



HAZARD ALERT

USW Alerts from the Tesoro Refinery Incident that Killed Seven Workers

During the course of the United Steelworkers investigation of the catastrophic failure of a heat exchanger at the Tesoro refinery in Anacortes Washington that killed seven workers, a number of concerns have arisen which may pertain to a large number of process vessels currently in use in the US refining industry.

This alert is to raise awareness of the concerns with this equipment.

Vessels operating at 50°F and 50 psia under the Nelson curve have now been determined to be susceptible to High Temperature Hydrogen Attack (HTHA). Vessels operating in this range should be inspected for HTHA using a variety of non-destructive testing methods as described in API 941.

A vessel could be susceptible to HTHA if it is operated over the Nelson curve limits for short time durations but for a large number of temperature cycles. HTHA is not necessarily restricted to vessels operating over the curve for long durations. Periods of operation above the Nelson curve, even of short duration may increase the opportunity for HTHA.

Vessels undergoing Post Weld Heat Treatment (PWHT) are more resistant to HTHA due to reduced residual stresses. Vessels with a thickness of less than 1½ inches are not required by the ASME code to be PWHT, but considering the advantages, it would be in the operator's best interest to PWHT these vessels if operated in a hydrogen service.

The increasing age of refineries in the United States increases the hazards and requires diligent maintenance. Failures tend to follow a pattern known as the "bathtub" curve because it is shaped like the cross section of the bathtub. In early years the failure rate may be high due to manufacturing defects. This is the age of infant mortality. In middle age, the failure rate is low and as age advances the failure rate increases again due to old age wear out.

Equipment is getting older and is more prone to failure from wear due to age. Deterioration of vessels and especially welds will occur over time and needs to be part of a regular and rigorous inspection program.

When non-destructive testing is done, it should be done in areas most susceptible to failure such as wear weld seams or the hottest sections area of the equipment. Testing at random locations is not good practice and testing at the most readily accessible locations is not necessarily good practice.

Finally, outside transient stresses (e.g. temperature or wind chill) should be taken into consideration when determining inspection requirements and equipment life.



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This hazard alert is based on an actual incident, and reflects our best understanding of the incident at the time it was written. However, many incidents have multiple causes; this alert may not cover all of them. The purpose of the alert is to illustrate workplace hazards; it is not intended to be a comprehensive report on the incident.