



U. S. Chemical Safety and Hazard Investigation Board

RECOMMENDATIONS STATUS CHANGE

SUMMARY

Report:	Tesoro Refinery Fatal Explosion and Fire
Recommendation Number(s):	2010-08-I-WA-R12 through R14
Date Issued:	May 12, 2014
Recipient:	Tesoro Refining and Marketing Company, LLC
New Status:	R12 through R14: Open – Acceptable Response
Date of Status Change:	March 31, 2015

Recommendation Text:

Recommendation No. 2010-08-I-WA-R12:

Actively participate with API in the completion of Recommendation 2010-08-I-WA-R10¹. Document this participation.

Recommendation No. 2010-08-I-WA-R13:

Once recommendation 2010-08-I-WA-R12 is in effect, develop and implement a plan to meet the requirements established through the acceptable completion of recommendation 2010-08-I-WA-R10. Document the implementation of the plan and the corrective actions taken.

Recommendation No. 2010-08-I-WA-R14:

Revise and improve the Process Hazard Analysis (PHA), the Integrity Operating Window (IOW), and the damage mechanism hazard review (DMHR) programs and cross-linking among these three programs such that all identified hazards are effectively managed in each program. For all Tesoro refineries require:

- a. *the IOW to review damage mechanism hazards from the most recent PHA and safeguards identified to control these hazards;*
- b. *the IOW review or revalidation to be conducted at least every five years;*
- c. *the IOW to analyze and incorporate applicable industry best practice, the hierarchy of controls, and inherently safer design to the greatest extent reasonably practicable;*
- d. *the DMHR report to be developed by the DMHR team and not just the "corrosion expert;"*
- e. *the DMHR team to review the operating data to verify an accurate understanding of how the data was obtained, what it represents, and that it appropriately addresses both routine and nonroutine operations;*
- f. *the DMHR and/or IOW review to identify and review gaps between current industry best practices and existing Tesoro practices with regard to material selection and process controls and make recommendations that reduce risks from damage mechanism hazards;*
- g. *the DMHR and IOW review to review applicable Tesoro and industry-wide damage mechanism incidents as part of the respective DMHR or IOW review;*
- h. *the DMHR to review relevant MOCs to fully evaluate the impact of the MOC on damage mechanism hazards;*

¹ CSB Recommendation No. 2010-08-I-WA-R10, to the American Petroleum Institute, reads as follows: *Revise American Petroleum Institute API RP 941: Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants to:*

- a. *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;*
- b. *Require the use of inherently safer materials to the greatest extent feasible;*
- c. *Require verification of actual operating conditions to confirm that material of construction selection prevents HTHA equipment failure; and*
- d. *Prohibit the use of carbon steel in processes that operate above 400 °F and greater than 50 psia hydrogen partial pressure.*

- i. *the identification of minimum qualifications for the "corrosion expert" and ensure that the DMHR team has the necessary skills to meet these requirements;*
- j. *for sites that have a corrosion/materials engineer, the corrosion/materials engineer shall be a required participant in the DMHR;*
- k. *the PHA to review the most recent DMHR and IOW reviews in order to contain a complete record of all identified damage mechanism hazards, evaluate existing safeguards, and propose new safeguards to control the identified hazards;*
- l. *the PHA to review the consequence of damage mechanism hazards identified in the risk-based inspection (RBI) program and IOW reviews to ensure effective safeguards are present to control the damage mechanism hazard; and*
- m. *the PHA to use the hierarchy of controls and implement opportunities for inherently safer design to the greatest extent reasonably practicable.*

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, and 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 represented actual process operating conditions and incorrectly concluded that the heat exchangers were not susceptible to HTHA damage.

The CSB also evaluated current Tesoro programs for identifying and controlling damage from process hazards, including its standards for Process Hazard Analyses (PHAs), Damage Hazard Mechanism Reviews (DHMRs), and Integrity Operating Window (IOW) and found that these three programs were insufficiently coordinated to ensure that effective safeguards were identified and evaluated.

Based on these findings, the CSB issued three recommendations to the Tesoro Refining and Marketing Company, LLC (Recommendation Nos. 2010-08-I-WA-R12 through R14).

B. Response to the Recommendation

Tesoro has indicated that they are participating in the API RP 941 Task Group; revising their Standards as new information from this Task Group becomes available; and revising or adding Tesoro Refining Standards to improve Process Hazard Analysis, Integrity Operating Window, and damage mechanism hazard review programs.

C. Board Analysis and Decision

As these changes, if fully implemented, appear to meet the intent of CSB Recommendation Nos. 2010-08-I-WA-R12 through R14, the Board voted to change the status of these recommendations to: "**Open – Acceptable Response.**" Closure of this recommendation will depend on documented completion of all the indicated planned actions.