



U. S. Chemical Safety and Hazard Investigation Board RECOMMENDATIONS STATUS CHANGE SUMMARY

Report:	Tesoro Refinery Fatal Explosion and Fire
Recommendation Number:	2010-08-I-WA-R13
Date Issued:	May 12, 2014
Recipient:	Tesoro Refining and Marketing Company, LLC
New Status:	Closed – No Longer Applicable
Date of Status Change:	January 18, 2017

Recommendation Text:

Once recommendation 2010-08-I-WA-R12¹ is in effect, develop and implement a plan to meet the requirements established through the acceptable completion of recommendation 2010-08-I-WA-R10². Document the implementation of the plan and the corrective actions taken.

Board Status Change Decision:

A. Rationale for Recommendation

On April 2, 2010, a catastrophic heat exchanger rupture at the Tesoro Anacortes refinery fatally injured seven workers. The CSB's investigation concluded that Tesoro failed to take actions that may have prevented the rupture, which was caused by a damage hazard mechanism known as high temperature hydrogen attack (HTHA). For example, the site relied on weak safeguards, such as equipment inspection and post-weld heat treating to prevent HTHA. They did not consider the use of inherently safer piping materials known to be less susceptible to HTHA. Moreover, internal inspectors repeatedly, erroneously assumed that heat exchanger design conditions were representative of actual process operating conditions. This contributed to the incorrect conclusion that the heat exchangers were not susceptible to damage from HTHA.

The CSB recommended that Tesoro participate in the revision of the American Petroleum Institute's (API's) recommended practice for addressing HTHA – API RP 941 *Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants* (Recommendation No. 2010-08-I-WA-R12). Following this participation, the CSB recommended that Tesoro Refining and Marketing Company, LLC update their corporate procedures to include changes made to API RP 941 (Recommendation No. 2010-08-I-WA-R13). This status change summary pertains to Recommendation No. 2010-08-I-WA-R13.

¹ CSB Recommendation No. 2010-08-I-WA-R12 to Tesoro Refining & Marketing Company LLC: Actively participate with API in the completion of recommendation 2010-08-I-WA-R10. Document this participation.

² CSB Recommendation No. 2010-08-I-WA-R10 to the American Petroleum Institute: Revise American Petroleum Institute API RP 941: Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants to:

- Clearly establish the minimum necessary "shall" requirements to prevent HTHA equipment failures using a format such as that used in ANSI/AIHA Z10-2012, Occupational Health and Safety Management Systems;
- Require the use of inherently safer materials to the greatest extent feasible;
- Require verification of actual operating conditions to confirm that material of construction selection prevents HTHA equipment failure; and
- Prohibit the use of carbon steel in processes that operate above 400 °F and greater than 50 psia hydrogen partial pressure.

B. Response to the Recommendation

In February 2016, the 8th edition of API RP 941 was published. On July 13, 2016, CSB voted to designate Recommendation No. 2010-08-I-WA-R10 to API as “Closed – Unacceptable Action.” The [status change summary](#) for that recommendation provides the rationale for the Board’s decision. Though the CSB advocates for the prevention of HTHA, industry has chosen to address HTHA through inspection, which is difficult to detect and requires a highly skilled inspector to identify rather than using materials less susceptible to HTHA. Further, the choice of metallurgy is based upon the API RP 941 Nelson curves which draw on incomplete data, since data submitted to API for inclusion is voluntary. API did make some changes to API RP 941, including the creation of a new non-post-weld-heat-treated (non-PWHT) carbon steel Nelson curve.

Tesoro updated their corporate procedure, TRS-663, *HTHA Mitigation and Inspection of Existing Equipment in Hot Hydrogen Service* in May 2016, in response to the changes made in API RP 941. The CSB appreciates that Tesoro has revised its inspection procedures to incorporate updates to API RP 941. However, ultimately both the Tesoro corporate procedures and API RP 941 rely on inspection rather than preventing HTHA by verifying actual operating procedures, requiring the use of inherently safer materials or prohibiting the use of carbon steel in processes operating above 400 degree Fahrenheit and 50 psia. As the CSB voted to designate API RP 941 (Recommendation No. 2010-08-I-WA-R10) as “Closed – Unacceptable Action,” the recommendation to Tesoro no longer applies, since it was contingent upon action by API. CSB encourages Tesoro to incorporate any further changes to API RP 941 and to use preventive actions and inherently safer materials rather than relying solely on inspection and monitoring equipment.

C. Board Analysis and Decision

As a result of the above analysis, CSB vote to designate **Recommendation No. 2010-08-I-WA-R13** as “**Closed – No Longer Applicable.**”