



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

Report:	Chevron Refinery Fire
Recommendation Number(s):	2012-3-I-CA-R12
Date Issued:	April 19, 2013
Recipient:	California State Legislature, Governor of California
New Status:	Closed – Acceptable Action
Date of Status Change:	May 30, 2018

Recommendation Text 2012-3-I-CA-R12:

Require that Process Hazard Analyses required under California Code of Regulations, Title 8, Section 5189 Section (e) include documentation of the recognized methodologies, rationale and conclusions used to claim that safeguards intended to control hazards will be effective. This process shall use established qualitative, quantitative, and/or semi-quantitative methods such as Layers of Protection Analysis (LOPA).

Board Status Change Decision:

A. Rationale for Recommendation

On August 6, 2012, the Chevron Refinery in Richmond, California, experienced a catastrophic pipe failure in a crude unit causing the release of a flammable hydrocarbon process fluid which partially vaporized into a large cloud. Nineteen Chevron employees engulfed by the vapor cloud narrowly escaped avoiding serious injury. The ignition and subsequent continued burning of the hydrocarbon process fluid resulted in a large plume of unknown particulates and vapor. Approximately 15,000 people from the surrounding area sought medical treatment in the weeks following the incident.

The U. S. Chemical Safety and Hazard Investigation Board's (CSB) investigation found that the pipe failure was caused by sulfidation corrosion, a damage mechanism that causes piping walls to thin over time. The CSB also found that the California Process Safety Management (PSM) regulation did not require the conducting of formal damage mechanism hazard reviews, and that the Process Hazards Analysis (PHA) team for the crude unit at the Richmond refinery did not identify the damage mechanism sulfidation corrosion as a potential cause of a leak or rupture in the piping. Additionally, the CSB found that the California PSM regulation did not require the use of a recognized methodology for making an objective determination of the effectiveness of safeguards in place to prevent a hazardous consequence from occurring. A more detailed safeguard analysis, which requires sufficient consideration of the principles of inherently safer technology and to driving risks As Low As Reasonably Practicable (ALARP), could have identified the need to upgrade the metallurgy of the piping to a material less susceptible to sulfidation corrosion.

The CSB concluded that the systematic and documented consideration of inherently safer systems and the hierarchy of controls to the greatest extent feasible by Chevron and other process plants during PHAs, Management of Change (MOC) analyses, prior to new construction, rebuilds, and repairs, and in the development of corrective actions from incident investigation recommendations, would provide a more adequate degree of protection from incidents like the one that occurred on August 6, 2012.

Finally, the CSB concluded that the reporting of leading and lagging process safety indicators to the relevant regulators would be an important driver for continual improvement of refinery operations in the state of California. The reporting of indicators and additional information related to activities such as damage mechanism hazard reviews and maintenance-related shutdowns promotes greater transparency and facilitates increased collaboration between regulators and industry in chemical accident prevention.

Based on these findings, the CSB issued six recommendations to the California State Legislature and the Governor. This recommendation pertains only to the performance of an effective safeguard protection analysis, or SPA.

Response to the Recommendation

The newly adopted California PSM for Petroleum Refineries (Section 5189.1) regulation,¹ which became effective on October 1, 2017, added provisions to new subsection (e), entitled “Process Hazard Analysis”, concerning effective safeguard analysis:

(e) Process Hazard Analysis

(5) For each scenario in the PHA that identifies the potential for a major incident, the employer shall perform an effective written SPA [Safeguard Protection Analysis] to determine the effectiveness of existing individual safeguards, the combined effectiveness of all existing safeguards for each failure scenario in the PHA, the individual and combined effectiveness of safeguards recommended in the PHA, and the individual and combined effectiveness of additional or alternative safeguards that may be needed.

- (A) All independent protection layers for each failure scenario shall be independent of each other and independent of initiating causes.
- (B) The SPA shall utilize a quantitative or semi-quantitative method, such as Layer of Protection Analysis, or an equally effective method to identify the most protective safeguards. The risk reduction obtainable by each safeguard shall be based on site-specific failure rate data, or in the absence of such data, industry failure rate data for each device, system or human factor.
- (C) The SPA shall be conducted by at least one individual with expertise in the specific SPA methodology being used. The SPA may be performed as part of the PHA or as a stand-alone analysis. The employer shall provide for employee participation in the performance of all SPAs, pursuant to subsection (q).

¹ For a copy of the regulation visit https://www.dir.ca.gov/title8/5189_1.html (accessed April 23, 2018).

- (D) The SPA shall document the likelihood and severity of all potential initiating events, including equipment failures, human errors, loss of flow control, loss of pressure control, loss of temperature control, loss of level control, excess reaction, and other conditions that may lead to a loss of containment. The SPA shall document the risk reduction achieved by each safeguard for all potential initiating events.
- (E) The employer shall complete all SPAs within six (6) months of completion of the PHA.

B. Board Analysis and Decision

As the intent of this recommendation has been met, the Board voted to change the status of Recommendation No. 2012-30I-CA-R12 to: **“Closed-Acceptable Action.”**