld failure on the side of the reducer. This failure was caused by accelerated corrosion resulting from elemental sulfur in contact with steel in an area where deposits could build up. Elemental sulfur acts as an oxidizer and is known to accelerate steel corrosion and cause localized reduction in wall thickness. The elemental sulfur in the scale was the result of oxygen contamination in the wet, sour gas stream. Oxygen reacts with hydrogen sulfide in liquid water to form elemental sulfur.
- Contributing factors to the accelerated corrosion include: high H_2S concentrations sufficient to introduce elemental sulfur which exacerbates the corrosion process and low flow rate in the area of the failure due to the reducer configuration. The areas in the reducer with higher flow rates did not have heavy buildup of corrosion products.
- The reducer spool that failed is included in a piping circuit in the operator's Mechanical Integrity Program. The circuit was last examined in May 2011 utilizing a non-destructive test (NDT) ultrasonic "A" scan that was run at specific points on the circuit. The results of the 2011 inspection did not indicate any issues that required corrective action.
- NDT results for the piping circuit covering the last 10 years showed no appreciable loss in wall material thickness.
- The ultrasonic inspection procedures used to examine the piping circuit may not have been effective in identifying the potential for a weld failure because the procedures were designed to assess the pipe's thickness and were taken on a smooth surface at some distance away from the weld's location. In addition, the voluminous scale

deposits on the steel surface may have affected the accuracy of the inspection results.

Therefore, BSEE recommends that operators:

- Inspect all piping with similar internal exposure, i.e., wet, sour gas where water and deposits can accumulate, and replace if extensive corrosion is identified.
- Review inspection and maintenance programs for piping exposed to sour gas and include procedures for identifying localized corrosion problems using radiography or other non-destructive inspection methods where normal ultrasonic inspection may not be effective, such as the areas near welds, reducers, and flanges.
- Verify that your Safety and Environmental Management System program adequately addresses the design, inspection, testing and quality assurance of piping exposed to sour gas in order to prevent the buildup of elemental sulfur and to identify and remediate areas of excessive corrosion so that similar releases of H_2S gas can be prevented.

Safety Alerts can be found on the following BSEE webpage:

http://www.bsee.gov/Regulations-and-Guidance/Safety-Alerts/Safety-Alerts/

Panel Investigation Reports can be found on the following BSEE webpage:

http://www.bsee.gov/Inspection-and-Enforcement/Accidents-and-Incidents/Panel-Investigation-Reports/Panel-Investigation-Reports/

Note:

A **Safety Alert** is a tool used by BSEE to inform the offshore oil and gas industry of the circumstances surrounding an accident or a near miss. It also contains recommendations that should help prevent the recurrence of such an incident on the Outer Continental Shelf.