Chemical Safety and Hazard Investigation Board

OFFICE OF GENERAL COUNSEL

Memorandum

To: Board Members

From: Richard C. Loeb RCL

Cc: Leadership Team
Mark Kaszniak

Subject: Board Action Report – Notation Item 2015-04

Date: November 20, 2014

On November 19, 2014, the Board approved Notation Item 2015-04, thereby approving the addition of the following item to its Most Wanted Chemical Safety Improvements List: "Modernize U.S. Process Safety Management Regulations."

Voting Summary – Notation Item 2015-04

Disposition: APPROVED

Disposition date: November 19, 2014

	Approve	Disapprove	Calendar	Not Participating	Date
R. Moure-Eraso	X				11/18/2014
M. Griffon	X				11/19/2014

MOST WANTED CHEMICAL SAFETY IMPROVEMENT:

Modernize U.S. Process Safety Management Regulations

Introduction

Process safety management regulations in the U.S. have undergone little reform since their inception in the 1990s. Although recently there have been some positive initial steps taken toward significant improvements in process safety management at the federal level, more must be done to ensure that a more comprehensive process safety management system is in place in the U.S. to protect worker safety, public health, and the environment. As such, the CSB has an opportunity to advance national process safety management reform by advocating for this issue as part of its Most Wanted Chemical Safety Improvements Program ("Most Wanted Program").[1] The goal of adding this important issue to the CSB Most Wanted Program is the continuous improvement of process safety management in the U.S. through the implementation of key federal and state CSB process safety-related recommendations and lessons learned.

Over the last two decades, the CSB has made important recommendations aimed at preventing recurrence of major industrial accidents by improving OSHA'S Process Safety Management (PSM) Standard and EPA's Risk Management Plan (RMP) Program, as described below and listed in Appendix A. The CSB has also noted in its recent investigations of major refinery incidents that both PSM and RMP, although written as performance-based regulations, appear to function primarily as reactive and activity-based regulatory schemes that require extensive rulemaking to modify, resulting in stagnation despite advancing best practices and technology. Specifically, CSB investigations of the Tesoro Anacortes refinery explosion and fire in April 2010 and the Chevron Richmond refinery fire in August 2012 found that there was no requirement to reduce risks to As Low As Reasonably Practicable (ALARP) or similar; there was no mechanism to ensure continuous safety improvement; no requirement to implement inherent safety or the hierarchy of controls; that there should be an increased role for workers and worker representatives in process safety management; and that there needed to be in place a more proactive, technically qualified regulator. As a result of these findings, the CSB made recommendations at the federal, state, and local level to prevent major incidents by adopting a more rigorous regulatory system that requires covered facilities to continuously reduce major hazard risks.

Two important ongoing activities present an opportunity for the CSB to advance these process safety management recommendations. Following the April 2013 explosion and fire that occurred at a fertilizer storage and distribution facility in West, Texas, and

[1] The CSB adopted the Most Wanted Program on June 12, 2012. Board Order 046, *Most Wanted Chemical Safety Improvements Program*, discusses the policies of the program in detail. *See*http://www.csb.gov/assets/Record/Order_046_(06122012).pdf (accessed October 27, 2014).

caused fifteen fatalities and hundreds of injuries,[2] President Obama issued Executive Order 13650, *Improving Chemical Facility Safety and Security*, on August 1, 2013.[3] The Executive Order established the Chemical Facility Safety and Security Working Group, a working group of federal agencies[4] tasked with, among other things, developing options for enhancing and modernizing policies, regulations, and standards to improve the safety and security of chemical facilities.[5,6] To date, both OSHA and the EPA have issued Requests For Information (RFI) as a result of the Order, and may soon initiate rulemaking to revise the PSM standard and RMP regulations.

At the state level, California is taking important initial steps towards modernizing process safety management by funding additional PSM unit inspectors and issuing revised draft process safety management regulations that address many of the attributes of a stronger regulatory system identified by the CSB investigative reports. If adopted, these regulatory changes may serve as a model for federal PSM reform.

These activities present an opportunity for the CSB to advance key federal and state CSB process safety-related recommendations. Adding an issue targeting modernizing process safety management to the CSB Most Wanted list will enhance agency efforts to advocate for their implementation.

Federal Process Safety Reform

CSB Recommendations for Federal Process Safety Management Reform

As mentioned in the introduction, the CSB has made recommendations for fundamental process safety management reform at the federal, state and local levels. As a result of the Tesoro Anacortes refinery incident that occurred in April 2010, the CSB made a sweeping recommendation to the EPA to use its existing authority under the Clean Air Act to require the documented use of inherently safer systems analysis and the hierarchy of controls to "the greatest extent feasible" with the goal of reducing risk of major accidents to As Low As Reasonably Practicable (ALARP).

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[2] *See* CSB investigation of West, Texas, fertilizer incident athttp://www.csb.gov/west-fertilizer-explosion-and-fire-/(accessed October 27, 2014).

[3] *Improving Chemical Facility Safety and Security.* Exec. Order No. 13650, 78 Fed. Reg. 48029 (August 1, 2013). https://www.federalregister.gov/articles/2013/08/07/2013-19220/improving-chemical-facility-safety-and-security (accessed January 7, 2014).

[4] The working group includes the EPA, the Department of Justice, the Department of Agriculture, the Department of Transportation, and the Department of Labor.

[5] *See* Section 6 of the Executive Order.

[6] The group has included the safety case regulatory model in a list of potential actions it may consider taking to improve chemical safety regulation. *See* Working Group response to Executive Order 13650, Section 6(a) – Solicitation of Public Input on Options for Policy, Regulation, and Standards Modernization. https://www.osha.gov/chemicalexecutiveorder/Section_6ai_Options_List.html (accessed January 7, 2014).

The CSB has made several recommendations over the years to OSHA and the EPA that have called for important changes to PSM and RMP within their current frameworks. To date, these recommendations have not been implemented.

On July 25, 2013, the CSB held a public meeting to discuss the status of key CSB safety recommendations made to OSHA in the last decade to revise and improve the PSM standard.[7] These recommendations include the potential impacts on process safety of organizational changes (e.g., mergers and acquisitions, key personnel changes and budget cutting), and the potential catastrophic hazards of atmospheric storage tanks containing flammable materials that are connected to processes covered under the PSM standard. While acknowledging some positive steps taken by OSHA, such as including process safety management in its regulatory agenda, the CSB expressed at the meeting its disappointment with OSHA's lack of progress with implementation of open CSB recommendations to improve the PSM standard.[8] As a result of the meeting, the Board voted to change the status of the three recommendations made to OSHA to "Open-Unacceptable."[9]

On March 11, 2014, the CSB Board voted to change the status of a recommendation made to EPA to improve the RMP rule to "explicitly cover catastrophic reactive hazards that have the potential to seriously impact the public, including those resulting from self-reactive chemicals and combinations of chemicals and process-specific conditions" to an "Open-Unacceptable Response" since more than ten years have passed since issuance of this recommendation, and EPA has not initiated rulemaking consistent with its intent.

Each regulatory recommendation made to OSHA or the EPA reflects a serious shortcoming in process safety management regulations, as the CSB investigations have demonstrated. OSHA has only taken a modest administrative action to partly address the recommendation regarding coverage of organizational changes under Management of Change requirements of the PSM standard. Even this administrative action is insufficient, as it relies on an interpretation of the standard that could be modified by a future OSHA

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[7] The CSB made another recommendation (2001-01-H-R1) to OSHA in its 2002 reactive hazards study to modify the PSM standard to more comprehensively manage reactive hazards. On January 28, 2004, the Board voted unanimously to designate the status of this recommendation as "Open-Unacceptable".

[8] For a copy of the public meeting transcript *see* http://www.csb.gov/assets/1/7/0725CSB-OSHA_(2).pdf (accessed October 27, 2014).

[9] "Open-Unacceptable" means that the recommendation recipient responds by expressing disagreement with the need outlined in the recommendation. The Board believes, however, that there is enough supporting evidence to ask the recipient to reconsider. The three open-unacceptable recommendations made to OSHA are: 1) Recommendation to ensure coverage under the Process Safety Management (PSM) standard for atmospheric storage tanks that could be involved in a potential catastrophic release as a result of being interconnected to a covered process with 10,000 pounds of a flammable substance. The recommendation was issued in 2002 following the CSB's investigation of a 2001 explosion of a poorly maintained, corroded storage tank containing spent sulfuric acid and flammable hydrocarbons at the Motiva refinery in Delaware City, Delaware. A worker was conducting hot work which ignited vapor through holes in the deteriorated tank. 2) Recommendation to revise the PSM standard to require management of change (MOC) reviews for organizational changes such as mergers and acquisitions that may impact process safety. This recommendation, issued in 2007, followed the 2005 explosions and fire at the BP Texas City refinery which killed 15 workers and injured 180 others. 3) Recommendation that OSHA issue a fuel gas safety standard for construction and general industry.

administration. With regard to reactive hazards, both OSHA and EPA have provided some very valuable additional guidance on its webpage, but have not taken any regulatory actions concerning these hazards. Finally, with regard to the hazards of atmospheric tanks with flammable connected to covered processes, OSHA has not fulfilled its commitments to administrative action (revisions of the PSM Compliance Directive), long past its promised or implied deadlines.

Executive Order 13650 presents an opportunity to advance these important CSB recommendations by advocating for their incorporation into forthcoming revisions to both PSM and RMP.

CSB Advocacy Activities to Date in the Context of the Recent Executive Order on Chemical Safety

Consistent with Executive Order 13650, both OSHA and the EPA issued Requests for Information, or RFIs, within the last year, requesting comment on potential revisions to several standards, including PSM and RMP.[10] The CSB submitted a comprehensive response to each RFI detailing needed improvements to the existing federal process safety management regulations, which are supported by a number of CSB ongoing and completed investigations.

For PSM, the CSB recommended that OSHA:

- Expand the rule's coverage to include the Oil and Gas Sector and add reactive chemicals, among others;
- Add additional management system elements to include the use of leading and lagging indicators to drive process safety performance and provide stop work authority to employees;
- Update existing Process Hazard Analysis requirements to include the documented use of inherently safer systems, hierarchy of controls, damage mechanism hazard reviews, and sufficient and adequate safeguards;
- Develop more explicit requirements for facility/process siting and human factors, including fatigue;
- Define and evaluate updates to Recognized And Generally Accepted Good Engineering Practice (RAGAGEP);

[10] OSHA issued its RFI on potential revisions to its standards, including the PSM standard, on December 9, 2013 (at 78 FR 73756). The CSB issued its formal response to the RFI on March 31, 2014. View the CSB's response at http://www.csb.gov/assets/1/16/CSB_RFIcomments.pdf (accessed October 27, 2014). The EPA issued its RFI on potential revisions to the RMP program regulations and related programs on July 31, 2014 (at 79 FR 44603). View the EPA RFI at https://www.federalregister.gov/articles/2014/07/31/2014-18037/accidental-release-prevention-requirements-risk-management-programs-under-the-clean-air-act-section (accessed October 27, 2014). The CSB issued its formal response to the RFI on October 29, 2014. View the CSB's response at http://www.csb.gov/assets/1/7/EPA_RFI.pdf (accessed November 12, 2014).

- Add safety-critical equipment to existing mechanical integrity requirements;
- Clarify Management of Change requirements to ensure they are applied to organizational changes
- Require coordination of covered facility emergency plans with local emergency-response authorities; and
- Permit third-party compliance audits

For RMP, in addition to PSM program related enhancements mentioned above, the CSB recommended that EPA:

- Expand the rule's coverage to include reactive chemicals, high and/or low explosives, and ammonium nitrate as regulated substances and to change enforcement policies for retail facilities;
- Enhance development and reporting of worst case and alternate release scenarios; and
- Add new prevention program requirements, including automated detection and monitoring, contractor selection and oversight, public disclosure of information, and, for petroleum refineries, attributes of goal-setting regulatory approaches.

Process Safety Reform at the State and Local Levels

In the Tesoro Anacortes investigation report, the CSB made recommendations to the state of Washington to augment its existing process safety management regulations to adopt more rigorous risk reduction requirements, including performance of a more comprehensive process hazard analysis; documented inherently safer systems analysis and hierarchy of controls to the greatest extent feasible with the goal of driving risk to ALARP; documented evaluation of the effectiveness of process safeguards; a thorough review of the comprehensive hazard analysis by a technically qualified regulator; and a requirement that all safety codes, standards, employer internal procedures and RAGAGEP contain adequate minimum requirements. Washington Governor Jay Inslee has committed to reviewing federal, state, and industry best practices to identify opportunities to further reduce or eliminate hazards associated with the catastrophic release of highly hazardous chemicals for all work places covered under Washington's Process Safety Management of Highly Hazardous Chemicals rules.[11]

In April 2013, the CSB released its first report on the August 2012 Chevron Richmond refinery incident ("the Interim Report") which made safety recommendations to a number of entities, including the California State Legislature, the EPA, Contra Costa County (CCC) and the City of Richmond. The Board recommended that the California State

[11] *See* August 14, 2014, letter sent from Washington Governor Jay Inslee to CSB Chairperson Moure-Eraso. In the letter he stated he was "fully committed to the prevention of all unnecessary worker fatalities, injuries and illnesses for our workers in Washington State."

Legislature require California petroleum refineries to perform damage mechanism hazard reviews; to identify and report leading and lagging process safety indicators; to document recognized methodologies, rationale, and conclusions used to claim that safeguards intended to control hazards will be effective; and to document their inherently safer systems analysis and the hierarchy of controls in establishing safeguards for process hazards, with the goal of driving risk of major accidents to ALARP. In response to the incident and to the CSB's recommendations, both CCC and the City of Richmond have each updated their Industrial Safety Ordinance regulations with more robust requirements.

In November 2014, the Board adopted the second investigation report on the Chevron incident ("the Regulatory Report"). The Regulatory Report makes a recommendation to the state of California that, similar to Washington, calls for a more rigorous process safety regulatory system for petroleum refineries with the goal of continuous risk reduction to prevent major incidents. These attributes include the development of a more comprehensive process hazard analysis; documented damage mechanism hazard reviews; documented use of inherently safer systems analysis and the hierarchy of controls "to the greatest extent feasible" with the goal of driving risk to ALARP or similar; and required preventative audits and inspections by a technically qualified regulator to ensure effective implementation of the comprehensive hazard analysis.

As a result of the Chevron Richmond refinery incident, the state of California has worked to revise and strengthen its PSM requirements. On September 9, 2014, the State of California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA) released its Draft *Process Safety Management for Refineries* Regulation.[12] The draft regulation incorporates a risk-reduction goal of "the greatest extent feasible"[13] for process hazard analyses and proposes significant new requirements such as performing damage mechanism reviews and hierarchy of controls analysis.

If adopted, California's draft proposed reforms to process safety management could serve as a model for the rest of the country. By adding this issue to the Most Wanted List, the CSB has an opportunity to advocate for the implementation of these recommendations, as well as to ensure that the applicability of such more rigorous risk reduction frameworks is explored within the context of the national dialogue on process safety management reform initiated under Executive Order 13650.

[12] The proposed draft regulations can be found here: http://www.dir.ca.gov/dosh/DoshReg/Process-Safety-Management-for-Refineries/PSM-Draft-Regulation.2014-09-09.pdf (accessed October 8, 2014).
[13] "Feasible" is defined as "capable of being achieved."

Conclusion

By adding the modernizing of U.S. process safety management regulations to the CSB's Most Wanted Safety Improvement List, the CSB is identifying this issue as one of the most important chemical safety improvement goals of the CSB. This issue is rooted in critical safety recommendations made over the last two decades to prevent recurrence of catastrophic industrial accidents by improving process safety management at federal, state, and local levels. Although some progress has been made, these recommendations have not been implemented to date. Executive Order 13650, *Improving Chemical Facility Safety and Security*, issued by the President on August 1, 2013, as well as positive steps towards modernizing process safety management at the state level, present an opportunity for the CSB to advance these key recommendations toward closure.

It is important to note that in the Chevron Regulatory Report, the Board committed to hold a public hearing in the Spring of 2015 to discuss the need for process safety management regulatory reform at the federal level. As stated in Section 7 of the Chevron Regulatory report:

> *The public hearing will include discussion of various models for high hazard facility safety regulation from around the U.S. and the world – including consideration of safety case type models [e.g. the "Safety Case" as practiced in the United Kingdom, Norway, and Australia]. Presentations, or written comments, regarding various regimes should discuss, at a minimum, the following:*

- *The role of transparency and community involvement;*
- *The effectiveness of worker (union and non-union) involvement programs and the effectiveness of protecting workers from retaliatory actions;*
- *The methods for measuring process safety performance and for reporting of process safety indicator data (to regulators, the public, third parties, or industry groups);*
- *The approach used to strive for risk reduction and continuous improvement;*
- *The approach for establishing a "tolerable" risk level; and*
- *The effectiveness of enforcement methods.*

Upon adoption of this issue onto the Most Wanted List by the CSB, CSB staff will develop an Advocacy Strategy to plan actions that the CSB and its staff will take to advocate for this issue. The strategy will include the public hearing described above and an issue webpage featuring the CSB's process safety management recommendations and responses to OSHA's PSM and EPA's RMP RFIs, among other actions. Moving forward, the CSB will be examining incidents at petroleum refineries around the country in order to study the need for fundamental process safety reform for refineries at the federal level. This study may identify additional changes in these regulations needed to protect workers, public health, and the environment.

Appendix A: CSB Recommendations for Process Safety Management Reform

Recommendation 2001-01-H-R1
2002 Improving Reactive Hazard Management Study
Recipient: OSHA
Status: Open--Unacceptable Response

Amend the Process Safety Management Standard (PSM), 29 CFR 1910.119, to achieve more comprehensive control of reactive hazards that could have catastrophic consequences.

- *Broaden the application to cover reactive hazards resulting from process-specific conditions and combinations of chemicals. Additionally, broaden coverage of hazards from self-reactive chemicals. In expanding PSM coverage, use objective criteria. Consider criteria such as the North American Industry Classification System (NAICS), a reactive hazard classification system (e.g., based on heat of reaction or toxic gas evolution), incident history, or catastrophic potential.*

- *In the compilation of process safety information, require that multiple sources of information be sufficiently consulted to understand and control potential reactive hazards. Useful sources include:*
    - *Literature surveys (e.g., Bretherick's Handbook of Reactive Chemical Hazards, Sax's Dangerous Properties of Industrial Materials).*
    - *Information developed from computerized tools (e.g., ASTM's CHETAH, NOAA's The Chemical Reactivity Worksheet).*
    - *Chemical reactivity test data produced by employers or obtained from other sources (e.g., differential scanning calorimetry, thermogravimetric analysis, accelerating rate calorimetry).*
    - *Relevant incident reports from the plant, the corporation, industry, and government. - Chemical Abstracts Service.*

- *Augment the process hazard analysis (PHA) element to explicitly require an evaluation of reactive hazards. In revising this element, evaluate the need to consider relevant factors, such as:*
    - *Rate and quantity of heat or gas generated. - Maximum operating temperature to avoid decomposition.*
    - *Thermal stability of reactants, reaction mixtures, byproducts, waste streams, and products.*

- *Effect of variables such as charging rates, catalyst addition, and possible contaminants.*
- *Understanding the consequences of runaway reactions or toxic gas evolution.*

Recommendation 2001-01-H-R3
2002 Improving Reactive Hazard Management Study
Recipient: EPA
Status: Open--Unacceptable Response

Revise the Accidental Release Prevention Requirements, 40 CFR 68, to explicitly cover catastrophic reactive hazards that have the potential to seriously impact the public, including those resulting from self-reactive chemicals and combinations of chemicals and process-specific conditions. Take into account the recommendations of this report to OSHA on reactive hazard coverage. Seek congressional authority if necessary to amend the regulation.

Recommendation 2001-05-I-DE-R1.
2002 Motiva Refinery Investigation Report
Recipient: OSHA
Status: Open—Unacceptable Response

Ensure coverage under the Process Safety Management Standard (29 CFR 1910.119) of atmospheric storage tanks that could be involved in a potential catastrophic release as a result of being interconnected to a covered process with 10,000 pounds of a flammable substance.

Recommendation 2005-4-I-TX-R9
2007 BP Texas City Final Investigation Report
Recipient: OSHA
Status: Open-Unacceptable Response

Amend the OSHA PSM standard to require that a management of change (MOC) review be conducted for organizational changes that may impact process safety including

a. major organizational changes such as mergers, acquisitions, or reorganizations;

b. personnel changes, including changes in staffing levels or staff experience; and

c. policy changes such as budget cutting.

Recommendations 2010-08-I-WA-R1 through R4
2014 Tesoro Anacortes Final Investigation Report
Recipient: EPA
Status: Open

2010-08-I-WA-R1

Revise the Chemical Accident Prevention Provisions under 40 CFR Part 68 to require the documented use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible when facilities are establishing safeguards for identified process hazards. The goal shall be to reduce the risk of major accidents to the greatest extent practicable, to be interpreted as equivalent to as low as reasonably practicable (ALARP). Include requirements for inherently safer systems analysis to be automatically triggered for all management of change, incident investigation, and process hazard analysis reviews and recommendations, prior to the construction of a new process, process unit rebuilds, significant process repairs, and in the development of corrective actions.

2010-08-I-WA-R2

Until Recommendation 2010-08-I-WA-R1 is in effect, enforce through the Clean Air Act's General Duty Clause, section 112(r)(1), 42 U.S.C. §7412(r)(1) the use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible when facilities are establishing safeguards for identified process hazards.

2010-08-I-WA-R3

Develop guidance for the required use of inherently safer systems analysis and the hierarchy of controls for enforcement under 40 CFR Part 68 and the Clean Air Act's General Duty Clause, section 112(r)(1), 42 U.S.C. §7412(r)(1).

2010-08-I-WA-R4

Effectively participate in the Tesoro Anacortes Refinery process safety culture survey oversight committee as recommended under recommendation 2010-08-I-WA-R15. Incorporate the expertise of process safety culture experts in the development and interpretation of the safety culture surveys. Ensure the effective participation of the workforce and their representatives in the development of the surveys and the implementation of corrective actions.

Recommendations 2010-08-I-WA-R5 through R7
2014 Tesoro Anacortes Final Investigation Report
Recipient: Washington State Legislature, Governor of Washington
Status: Open

2010-08-I-WA-R5

Based on the findings in this report, augment your existing process safety management regulations for petroleum refineries in the state of Washington with the following more rigorous goal-setting attributes:

a. A comprehensive process hazard analysis written by the company that includes:

i. Systematic analysis and documentation of all major hazards and safeguards, using the hierarchy of controls to reduce those risks to as low as reasonably practicable (ALARP);

ii. Documentation of the recognized methodologies, rationale and conclusions used to claim that safeguards intended to control hazards will be effective;

iii. Documented damage mechanism hazard review conducted by a diverse team of qualified personnel. This review shall be an integral part of the Process Hazard Analysis cycle and shall be conducted on all PSM-covered process piping circuits and process equipment. The damage mechanism hazard review shall identify potential process damage mechanisms and consequences of failure, and shall ensure effective safeguards are in place to control hazards presented by those damage mechanisms. Require the analysis and incorporation of applicable industry best practices and inherently safer design to the greatest extent feasible into this review; and

iv. Documented use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards. The goal shall be to drive the risk of major accidents to As Low As Reasonably Practicable (ALARP). Include requirements for inherently safer systems analysis to be automatically triggered for all Management of Change and Process Hazard Analysis reviews, prior to the construction of new processes, process unit rebuilds, significant process repairs, and in the development of corrective actions from incident investigation recommendations.

b. A thorough review of the comprehensive process hazard analysis by technically competent regulatory personnel;

c. Required preventative audits and preventative inspections by the regulator;

d. Require that all safety codes, standards, employer internal procedures and recognized and generally accepted good engineering practices (RAGAGEP) used in the implementation of the regulations contain adequate minimum requirements;

e. A model where the regulator, the company, and workers and their representatives play an equal and essential role in the direction of preventing major accidents. Require an increased role for workers in management of process safety by establishing the rights and responsibilities of workers and their representatives on health and safety-related matters, and the election of safety representatives and establishment of safety committees (with equal representation between management and labor) to serve health and safety-related functions. The elected representatives should have a legally recognized role that goes beyond consultation in activities such as the development of the comprehensive process hazard analysis, management of change, incident investigation, audits, and identification and effective control of hazards. The representatives should also have the authority to stop work that is perceived to be unsafe or that presents a serious hazard until the regulator intervenes to resolve the safety concern. Workforce participation practices should be documented by the company to the regulator; and

f. Requires reporting of information to the public to the greatest extent feasible such as a summary of the comprehensive process hazard analysis which includes a list of safeguards implemented and standards utilized to reduce risk, and process safety indicators that demonstrate the effectiveness of the safeguards and management systems.

2010-08-I-WA-R6

A well-funded, well-staffed, technically qualified regulator with a compensation system to ensure the Washington Department of Labor and Industries regulator has the ability to attract and retain a sufficient number of employees with the necessary skills and experience to ensure regulator technical qualifications. Periodically conduct a market analysis and benchmarking review to ensure the compensation system remains competitive with Washington petroleum refineries.

2010-08-I-WA-R7

Work with the regulator, the petroleum refining industry, labor, and other relevant stakeholders in the state of Washington to develop and implement a system that collects, tracks, and analyzes process safety leading and lagging indicators from operators and contractors to promote continuous process safety improvements. At a minimum, this program shall:

a. *Require the use of leading and lagging process safety indicators to actively monitor the effectiveness of process safety management systems and safeguards for major accident prevention. Include leading and lagging indicators that are measureable, actionable, and standardized. Include indicators that measure safety culture, such as incident reporting and action item implementation culture. Require that the reported data be used for continuous process safety improvement and accident prevention;*

b. *Analyze data to identify trends and poor performers and publish annual reports with the data at facility and corporate levels;*

c. *Require companies to publicly report required indicators annually at facility and corporate levels;*

d. *Use process safety indicators (1) to drive continuous improvement for major accident prevention by using the data to identify industry and facility safety trends and deficiencies and (2) to determine appropriate allocation of regulator resources and inspections; and*

e. *Be periodically updated to incorporate new learning from world-wide industry improvements in order to drive continuous major accident process safety improvements in Washington.*

Recommendations 2012-03-I-CA-R3 through R5
2013 Chevron Richmond Refinery Fire Interim Investigation Report
Recipient: Mayor and City Council, City of Richmond, California
Status: Open

2012-03-I-CA-R3

Revise the Industrial Safety Ordinance (ISO) to require that Process Hazard Analyses 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).

2012-03-I-CA-R4

Revise the Industrial Safety Ordinance (ISO) to require the documented use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards. The goal shall be to drive the risk of major accidents to As Low As Reasonably Practicable (ALARP). Include requirements for inherently safer systems analysis to be automatically triggered for all Management of Change and Process Hazard Analysis reviews, prior to the construction of new processes, process unit rebuilds, significant process repairs, and in the development of corrective actions from incident investigation recommendations.

2012-03-I-CA-R5

Ensure the effective implementation of the damage mechanism hazard review program (2012-03-I-CA-R1 and 2012-03-I-CA-R2), so that all necessary mechanical integrity work at the Chevron Richmond Refinery is identified and recommendations are completed in a timely way.

Recommendations 2012-03-I-CA-R6 through R8
2013 Chevron Richmond Refinery Fire Interim Investigation Report
Recipient: Board of Supervisors, Contra Costa County, California
Status: Open

2012-03-I-CA-R6

Revise the Industrial Safety Ordinance (ISO) to require that Process Hazard Analyses 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).

2012-03-I-CA-R7

Revise the Industrial Safety Ordinance (ISO) to require the documented use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards. The goal shall be to drive the risk of major accidents to As Low As Reasonably Practicable (ALARP). Include requirements for inherently safer systems analysis to be automatically triggered for all Management of Change and Process Hazard Analysis reviews, prior to the construction of new processes, process unit rebuilds, significant process repairs, and in the development of corrective actions from incident investigation recommendations.

2012-03-I-CA-R8

Monitor and confirm the effective implementation of the damage mechanism hazard review program (2012-03-I-CA-R1 and 2012-03-I-CA-R2), so that all necessary mechanical integrity work at the Chevron Richmond Refinery is identified and recommendations are completed in a timely way.

Recommendations 2012-03-I-CA-R9 through R14
2013 Chevron Richmond Refinery Fire Interim Investigation Report
Recipient: California State Legislature, Governor of California
Status: Open

2012-03-I-CA-R9

Revise the California Code of Regulations, Title 8, Section 5189, Process Safety Management of Acutely Hazardous Materials, to require improvements to mechanical integrity and process hazard analysis programs for all California oil refineries. These improvements shall include engaging a diverse team of qualified personnel to perform a documented damage mechanism hazard review. This review shall be an integral part of the Process Hazard Analysis cycle and shall be conducted on all PSM-covered process piping circuits and process equipment. The damage mechanism hazard review shall identify potential process damage mechanisms and consequences of failure, and shall ensure safeguards are in place to control hazards presented by those damage mechanisms. Require the analysis and incorporation of applicable industry best practices and inherently safety systems to the greatest extent feasible into this review.

2012-03-I-CA-R10

For all California oil refineries, identify and require the reporting of leading and lagging process safety indicators, such as the action item completion status of recommendations from damage mechanism hazard reviews, to state and local regulatory agencies that have chemical release prevention authority. These indicators shall be used to ensure that requirements described in 2012-03-I-CA-R9 are effective at improving mechanical integrity and process hazard analysis performance at all California oil refineries and preventing major chemical incidents.

2012-03-I-R11

Establish a multi-agency process safety regulatory program for all California oil refineries to improve the public accountability, transparency, and performance of chemical accident prevention and mechanical integrity programs. This program shall:

1. Establish a system to report to the regulator the recognized methodologies, findings, conclusions and corrective actions related to refinery mechanical integrity inspection and repair work arising from Process Hazard Analyses, California oil refinery turnarounds and maintenance-related shutdowns;

2. Require reporting of information such as damage mechanism hazard reviews, notice of upcoming maintenance-related shutdowns, records related to proposed and completed mechanical integrity work lists, and the technical rationale for any delay in work proposed but not yet completed;

3. Establish procedures for greater workforce and public participation including the public reporting of information; and

4. Provide mechanisms for federal, state and local agency operational coordination, sharing of data (including safety indicator data), and joint accident prevention activities. The California Department of Industrial Relations will be designated as the lead state agency for establishing a repository of joint

investigative and inspection data, coordinating the sharing of data and joint accident prevention activities.

2012-03-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).

2012-03-I-CA-R13

Require the documented use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards. The goal shall be to drive the risk of major accidents to As Low As Reasonably Practicable (ALARP). Include requirements for inherently safer systems analysis to be automatically triggered for all Management of Change and Process Hazard Analysis reviews, prior to the construction of new process, process unit rebuilds, significant process repairs and in the development of corrective actions from incident investigation recommendations.

2012-03-I-CA-R14

Monitor and confirm the effective implementation of the damage mechanism hazard review program (2012-03-I-CA-R9 and 2012-03-I-CA-R10), so that all necessary mechanical integrity work at all California Chevron Refineries is identified and recommendations are completed in a timely way.

Recommendation 2012-03-I-CA-R15
2013 Chevron Richmond Refinery Fire Interim Investigation Report
Recipient: EPA
Status: Open

Jointly plan and conduct inspections with Cal/OSHA, California EPA, and other state and local regulatory agencies with chemical accident prevention responsibilities to monitor the effective implementation of the damage mechanism hazard review and disclosure requirements under 2012-03-I-CA-R9 and R10 above.

Recommendations 2012-03-I-CA-R16 through R20
Recipients:
The Board of Supervisors, Contra Costa County, California, 2012-03-I-CA-R16;
The Mayor and City Council, City of Richmond, California, 2012-03-I-CA-R17;
The California Air Quality Management Divisions, 2012-03-I-CA-R18;
The U.S. Environmental Protection Agency, 2012-03-I-CA-R19; and
The California Environmental Protection Agency, 2012-03-I-CA-R20;
Status: Open

Participate in the joint regulatory program described in recommendation 2012-03-I-CA-R11. This participation shall include contributing relevant data to the repository of investigation and inspection data created by the California Department of Industrial Relations and jointly coordinating activities.

Recommendations 2012-03-I-CA-R21 through 23
2014 Chevron Richmond Refinery Fire Regulatory Report
Recipient: California State Legislature, Governor of California
Status: Open

2012-03-I-CA-R21

Based on the findings in this report, enhance and restructure California's process safety management (PSM) regulations for petroleum refineries by including the following goal-setting attributes:

a. Require a comprehensive process hazard analysis (PHA) written by the company that includes:

> *i. Systematic analysis and documentation of all major hazards and safeguards, using the hierarchy of controls to identify hazards and significantly reduce risks to a goal of as low as reasonably practicable (ALARP) or similar;*
>
> *ii. Documentation of the recognized methodologies, rationale and conclusions used to claim that inherently safer systems have been implemented to as low as reasonably practicable (ALARP) or similar, and that additional safeguards intended to control remaining hazards will be effective;*
>
> *iii. Documented damage mechanism hazard review conducted by a diverse team of qualified personnel. This review shall be an integral part of the process hazard analysis (PHA) cycle and shall be conducted on all covered processes, piping circuits and equipment. The damage mechanism hazard review shall identify potential process damage mechanisms and consequences of failure, and shall ensure effective safeguards are in place to prevent or control hazards presented by those damage mechanisms. Require the analysis and incorporation of applicable industry best practices and inherently safer design to the greatest extent feasible into this review; and*

iv. Documented use of inherently safer systems analysis and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards. The goal shall be to drive the risk of major accidents to As Low As Reasonably Practicable (ALARP) or similar. Include requirements for inherently safer systems analysis to be automatically triggered for all management of change (MOC) and process hazard analysis (PHA) reviews, as well as prior to the construction of new processes, process unit rebuilds, significant process repairs, and in the development of corrective actions from incident investigation recommendations.

b. Require a thorough review of the comprehensive process hazard analysis by technically competent regulatory personnel;

c. Require preventative audits and preventative inspections by the regulator to ensure the effective implementation of the comprehensive process hazard analysis (PHA);

d. Require that all safety codes, standards, employer internal procedures and recognized and generally accepted good engineering practices (RAGAGEP) used in the implementation of the regulations contain adequate minimum requirements;

e. Require mechanisms for the regulator, the refinery, and workers and their representatives to play an equal and essential role in the direction of preventing major incidents. Require an expanded role for workers in management of process safety by establishing the rights and responsibilities of workers and their representatives on health and safety-related matters, and the election of safety representatives and establishment of safety committees (with equal representation between management and labor) to serve health and safety-related functions. The elected representatives should have a legally recognized role that goes beyond consultation in activities such as the development of the comprehensive process hazard analysis, implementation of corrective actions generated from hierarchy of control analyses, management of change, incident investigation, audits, and the identification, prevention, and control of all process hazards. The regulation should provide workers and their representatives with the authority to stop work that is perceived to be unsafe until the employer resolves the matter or the regulator intervenes. Workforce participation practices should be documented by the refinery to the regulator;

f. Require reporting of information to the public to the greatest extent feasible, such as a summary of the comprehensive process hazard analysis (PHA) which should include a list of inherently safer systems implemented; safeguards implemented for remaining hazards; standards utilized to reduce risks to As Low As Reasonably Practicable (ALARP) or similar; and process safety indicators that demonstrate the effectiveness of the safeguards and management systems;
g. Implement an approach or system that determines when new or improved industry standards and practices are needed and initiate programs and other activities, such as an advisory committee or forum, to prompt the timely development and implementation of such standards and practices; and

h. Ensure that a means of sustained funding is established to support an independent, well-funded, well-staffed, technically competent regulator.

2012-03-I-CA-R22

Implement a compensation system to ensure the regulator has the ability to attract and retain a sufficient number of employees with the necessary skills and experience to ensure regulator technical competency at all levels of process safety regulatory oversight and policy development in California. A market analysis and benchmarking review should be periodically conducted to ensure the compensation system remains competitive with California petroleum refineries.

2012-03-I-CA-R23

Work with the regulator, the petroleum refining industry, labor, and other relevant stakeholders in the state of California to develop and implement a system that collects, tracks, and analyzes process safety leading and lagging indicators from refineries and contractors to promote continuous safety improvements. At a minimum, this program shall:

a. Require the use of leading and lagging process safety indicators to actively monitor the effectiveness of process safety management systems and safeguards for major accident prevention. Include leading and lagging indicators that are measureable, actionable, and standardized. Require that the reported data be used for continuous process safety improvement and accident prevention;

b. Analyze data to identify trends and poor performers and publish annual reports with the data at facility and corporate levels;

c. Require companies to publicly report required indicators annually at facility and corporate levels;

d. Use process safety indicators (1) to drive continuous improvement for major accident prevention by using the data to identify industry and facility safety trends and deficiencies and (2) to determine appropriate allocation of regulator resources and inspections; and

e. Be periodically updated to incorporate new learning from world-wide industry improvements in order to drive continuous major accident safety improvements in California.

Recommendation 2012-03-I-CA-R24
2014 Chevron Richmond Refinery Fire Regulatory Report
Recipient: Mayor and City Council, City of Richmond, California
Status: Open

2012-03-I-CA-R24

Implement or cause to be implemented a compensation system to ensure the regulator has the ability to attract and retain a sufficient number of employees with the necessary skills and experience to ensure regulator technical competency at all levels of process safety regulatory oversight and policy development in Richmond, California. A market analysis and benchmarking review should be periodically conducted to ensure the compensation system remains competitive with California petroleum refineries.

Recommendation 2012-03-I-CA-R25
2014 Chevron Richmond Refinery Fire Regulatory Report
Recipient: Board of Supervisors, Contra Costa County, California
Status: Open

2012-03-I-CA-R25

Implement a compensation system to ensure the regulator has the ability to attract and retain a sufficient number of employees with the necessary skills and experience to ensure regulator technical competency at all levels of process safety regulatory oversight and policy development in Contra Costa County, California. A market analysis and benchmarking review should be periodically conducted to ensure the compensation system remains competitive with California petroleum refineries.