



CSB Public Meeting

**CSB Investigation of Chevron Richmond
Refinery Pipe Rupture and Fire**

Richmond, California

January 15, 2014





Chevron Richmond Refinery Investigation

Speakers from Investigation Team:

- Don Holmstrom**
- Dan Tillema**
- Amanda Johnson**





Public Meeting Agenda

- **Incident Summary**
- **Key Findings**
- **Proposed Recommendations**
- **Board Questions**
- **Public Statement Period**
- **Board Vote**



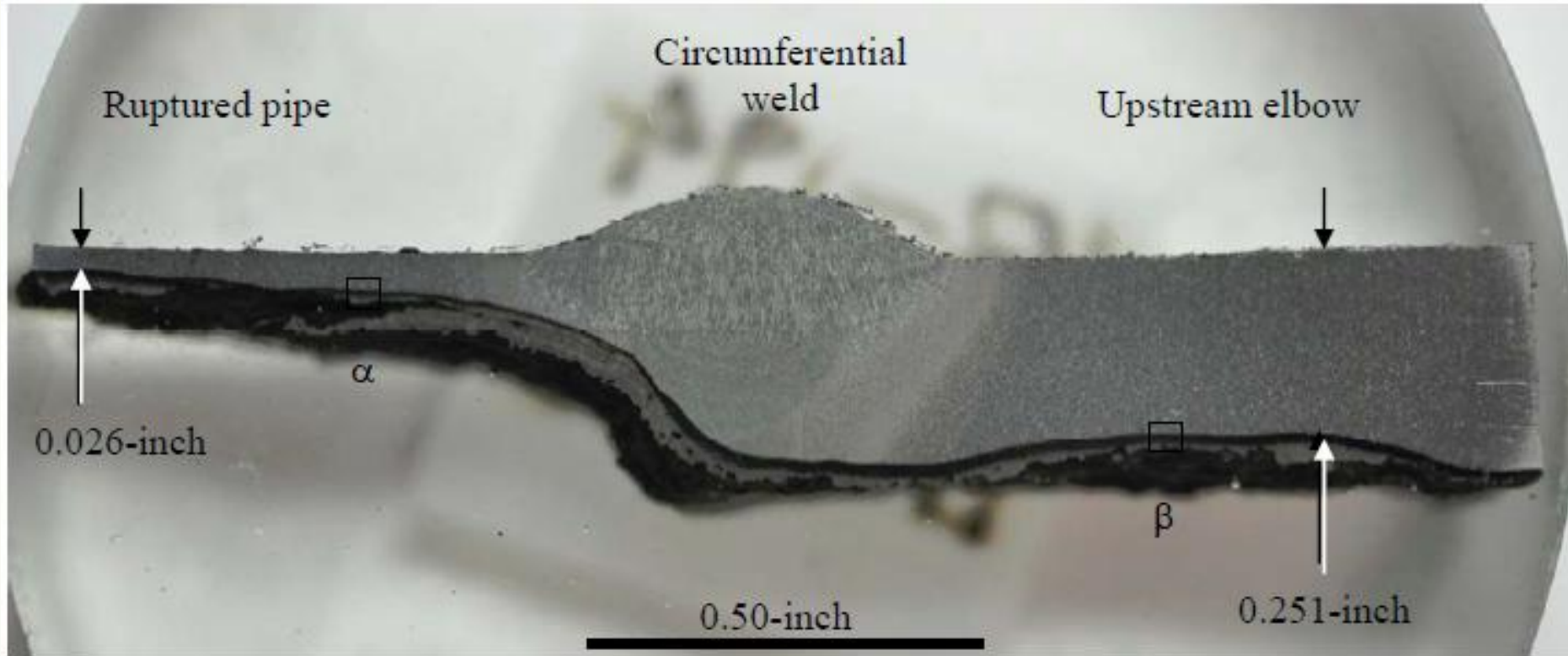




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Refinery Process Safety is a Problem

- Over the last decade, there has been a considerable problem with significant and deadly incidents at petroleum refineries in the United States.
- In 2012 alone, the CSB tracked **125 significant process safety incidents** at US petroleum refineries. Seventeen of these took place in California.

The U.S. has experienced financial losses from refinery incidents that are at least three times that of other countries.



Refinery Process Safety is a Problem

The CSB has investigated many U.S. refinery incidents:

- Tosco Avon Refinery (1999 - **4 fatalities**)
- Motiva Enterprises Refinery (2002)
- Giant Industries Ciniza Refinery (2004)
- BP Texas City (2005 - **15 fatalities**)
- Valero Refinery (2005 - **2 fatalities**)
- Valero Refinery (2007)
- Silver Eagle Refinery (2009)
- CITGO Refinery (2009)
- Tesoro Anacortes Refinery (2010 - **7 fatalities**)
- Chevron Richmond Refinery (2012)

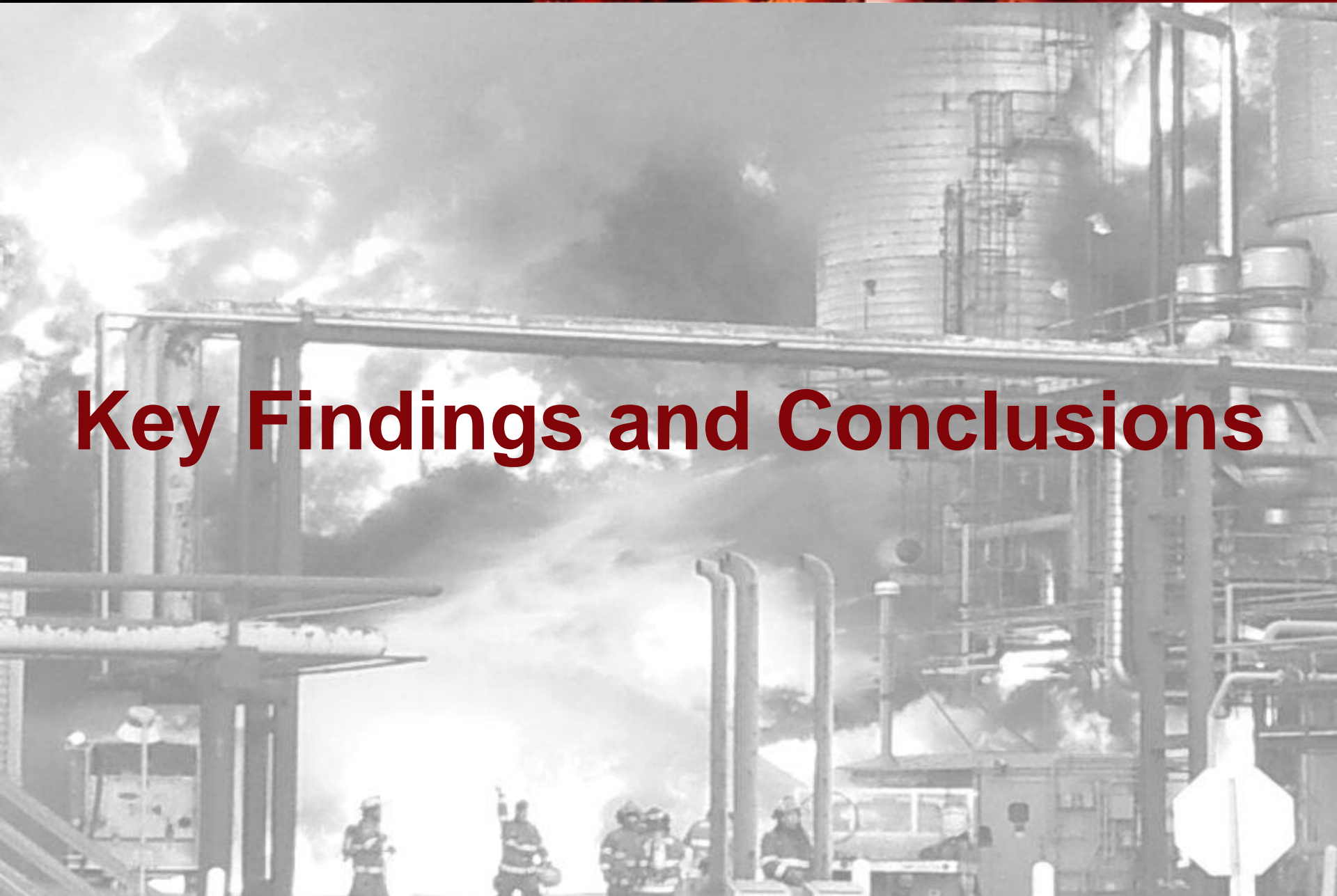


Process Safety Gaps Led to Chevron Refinery Incident

- Damage mechanism hazard reviews were not performed
- Internal Chevron recommendations were not implemented
- Safeguard effectiveness was not rigorously evaluated
- Inherently safer design was not effectively employed
- MOCs and incident investigations did not control recognized hazards



Key Findings and Conclusions





Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 1

Are activity-based rather than goal-based



Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 2

**Are static: are unable to adapt to innovation,
newly defined hazards, and technical
advances**



Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 3

Do not ensure continuous improvement



Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 4

**Do not require the use or implementation of
inherently safer systems or
hierarchy of controls**



Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 5

**Do not effectively involve the workforce in
hazard analyses**



Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 6

Do not grant the regulator the authority to accept or reject a company's hazard analysis, risk assessment, or proposed safeguards



Regulatory Key Findings

The existing U.S. and California Process Safety Regimes:

Finding 7

Do not employ the requisite number of staff with the technical skills, knowledge, and industry experience to provide sufficient direct safety oversight of petroleum refineries



CSB's Proposed PSM Regulatory System Conclusions

Tweaking regulations only incorporates learnings from most recent accidents. This is performed at a very slow rate, if at all.

The safety case regime requires continuous risk reduction and is a more effective approach to prevent major incidents in petroleum refineries.



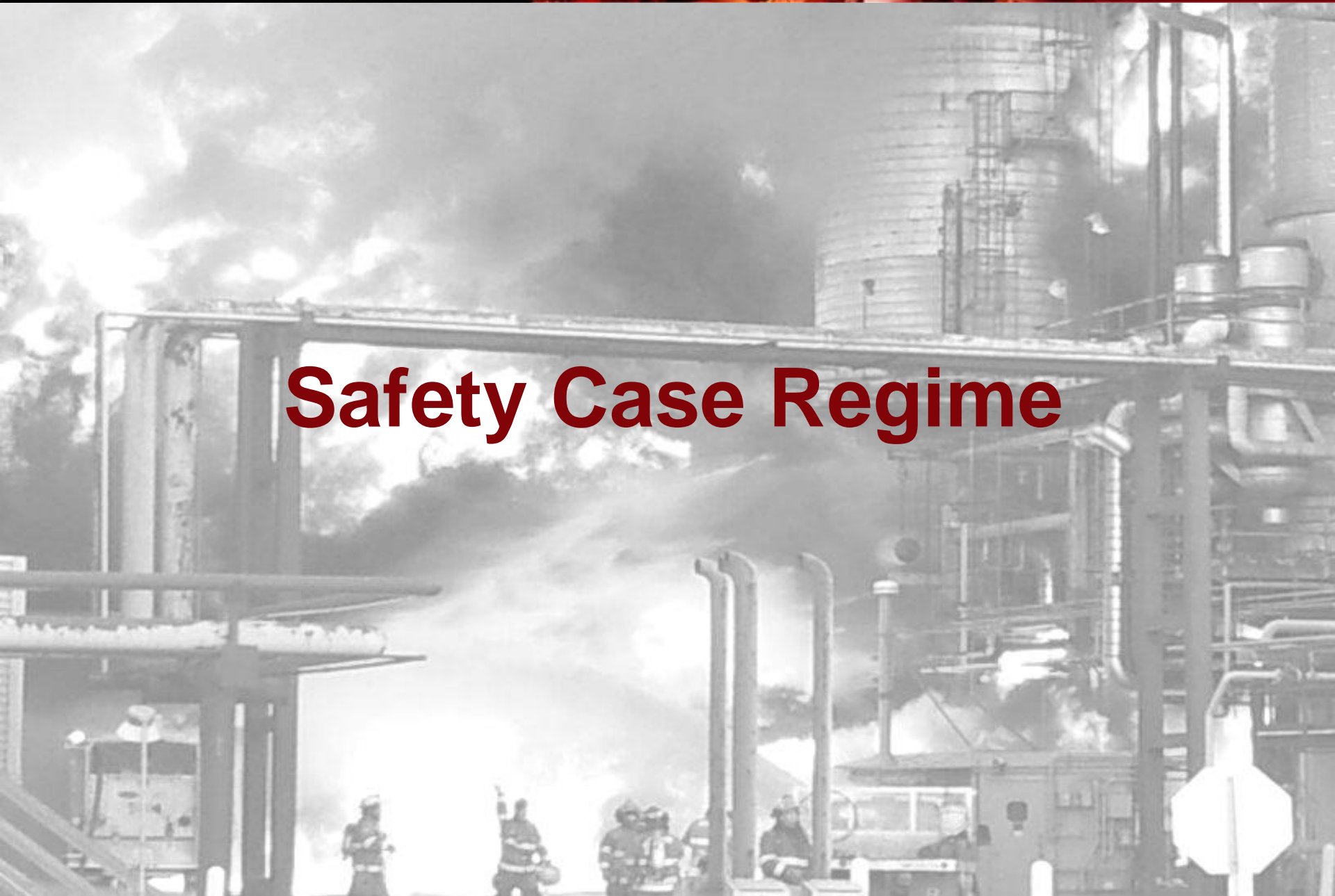
U.S. Uses Safety Case Approach in Other Industries

*The safety case regulatory approach is not foreign
to the U.S.*

The U.S. already uses the safety case approach:

Nuclear Regulatory Commission (NRC)

National Aeronautics and Space Administration (NASA)



Safety Case Regime



Safety Case Definition

Andrew Hopkins:

Lessons from Esso Gas Plant Explosion, ANU 2013

A verifiable case which the company makes to a regulator, setting how safety is to be managed. Includes:

- Identification of hazards and controls
- Demonstration by the company to the regulator that its strategy for managing safety is satisfactory
- Adoption of industry best practices by the company



Key Features of an Effective Safety Case Regime





Safety Case Regime Key Feature

Duty Holder Safety Responsibility

- Written safety case report that describes how hazards and risk are reduced to ALARP
- Must demonstrate how inherently safer design concepts have been applied
- Should be an evergreen document
- Regulators review must “accept” the safety case report
- Submitted to the regulator at least every five years



Safety Case Regime Key Feature

Continuous Risk Reduction to ALARP

- Duty on owners or operators of covered facilities to reduce risks to ALARP
- CCPS definition of ALARP:
“a risk reduction goal, where risk reduction efforts are continued until the incremental effort to further reduce risk becomes grossly disproportionate to the level of additional risk reduction.” Center for Chemical Process Safety (CCPS). *Inherently Safer Chemical Processes – A Life Cycle Approach*; 2nd ed., 2009; p 46.
- Regulator may accept good practice as ALARP or may require additional measures be taken to further reduce risk



Safety Case Regime Key Feature

Adaptability and Continuous Improvement

- Allows regulator to require facilities to go above and beyond current good practices and standards to achieve ALARP **without requiring rulemaking**
- This would allow California regulators to require petroleum refineries to implement their own technically sound recommendations or upgrade sulfidation-susceptible carbon steel equipment to inherently safer materials of construction



Safety Case Regime Key Feature

Active Workforce Participation

- CCPS: Workforce involvement provides management a mechanism for tapping into valuable expertise. *Guidelines for Risk Based Process Safety; March 2007.*
- The PSM standard only requires **consultation** with employees
- **The safety case goes further:**
 - Provides for the election of safety representatives and creation of safety committees.
 - Uses tripartite approach with active and equal participation from the regulator, industry, and labor.



Transparency

- **Interim Report**
 - Recommendation to CA to establish procedures for greater workforce and public participation
- **Lack of Transparency with PSM and RMP**
 - Key records related to PHAs, turnarounds, maintenance-related shutdowns not made public
- **Safety Case**
 - Safety Case summaries made available to the public
 - Detailed, publically reported process safety indicator data shows trends and allows for target setting



Safety Case Regime Key Feature

Process Safety Indicators

- OSHA recordable injury and illness rates are not sufficient.
- The Safety Case allows regulators to
 - Collect and analyze indicator data
 - Release the data and trends to the public
 - Use the data to target inspections
 - Drive continuous improvement



Safety Case Regime Key Feature

Regulatory Assessment, Verification, and Intervention

- Regulators review and accept safety case reports
- Great emphasis is placed on inherently safer design and the hierarchy of controls
- The regulator may reject the safety case report and require additional measures to further reduce risks
- Preventative inspections and audits are conducted to intervene before high-risk activities commence

This rarely happens in the U.S.



Safety Case Regime Key Feature

Well-Funded and Qualified Regulator

The role of the safety regulator:

- Provide independent assurance that companies have identified risks and put appropriate measures in place to control them
- Can interact as equals with company management
- Retain a sufficient number of technically competent, experienced, and well-trained staff that can critically assess safety case reports and performance



Safety Case Implementation Strategies

- Major stakeholders must be committed to the process
- The safety case report must be treated as an evergreen document that accurately reflects new process hazards and risks
- The safety case report must not be treated as a check-the-box exercise
- The transition to the safety case regime must be carefully planned and managed. It may take several years to effectively implement

A grayscale photograph of an industrial facility, possibly a refinery or chemical plant, with several firefighters in full gear working in the foreground. The scene is filled with smoke and steam, suggesting a recent incident or ongoing emergency response. The background shows complex piping, storage tanks, and structural steel.

Proposed Recommendations



Proposed Recommendations

To California State Legislature, Governor of California

Develop and implement a step-by-step plan to establish a more rigorous safety management regulatory framework for petroleum refineries in the state of California based on the principles of the “safety case” framework in use in regulatory regimes such as those in the United Kingdom, Australia, and Norway, and as described in this report, with the following minimum components:



Proposed Recommendations

To California State Legislature, Governor of California

- a. A case for safety written by the duty holder that includes a systematic analysis and documentation of all major hazards and effective control methods implemented to reduce those risks as low as reasonably practicable (ALARP);**
- b. A thorough review of the safety case report by technically competent regulatory personnel that requires modifications and improvements to the document as necessary prior to acceptance;**
- c. Audits and preventative inspections by the regulator to verify effective implementation of safety case elements;**



Proposed Recommendations

To California State Legislature, Governor of California

- d. A risk management approach that requires analysis and effective implementation of safeguards, using the hierarchy of controls, to protect people and the environment from major accident hazards. The effectiveness of the safeguards will be demonstrated through the use of leading and lagging process safety indicators;**
- e. Ability to adapt and implement safety requirements in response to newly identified hazards, advances in technology, lessons learned from major accidents, and improved safety codes without the need for new rule-making;**



Proposed Recommendations

To California State Legislature, Governor of California

- f. Determines when new or improved industry standards and practices are needed and initiates programs and other activities such as forums to prompt the timely development and implementation of such standards and practices;**
- g. Uses a tripartite model where the regulator, the company, and workers and their representatives play an equal and essential role in the direction of preventing major accidents;**



Proposed Recommendations

To California State Legislature, Governor of California

- h. A regulatory model and accompanying guidance based on the UK's The Safety Representatives and Safety Committees Regulations 1977 and the Health and Safety (Consultation with Employees) Regulations 1996, which set out the legal framework for 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 to serve health and safety-related functions.**



Proposed Recommendations

To California State Legislature, Governor of California

- i. Requires reporting of information to the public to the greatest extent feasible such as a summary of the safety case report, the process hazard analysis, 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;**
- j. An independent, well-funded, well-staffed, technically competent regulator; and**



Proposed Recommendations

To California State Legislature, Governor of California

- k. A compensation system to ensure the safety case regulator has the ability to attract and retain a sufficient number of employees with the necessary skills and experience to ensure regulator technical competency. Periodically conduct a market analysis and benchmarking review to ensure the compensation system remains competitive with California petroleum refineries.**



Proposed Recommendations

To California State Legislature, Governor of California

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 operators and contractors to promote continuous safety improvements. At a minimum, this program shall:



Proposed Recommendations

To California State Legislature, Governor of California

- 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;**



Proposed Recommendations

To California State Legislature, Governor of California

- 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.**



Proposed Recommendations

*To The Chemical Facility Safety and Security Working Group
To Occupational Safety and Health Administration*

This report highlights significant advantages of the safety case regime over the existing Process Safety Management standard to prevent potentially catastrophic chemical accidents that are relevant to OSHA's response to Executive Order 13650. In the development of the OSHA EO response, incorporate a written plan that includes the evaluation of issues raised from the findings, conclusions and recommendations in this report concerning the safety case regime.



Questions from the Board





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