Changes in the PSM/RMP Regulatory Framework  
(California and National)  

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Prepared for Presentation at  
11th Global Congress on Process Safety  
Austin, Texas  
April 27-29, 2015  

UNPUBLISHED  

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Keywords: PSM, RMP, CalARP, Cal/OSHA, OSHA, EPA, Process Safety

Abstract

Since August 2012, significant changes have been proposed by a number of agencies to Safety Management Systems (SMS) Programs, e.g., Process Safety Management (PSM), Risk Management Programs (RMP), and related SMS Regulatory Requirements. Many of these are framed within OSHA's and EPA's PSM/RMP Modernization/Expansion Programs, and key technical and regulatory changes are being proposed by Federal OSHA, U.S. EPA, Cal/OSHA, Chemical Safety Board (CSB), California Office of Emergency Services (OES), and other agencies. As part of these SMS Regulatory Program Modernization Initiatives, on October 31, 2014, Cal/OSHA issued the latest update to its proposed regulation for "Process Safety Management for Refineries" in response to a report from the California Interagency Refinery Task Force.

The changes being proposed for these programs are extensive, currently being formulated, and are not synchronized between the various agencies. The focus of this paper will be to provide relevant background information, a summary of the proposed changes, and tips for addressing key technical and regulatory challenges, as well as providing the reader with a "roadmap" for effective implementation. This paper is designed to address the regulatory environment in March 2015, will be updated periodically to reflect this “moving target”, and key topics include:

- Background – Pre-2012 PSM/RMP Universe
- Overview of Key Safety Management System Program Modernization Initiatives
- Key Elements of the Various SMS Regulatory Initiatives
- SMS Modernization Status and Potential SMS Program Impact
- What Should I Be Doing Now?

1. Background – Pre-2012 PSM/RMP Universe

The December 2, 1984 Methyl Isocyanate (MIC) release from the Union Carbide Bhopal Facility is considered a pivotal event in catalyzing the application of Safety Management System (SMS) approaches to control process safety. Referencing the analogies in Figure 1.1, the MIC release
resulted from the concurrent alignment of several “holes,” and the magnitude of the tragedy (3928 fatalities and over 100,000 permanent injuries are estimated)\[1\], drew the attention of industry, the public, and the regulatory community to the potential consequences associated with process safety events (Figure 1.2). Industry was quick to realize the significance of the event, with respect to the need to create and implement SMS mechanisms at highly-hazardous facilities, and the importance of developing mechanisms to control process safety.

Industry’s response was swift and definitive. The American Institute of Chemical Engineers (AIChE) founded the Center for Chemical Process Safety (CCPS) in 1985, recognizing that the most effective mechanism for addressing process safety was not the application of additional prescriptive mechanisms, or by addressing any specific action, but by effecting changes in the way business is done (i.e., safety culture and management systems). CCPS Guidebooks are currently considered key references in conveying the technologies needed for process safety, and the very first guidebook ("Guidelines for Technical Management of Chemical Process Safety")\[2\] published in 1987 was designed to address this pressing need. Shortly thereafter, the American Petroleum Institute (API) distilled its version of Safety Management Systems and issued Recommended Practice 750, “Management of Process Hazards”\[3\] in 1990. The following characteristics have remained consistent from the onset:

- All segments of the process industries correctly identified SMS as the primary and most effective mechanism for addressing core issues associated with process safety incidents.
Although some details differ between the above two documents, and also between the current requirements of OSHA’s Process Safety Management (PSM) Program[4], U.S. EPA’s Risk Management Program (RMP)[5], Bureau of Safety and Environmental Enforcement’s (BSEE’s) Safety and Environmental Management Systems (SEMS) Program[6], the same key Safety Management System elements are at the core of PSM, RMP, and SEMS, spanning an entire spectrum of facility types and geographic application.

Figure 1.3 illustrates the parallel evolution of PSM, RMP, and SEMS Programs. It’s interesting to note that although PSM and RMP were catalyzed by an onshore tragedy and focus on onshore facilities in the United States and SEMS was catalyzed by an offshore-US tragedy and focuses on offshore facilities in waters off the coast of the United States, the key prevention program elements are nearly identical (see the key elements of PSM in Figure 1.4). This parallel evolution and resultant overlap are important to note for several reasons:

- Although these regulatory programs were developed independently, at different times, and in different locations, industry and the regulatory community noted the importance of SMS application across all facility types.
- As performance-based regulatory requirements continue to evolve, the same phenomenon associated with the effectiveness of key SMS elements will gravitate the programs towards synchronization.

The Richmond Refinery Fire on August 6, 2012 and West (Texas) Ammonium Nitrate Explosion (April 17, 2013) triggered a fresh look at the different SMS programs and resulted in several proposals for the modernization of PSM and RMP.

![FIGURE 1.4 – Key PSM Elements](image-url)
2. Overview of Key Safety Management Systems Program Modernization Initiatives

Since August 2012, significant changes have been proposed by a number of agencies to Safety Management Systems (SMS) Programs. After various high-profile incidents occurred, Executive Order 13650 was signed by President Obama on August 1, 2013 to emphasize the importance of various agencies working together towards the common goal of improving process safety, as well as modernizing the current standards[7]. In addition to Executive Order 13650 mandating increased coordination amongst federal agencies, the Chemical Safety Board (CSB) investigated the Richmond Refinery Fire, and identified improvement areas[8,9,10] for both PSM/RMP implementation at the facility, as well as agency oversight and cooperation (eventually forming the Interagency Refinery Task Force). As a result, there have been changes proposed for the following programs: Federal OSHA PSM[11], U.S. EPA RMP[12], and Cal/OSHA PSM[13].

<table>
<thead>
<tr>
<th>TABLE 2.1 – SMS Program Overlap Matrix (March 2015)</th>
<th>Fed OSHA</th>
<th>Cal/OSHA</th>
<th>U.S. EPA</th>
<th>CalARP</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Process) Safety Information</td>
<td>1910.119 (d)</td>
<td>5189 (d)</td>
<td>68.65</td>
<td>2760.1</td>
</tr>
<tr>
<td>Process Hazard Analysis (PHA)</td>
<td>1910.119 (e)</td>
<td>5189 (e)</td>
<td>68.67</td>
<td>2760.2</td>
</tr>
<tr>
<td>Operating Procedures</td>
<td>1910.119 (f)</td>
<td>5189 (f)</td>
<td>68.69</td>
<td>2760.3</td>
</tr>
<tr>
<td>Training</td>
<td>1910.119 (g)</td>
<td>5189 (g)</td>
<td>68.71</td>
<td>2760.4</td>
</tr>
<tr>
<td>Mechanical Integrity</td>
<td>1910.119 (j)</td>
<td>5189 (j)</td>
<td>68.73</td>
<td>2760.5</td>
</tr>
<tr>
<td>Management of Change</td>
<td>1910.119 (i)</td>
<td>5189 (l)</td>
<td>68.75</td>
<td>2760.6</td>
</tr>
<tr>
<td>Pre-Startup Safety Review</td>
<td>1910.119 (i)</td>
<td>5189 (i)</td>
<td>68.77</td>
<td>2760.7</td>
</tr>
<tr>
<td>Compliance Audits</td>
<td>1910.119 (o)</td>
<td>5189 (o)</td>
<td>68.79</td>
<td>2760.8</td>
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<tr>
<td>Incident Investigation</td>
<td>1910.119 (m)</td>
<td>5189 (m)</td>
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<td>Employee Participation</td>
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<td>68.87</td>
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<tr>
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<td>5189 (n)</td>
<td>68.90-95</td>
<td>2765</td>
</tr>
<tr>
<td>Off-site Consequence Analysis</td>
<td>---</td>
<td>---</td>
<td>68.20-42</td>
<td>2750</td>
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</table>

a – Captured as part of the “Injury and Illness Prevention Program” Subsection.

Table 2.1 (above) identifies the key elements of the California SMS regulatory elements that are in-place as of March 2015. Table 2.2 (below) summarizes and compares the various changes being proposed (as of March 2015) for the various SMS Regulatory Program Modernization Initiatives. Table 2.2 also delineates the various topics by the type and magnitude of the impact on PSM and RMP Programs. References 11, 12, and 13 may be reviewed for more complete details, and Section 3 is designed to provide additional background on the proposed changes. Many of these additional requirements overlap, and with some planning, existing PSM, RMP, and CalARP efforts can be slightly modified to address some of the more significant new requirements with minimal effort. The focus of this paper will be to summarize the more significant changes proposed by the various agencies, and provide readers with a “roadmap” of how to effectively implement these changes in as efficient a manner as possible.
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Atmospheric Tank PSM Exemption Clarification</td>
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<td>1</td>
<td>Inclusion of Oil/Gas-Well Drilling &amp; Servicing</td>
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<tr>
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<td>3</td>
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<td>2</td>
<td>Expand Coverage &amp; Requirements for Reactivity Hazards</td>
<td>4</td>
<td>II.C.1.d</td>
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<tr>
<td>4</td>
<td>Updating the List of Applicable Chemicals / Threshold Quantities</td>
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<td>II.C.1</td>
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<tr>
<td>2</td>
<td>Require Additional Management System Elements from Risk Based Process Safety (RBPS) and Bureau of Safety and Environmental Enforcement (BSEE) Safety and Environmental Management Systems (SEMS)</td>
<td>6</td>
<td>II.C.2</td>
<td>5189.1(q)</td>
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<tr>
<td>4</td>
<td>Evaluation of Updates Applicable to Recognized and Generally Accepted Good Engineering Practices (RAGAGEP)</td>
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<td>II.C.3</td>
<td>5189.1 (d)</td>
</tr>
<tr>
<td>4</td>
<td>Adding a Definition for RAGAGEP</td>
<td>8</td>
<td>II.C.3</td>
<td>5189.1 (c)</td>
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<tr>
<td>4</td>
<td>Cover the Mechanical Integrity of Any Safety-Critical Equipment</td>
<td>9</td>
<td>II.C.4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Management of Organizational Changes</td>
<td>10</td>
<td>II.C.5</td>
<td>5189.1 (t)</td>
</tr>
<tr>
<td>3</td>
<td>Require Coordination of Emergency Planning with Local Emergency-Response Authorities</td>
<td>11</td>
<td>II.D.5</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Require Third Party Compliance Audits</td>
<td>12</td>
<td>II.C.6</td>
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<tr>
<td>4</td>
<td>Expanding the Requirements of §1910.109 to Cover Dismantling and Disposal of Explosives, Blasting Agents, and Pyrotechnics</td>
<td>13</td>
<td>II.C.1.b</td>
<td>N/A</td>
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<tr>
<td>4</td>
<td>Updating §1910.106 and 1910.107 Based on the Latest Applicable Consensus Standards</td>
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<td>N/A</td>
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<td>1</td>
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<td>II.C.1.b/c, II.D.1</td>
<td>N/A</td>
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<td>1</td>
<td>Enforcement of the Exemption for Retail Facilities</td>
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<td>II.C.7</td>
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<tr>
<td>4</td>
<td>Enforcement Policy for Highly Hazardous Chemicals Without Specific Concentration Thresholds</td>
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<td>---</td>
<td>N/A</td>
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<tr>
<td>2</td>
<td>Safer Technology and Alternatives Analysis</td>
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<td>II.D.1</td>
<td>5189.1 (e, l)</td>
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<tr>
<td>3</td>
<td>Emergency Drills to Test Emergency Response Plan</td>
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<td>II.D.2</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Automated Detection and Monitoring</td>
<td>---</td>
<td>II.D.3</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Additional Stationary Source Requirements</td>
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<td>Incident Investigation and Accident History Requirements</td>
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<td>II.D.6</td>
<td>5189.1 (o)</td>
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<tr>
<td>4</td>
<td>WCS Quantity Requirements for Numerous Small Vessels</td>
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<td>II.D.7</td>
<td>N/A</td>
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<td>4</td>
<td>Public Disclosure of Information to Promote Compliance and Public Understanding</td>
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<td>II.D.8</td>
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<tr>
<td>4</td>
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<td>II.D.9</td>
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<td>II.D.10</td>
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<td>II.D.11</td>
<td>---</td>
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<tr>
<td>1</td>
<td>Streamlining RMP Requirements / Effects of OSHA PSM Coverage on RMP Applicability</td>
<td>---</td>
<td>II.D.12, II.D.7</td>
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</tr>
<tr>
<td>2</td>
<td>Damage Mechanism Review (DMR)</td>
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<td>5189.1 (e, k)</td>
</tr>
<tr>
<td>2</td>
<td>Hierarchy of Hazard Control Analysis (HCA)</td>
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<td>5189.1 (e, l)</td>
</tr>
<tr>
<td>2</td>
<td>Safeguard Protection Analysis (SPA)</td>
<td>---</td>
<td>---</td>
<td>5189.1 (e, u)</td>
</tr>
<tr>
<td>3</td>
<td>Contractor Safety Research and Documentation</td>
<td>---</td>
<td>---</td>
<td>5189.1 (h)</td>
</tr>
<tr>
<td>2</td>
<td>Management of Change (Interaction with other Elements)</td>
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</tr>
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<td>2</td>
<td>Incident Investigation – Root Cause Analysis</td>
<td>---</td>
<td>---</td>
<td>5189.1 (o)</td>
</tr>
<tr>
<td>3</td>
<td>Process Safety Culture Assessment (PSCA)</td>
<td>---</td>
<td>---</td>
<td>5189.1 (r)</td>
</tr>
</tbody>
</table>
3. Key Elements of the Various SMS Regulatory Initiatives

The key elements of the various Safety Management System (SMS) Regulatory Initiatives identified in Table 2.2 have been categorized into four subsets to facilitate understanding and to strategize on their implementation.

3.1 SMS Program Modernization Initiatives – Subset 1

Subset 1 topics in Table 2.2 were judged to have the potential to alter facility program types or add additional facilities to the regulatory regimes, including:

1. **Atmospheric Tank PSM Exemption Clarification** – In a previous court decision (Secretary of Labor v. Meer Corporation (1997)) it was ruled that PSM coverage does not extend to atmospheric tanks connected to, or in close proximity to, a process; OSHA noted that this is contrary to its interpretation of the Standard[^11], and thus would like to close this exemption by revising (a)(1)(ii)(B) to incorporate flammable liquids in atmospheric storage tanks within or connected to a PSM covered process.

2. **Inclusion of Oil/Gas-Well Drilling and Servicing and Inclusion of Oil/Gas-Production Facilities** – The inclusion of oil- and gas-well drilling and servicing, as well as oil- and gas-production facilities in PSM coverage is an effort designed to address a perceived gap in the original rollout of PSM by Federal OSHA per the previous OSHA initiative to create separate drilling and servicing rules (48 FR 57202) and the 20Dec99 Interpretation Letter entitled “PSM Applicability to Oil/Gas Production Facilities”[^11].

3. **Regulations Addressing the Storage, Handling, and Management of Ammonium Nitrate** – OSHA and the EPA both have expressed interest in updating their regulations involving ammonium nitrate; OSHA has questioned how to best update existing standards (outside of the PSM Standard), and the EPA asked for comments regarding the addition of ammonium nitrate to its Risk Management Program. Currently, it is unclear if OSHA will decide to join the EPA and add ammonium nitrate to its list of highly hazardous chemicals, or how the EPA will set the threshold quantity if ammonium nitrate is added to its list of highly hazardous chemicals.

4. **Enforcement Changes Regarding the Retail Facilities Exemption** – OSHA and the EPA have both proposed to change the enforcement procedure to close a perceived loophole regarding the retail facility exemption; both agencies have noted that this was written to apply to businesses with large inventories of small containers of regulated substances; however, many industries have used this exemption to apply where it was not intended (e.g., fertilizer companies claiming the exemption, as farmers are the end users, not the facility).
5. **Changes to the Program 3 NAICS Codes with regards to RMP Accident History Data** – The EPA has proposed a new set of NAICS codes to trigger being required for Program 3 Status. Of the 10 NAICS Codes, five were left on the list: pulp mills (32211), petroleum refineries (32411), alkalis and chlorine manufacturing (325181), inorganic chemical manufacturing (325188), and basic organic chemical manufacturing (325199). The five were replaced as follows: petrochemical manufacturing (32511) with water supply and irrigation systems (22131), cyclic crude and intermediate manufacturing (325192) with poultry processing (311615), plastics and resins manufacturing (325211) with farm supplies merchant wholesalers (42491), nitrogen fertilizer (325311) with sewage treatment facilities (22132), and pesticide and other agricultural chemicals (32532) with refrigerated warehousing and storage (49312). Thus, if this update is accepted, NAICS Codes 32211, 32411, 325181, 325188, 325199, 22131, 311615, 42491, 22132, and 49312 would be required to be Program 3 if they are ineligible for Program, and 32511, 325192, 325211, 325311, and 32532 would be able to classify as Program 2.

6. **Streamlining RMP Requirements / Effects of OSHA PSM Coverage on RMP Applicability** – Several methods are proposed, and the most substantial would be the potential elimination of the Program 2 RMP; the rationale is discussed under “The Effects of OSHA PSM Coverage on RMP Applicability”, in which it notes that, due to public utility exemptions and bulk fertilizers taking the retail exemption, only about 400 facilities of the 5,360 Program 2 facilities[12] would still be under Program 2 Status if the retail exemption is closed and the EPA regulates water treatment facilities as Program 3.

### 3.2 Safety Management System Program Modernization Initiatives – Subset 2

Subset 2 topics in Table 2.2 were judged to have the potential to significantly change the state of regulations.

1. **Expand Coverage and Requirements for Reactivity Hazards** – Both OSHA and the EPA are exploring ways to cover reactivity hazards, specifically in a framework similar to New Jersey’s Toxic Catastrophe Prevention Act (TCPA), which uses the heat of reaction to come up with various threshold quantities[14]. Also, TCPA uses the EPA’s OCA Methodology for calculating a vapor cloud explosion endpoint, which can be applied to encompass the reactive substance with regards to OCAs.

2. **Require Additional Management System Elements from CCPS’s RBPS and BSEE’s SEMS** – Another significant change is the proposed addition of several other Safety Systems, borrowed from CCPS’s RBPS and BSEE’s SEMS.
   a. **CCPS’ RBPS:**
      i. **Measurements and Metrics** is an element that strives to ensure facilities have a more empiric way of verifying what areas are the facility’s SEMS Program’s strengths and weaknesses[15].
      ii. **Management Review and Continuous Improvement** is intended to bridge the gap between day-to-day activities and periodic formal compliance audits (generally every 3 years), specifically to ensure that management systems are functioning as they were intended[16].
      iii. **Process Safety Competency** is contingent on three items: continuously improving knowledge and competency, ensuring that appropriate
information is available to people who need it, and consistently applying what has been learned\cite{17}.

b. **BSEE’s SEMS:**
   i. **Stop Work Authority**, per BSEE, “creates procedures that establish [Stop Work Authority] and make responsible any and all personnel who witness an activity that is creating imminent risk or danger to stop work.”\cite{6}
   ii. **Ultimate Work Authority**, per BSEE, “clearly defines requirements establishing who has the [Ultimate Work Authority] on the facility for operational safety and decision-making at any given time”\cite{6}.
   iii. **Employee Participation Plan** is very similar to that currently required by OSHA, with the major difference being that OSHA requires the employee input on implementation only, whereas BSEE discusses updating and modifying the SEMS Program, as well as SEMS requires written procedures on how employees will participate in the Program\cite{6}.

3. **Management of Organizational Changes** – OSHA and the EPA are also considering explicitly requiring facilities to use the Management of Change (MOC) Procedure to apply to organizational changes as well, as this was their intention during rulemaking\cite{11,12}. Another proposed change to the MOC Process was put in place by Cal/OSHA, which is to require additional interaction between the MOC Process and other elements of their PSM for Refineries proposed regulation (e.g., DMR, HCA, PSA).

4. **Safer Technology and Alternatives Analysis (STAA)** – STAA are being explored explicitly through the EPA, and Cal/OSHA; STAA use the operational and engineering expertise in the facility to explore alternative ways to create the product in a safer manner. STAAAs can be performed in multiple ways: using stand-alone checklists, a separate PHA, or integrated within the existing PHA. When implementing a STAA, the alternative should minimize (using smaller quantities or eliminating equipment), substitute (use safer chemicals), moderate (use less hazardous conditions or a safer form of a necessary hazardous chemical), or simplify (reduce complexity, and thus the chance of Operator error)\cite{18}.

5. **The “Safety Case” Regulatory Model** – A similar, but more robust method of achieving risks as low as reasonably practicable (ALARP) is the “Safety Case” regulatory regime, which was proposed by the EPA; the basis of the safety case is to put the onus of proving the facility operates safely on the facility, giving the regulator more power to decide if more can be done to reduce risk, or if additional efforts are required in certain areas of the facility’s safety case.

6. Some substantial changes have been proposed by Cal/OSHA regarding the PHA Cycle, including Recommendation closure timelines, Damage Mechanism Reviews (DMR), Hierarchy of Hazard Control Analysis (HCA), and Safeguard Protection Analysis (SPA).
   a. **PHA Recommendation Closure Timeline** – PHA Recommendation closure timelines have been proposed by both Cal/OSHA to combat facilities from accruing recommendations.
   b. **Damage Mechanism Review (DMR)** – The DMR (which is discussed in depth in Reference 30) is intended to precede the PHA to identify damage mechanisms, which are defined by Cal/OSHA as the “mechanical, chemical, physical, or other process that results in equipment or material degradation”; this effort should involve a broad team, including inspection and damage/failure mechanism
experts, using process flow diagrams, materials of construction, process conditions, and chemical substances to determine potential damage/failures. This effort should also assess previous process experience, inspection history, damage mechanism data, industry-wide experience with the process, and applicable codes and standards.

c. **Hierarchy of Hazard Control Analysis (HCA)** – The HCA is defined by Cal/OSHA as “hazard prevention and control measures, in priority order, to eliminate or minimize a hazard… ranked from most preferred to least preferred are: First Order Inherent Safety, Second Order Inherent Safety, and Independent Protection Layers
   i. **First Order Inherent Safety** – Prevents a major incident by eliminating or reducing the hazard (e.g., changing to a safer chemical)
   ii. **Second Order Inherent Safety** – Reduces the severity or likelihood of a release without the use of add-on safety devices (e.g., changing operating parameters to safer levels, such as lower pressures or temperatures)
   iii. **Independent Protection Layers** – Reduces the likelihood or consequence of a major incident through the application of add-on safety devices, from most preferred to least:
      1. Passive safeguards (e.g., double-walled vessels)
      2. Active safeguards (e.g., PSVs or automated shutdowns)
      3. Procedural safeguards (e.g., emergency response plans)

d. **Safeguard Protection Analysis (SPA)** – SPA is a similar analysis to the HCA, but focuses on how all safeguards interact to gauge the overall effectiveness of all measures and safeguards as an integrated unit. As part of this analysis, facilities should investigate additional or alternative safety measures that may be needed to reduce the risk to the greatest extent feasible; with the SPA in mind, facilities may wish to use the STAA Integrated into the PHA approach discussed above to most easily encompass these requirements.

7. **Incident Investigation – Root Cause Analysis** – Cal/OSHA is considering requiring facilities to apply the Root Cause Analysis (RCA) Methodology for Incident Investigations, as well as investigating underlying management system causes (including organization and safety culture), the review of HCA and DMR results, and retaining any Incident Investigation Reports for the life of the process. The EPA independently is looking for comments on accident history and incident investigation requirements, as well as public disclosure of information. The EPA also questions requiring RCA Methodology for Incident Investigations, as well as expanding the items required to be investigated to include near misses and processes that the facility decommissioned after an incident.

### 3.3 Safety Management System Program Modernization Initiatives – Subset 3

Subset 3 topics in Table 2.2 were used to capture the remaining changes after separating other elements into the previous three Subsets.

1. **Require Coordination of Emergency Planning with Local Emergency-Response Authorities** – The coordination of emergency planning with local emergency response authorities has always been implied by the regulations (and required by others), but now
the proposed regulations are explicitly requiring that coordination occurs, and
documentation to prove this has occurred is compiled.

2. **Emergency Drills to Test Emergency Response Plan**

3. **Require Third Party Compliance Audits** – OSHA and the EPA are exploring a requirement for triennial compliance audits to be done by a third party.

4. **Automated Detection and Monitoring / Additional Stationary Source Requirements**
   – Additional stationary source requirements are being questioned by various regulatory agencies, including the EPA exploring the requirement for automated detection and monitoring of the process area and the facility’s property line (commonly referred to as its “fence line”), as well as increased focus on facility siting issues (such as establishing a buffer zone between the facility and the public).

5. Items that have been proposed by Cal/OSHA’s PSM for Refineries include Process Safety Culture Assessments (PSCA’s), Human Factors Program, and a PSM Management System.
   a. **Contractor Safety Research and Documentation** – More requirements are placed on both the facility and the contract owner regarding training verification and hazard identification.
   b. **Process Safety Culture Assessment (PSCA)** – The PSCA is a triennial assessment of cultural safety practices at a facility, particularly assessing that the facility encourages reporting safety concerns, reward/incentive programs do not deter reporting safety concerns, safety is not compromised by production pressures, and that effective process safety leadership is promoted at all levels of the organization.
   c. **The Human Factors Program** – Requires that, at minimum, the facility accounts for the complexity of tasks, levels of training and expertise required for employees, the human-machine interfaces are effective, and that the physical challenges of the work environment and effects of shift work and overtime are accounted for.
   d. **The PSM Management System** – Requires an organizational chart that details roles and responsibilities for employees in the various SMS programs as well as requiring the development goals to achieve continuous improvement of the PSM Program.

3.4 **Safety Management System Program Modernization Initiatives – Subset 4**

Subset 4 topics in Table 2.2 were judged to have low potential for significant effort, or relate closely to efforts made in modernizing regulations.

1. **Evaluation of Updates Applicable to Recognized and Generally Accepted Good Engineering Practices (RAGAGEP) / Adding a Definition for RAGAGEP** – OSHA and the EPA propose to require facilities to evaluate updates to RAGAGEP, as updates often occur between facility construction/upgrades and present day; as part of this effort, OSHA would like to define RAGAGEP to help facilities adhere to the proposed requirement of updating RAGAGEP.

2. **Updating the List of Applicable Chemicals / Threshold Quantities** – OSHA and the EPA plan to examine updates to the list of Highly Hazardous Chemicals, but until
comments have been processed, it is difficult to predict how significantly the chemicals and their threshold quantities may change for the list of Highly Hazardous Chemicals.

3. **Expanding the Requirements of §1910.109 to Cover the Dismantling and Disposal of Explosives, Blasting Agents, and Pyrotechnics**

4. **Updating §1910.106 and §1910.107 Based on the Latest Applicable Consensus Standards**

5. **Enforcement Policy for Highly Hazardous Chemicals without Specific Concentration Thresholds** – OSHA proposes to adopt the EPA’s approach to RMP threshold quantities, which is to cover the substance if the chemical is present in a concentration of one percent and the calculated weight of the chemical in the mixture is greater than the threshold quantity.

6. **Public Disclosure of Information to Promote Compliance and Public Understanding** – The EPA is investigating whether compliance can be increased through increased information disclosure to the public and local authorities (e.g., executive summaries or emergency contact information); it is important to note that the OCA and PHA are considered restricted, and thus are not proposed to be publicly accessible via the Internet.

7. **Cover the Mechanical Integrity of Any Safety-Critical Equipment** – Both OSHA and the EPA plan to cover any safety-critical equipment under the Mechanical Integrity Program. Both agencies intended for the lists made in the regulations to be used as examples; however, the regulations are sometimes taken verbatim, and thus making it difficult to regulate a lack of inclusion for some safety critical equipment.

8. **WCS Quantity Requirements for Numerous Small Vessels** – The EPA is proposing several changes to the Offsite Consequence Analysis portion of RMP, including changing the threshold quantities and endpoints, as well as changing the worst case scenario requirements for numerous vessels by requiring facilities to consider that multiple small containers (especially with regards to flammables) could cause a chain reaction.

4. **SMS Modernization Status and Potential SMS Program Impact**

Figure 4.1 identifies Recent SMS Regulatory Activities, and Figure 4.2 depicts the different agencies involved in the current Safety Management System (SMS) Modernization Initiatives. Even though the ultimate performance objectives of each agency include accident prevention and consequence minimization, each of these agencies have a slightly different assigned mission and perspectives on the role they should play in SMS regulation implementation. Thus, at the time that this paper is being written (March 2015), the different initiatives use different approaches, and are applying different timelines. The following represents the current status and anticipated outcome.

![FIGURE 4.1 – Recent SMS Regulatory Activities](image-url)
**Chemical Safety Board (CSB)**[19] – Three reports associated with the 06Aug12 Richmond Refinery Fire were created by the CSB and adopted by the CSB Board. Each report has specific recommended actions for industry and the regulatory community.

- **Publications:**
  - “Interim Investigation Report, Chevron Richmond Refinery Fire,” April 2013.[8]

- **Status** – No further CSB investigation efforts regarding the Richmond Refinery Fire are currently planned. CSB will continue tracking the implementation of their recommendations by other agencies.

**California Interagency Refinery Task Force (IRTF)**[20] – The task force is composed of various federal, state, and local agencies with jurisdiction over refineries in California.

- **Publication** – “Improving Public and Worker Safety at Oil Refineries,” February 2014.[21]
- **Status** – Task Force meetings continue. Additional reports are not currently planned.

**U.S. Environmental Protection Agency (EPA)**[22]**Risk Management Program (RMP)**

- **Status** – EPA is currently processing comments received by the October 29, 2014 deadline and formulating draft regulations.
- **Anticipated Outcome** – Promulgation of updated RMP requirements is anticipated to take several years to navigate through the current regulatory approval process.
Federal Occupational Safety & Health Administration (OSHA)[23] Process Safety Management (PSM) Program

- **Status** – OSHA is currently processing comments received by the March 31, 2014 deadline and formulating draft regulations.
- **Anticipated Outcome** – Promulgation of updated PSM requirements is anticipated to take several years to navigate through the current regulatory approval process.

California Division of Occupational Safety & Health (Cal/OSHA)[24] Process Safety Management (PSM) Program

- **Publication** – Process Safety Management for Refineries, Proposed General Industrial Safety Order Title 8 §5189.1, October 31, 2014.[13]
- **Status** – Additional review/formulation meetings are being conducted under the sponsorship of the IRTF. Comments on the Proposed §5189.1 are being processed. Updated proposed regulations are anticipated.
- **Anticipated Outcome:**
  - Final Regulation Promulgation – Estimated 1/2Q2016
  - Initially, 2 Separate PSM Regulations in California – §5189.1 for Petroleum Refineries, §5189 for Others
  - Initially, No Synchronization with Federal PSM/RMP Requirements or CalARP

California Office of Emergency Services (CalOES)[25] California Accidental Release Prevention (CalARP) Program[26]

- **Publication** – CalARP Regulation Amendments 2015, January 1, 2015.[27] These requirements are relatively minor updates to the existing program.
- **Status** – Although CalARP regulatory requirements were updated for January 1, 2015 implementation, a later update will be required to address petroleum refinery safety in California.
- **Anticipated Outcome:**
  - Draft of Additional Update to be Issued by Spring 2015 or After Comments from Draft §5189.1 Processed
  - Final Regulation Promulgation Likely After §5189.1
  - Single CalARP Regulation with Additional Requirements for “High Hazard Facilities”
Initially, No Synchronization with Federal PSM/RMP Requirements or Cal/OSHA PSM

4.1 Anticipated Near-Term Impact

At this point, the most significant near-term impact on SMS Programs for California Facilities will be the promulgation of §5189.1 by Cal/OSHA. This could occur in early-2016 along with reportedly aggressive implementation schedule requirements. §5189.1 is the current channel for the efforts of the IRTF, and the initial focus will be on petroleum refineries in California.

The projected outcome would be two PSM regulations in California (one for petroleum refineries and one for non-refineries). For California facilities, Federal OSHA (along with Federal PSM requirements) does not have direct jurisdiction; however, for refineries that have "sister facilities" that are part of the same company, but in other parts of the United States, PSM Program synchronization within the company may no longer be practical. In addition, the current organization of the PSM elements in §5189.1 is not the same as the Prevention Program elements of CalARP and EPA RMP, thus desynchronizing the programs and making implementation more challenging. This regulatory framework for the near-term California SMS environment is depicted in Figure 4.3.

4.2 Potential Medium-Term Impact

Since the Cal/OSHA PSM requirements have not been finalized and the CalARP updates have not yet been proposed, predicting the SMS Regulatory Environment in mid/late-2016 is a bit
more difficult; however, based on the current direction of the agencies involved in the SMS Modernization Programs in California, possibly in Late-2016 or Early-2017, CalARP may be updated to address CSB recommendations and select elements of §5189.1. California Refineries may then have desynchronized Cal/OSHA PSM, EPA RMP, and CalARP Program requirements, including potential differences in the RMP program levels that would be assigned to the various processes at the refinery. This medium-term California SMS Regulatory Environment is depicted in Figure 4.3.

In addition to SMS Program implementation challenges at the plant site, the existing decentralization of regulatory oversight in California for CalARP can present additional challenges. In California, CalARP oversight is provided by the Certified Unified Program Agency (CUPA) with jurisdiction over the facility. Commonly, the CUPA is either a municipal-level or county-level fire agency, and there are 97 in the State of California. Each CUPA has one or more individuals involved in the CalARP Program, along with their other program responsibilities, so if the CUPA is to retain their jurisdictional authority, significant training will be required to bring all of these responsible individuals up-to-speed with updated CalARP regulatory requirements.

Another potential concern with multiple agencies having different programs with nearly identical objectives is the general nature of regulations in the United States, and especially in California, to gain momentum and become more complex. Although there are examples of regulations becoming less complex over time (e.g., the transition of the Risk Management and Prevention Program (RMPP) requirements to CalARP in 1999), the general tendency is for the regulatory environment to evolve towards increased complexity. As the application of the additional program elements being proposed for §5189.1 becomes more common-place for refineries, there is going to a natural inclination for regulators to encourage application to other hazardous materials facilities or require justification from the facility for not applying them.

Another potential complexity for industry is the EPA General Duty Clause\textsuperscript{[28]}. If a non-petroleum-refinery highly-hazardous facility does not apply elements that are required (and implicitly considered a best practice) for other types of highly-hazardous facilities (e.g., a petroleum refinery), could there be increased liability issues? At a minimum, it would seem prudent for the SMS Specialists at all facilities encompassed by PSM and RMP to at least understand the requirements for petroleum refineries in California and at least briefly document a position for why these requirements do not need to be implemented at their facility.

It should be noted that a complex SMS Regulatory Environment can create implementation challenges for not only industry, but also for regulators providing oversight. It is an important objective for regulators to always minimize unnecessary complexity, which can erode some of the safety benefits desired from the promulgation of Modernized PSM/RMP regulations.

### 4.3 Anticipated Long-Term Impact

Challenges with overlapping regulations from multiple agencies that are designed to achieve similar objectives is not a new phenomenon. For SMS Regulatory Requirements, this environment existed in California in the 1990s. In California, Risk Management and Prevention
Program (RMPP) requirements were promulgated in 1986[29] that were designed to provide a platform for the formulation of a “prevention program” to minimize the potential for accidents at highly-hazardous facilities. When PSM was promulgated in 1992, it created a similar challenge with overlapping, but desynchronized, SMS Regulatory Requirements that were essentially trying to accomplish the same thing. This environment existed until 1999, when the CalARP Program was created to replace RMPP and synchronize key prevention program elements with EPA RMP requirements, which went into effect in 1997. This evolution is depicted in Figure 4.4. The net result were programs that were easier to manage, both for industry and for the regulatory community, thus becoming more effective in achieving their objectives of protecting workers, the community, and the environment.

Although there will likely be several iterations in the current SMS Modernization Program initiatives, it would be appropriate to anticipate eventual program synchronization. The time period for this could only be the subject of speculation.

5. What Should I Be Doing Now?

5.1 General Regulatory Program Compliance, Monitoring, and Awareness

The January 1, 2015 CalARP Program Updates are promulgated and currently applicable for all CalARP-covered facilities, refinery and non-refinery. Thus, facilities must adhere to these relatively minor changes in the program at this time.

Although the focus of the current SMS Modernization Program is on petroleum refineries in California, it is important for all U.S. “highly-hazardous facilities” to be carefully monitoring the proposed changes to CalARP, Federal PSM, California PSM, and RMP, and as changes are made, understanding the requirements and any potential for interpreting them as applying to your facility. Even if these new requirements do not directly affect your facility at this time, it is possible that:
- Applicability could be later expanded to other highly-hazardous facilities in California.
- Applicability could be later expanded to non-California petroleum refineries and other facilities.
- Inference could be made to the new requirements in California as “best practice.”
- General Duty Clause covenants could point to the new requirements in California.

5.2 Specific Program Implementation Recommendations

At this time, the SMS Regulatory Program Modernization Initiatives are very much a “moving target.” Many of the specific requirements are being formulated, and there are likely to be significant changes; however, there are several common elements between the different programs, which are also directly linked to CSB-identified SMS Program gaps and which are likely to be included in the final SMS Regulatory Requirements. This section will focus on these higher-priority elements and suggest “high-value” implementation strategies, such that substantive progress can be made on addressing important aspects of recommendations made by the CSB (i.e., could be considered best practice) in a focused manner. The specific tips offered will focus on streamlined approaches for adapting efforts currently expended on Process Hazard Analysis (PHA) to address and make progress on some of these new requirements. Although the initial focus of the SMS regulatory modernization programs will be on California petroleum refineries, applying these high-value elements to refineries in other U.S. locations and to other types of facilities may be prudent.

One of the potential challenges identified by the regulatory community is a shortage of capable resources for some of these specialized areas to deal with the anticipated tight schedules, once the proposed regulations are promulgated. One key regulatory agency recommended applying “High-Value/Priority” elements now. Even if schedules are tight, if substantial progress has been made addressing the spirit of the new requirements, “selective-‘grandfathering’ may be allowed.”

5.2.1 Damage Mechanism Review (DMR), aka Damage Mechanism Hazard Review (DMHR)

The complete implementation of DMHR/DMR can require extensive resources. The following paper clarifies the challenge and provides some focused approaches for implementation:


5.2.2 Safeguard Protection Analysis (SPA)

Safeguards effectiveness was identified as an important issue in CSB Recommendations 2012-03-I-CA-6 and 2012-03-I-CA-12, and SPA is specifically required by the proposed Cal/OSHA PSM §5189.1(e) and §5189.1(u) to validate the effectiveness of safeguards. CSB’s
recommendations apply to all CalARP Facilities, and Cal/OSHA’s proposed requirements are initially focused on California Refineries. The CSB recommendations focus on documenting “recognized methodologies, rationale, and conclusions used to claim that safeguards intended to control hazards will be effective,” and the stated objective of §5189.1(u) “is to reduce the likelihood and severity of a major incident to the greatest extent feasible. All safeguards shall be independent of each other and of initiating causes.”

Best practices for PHA implementation already include the Facilitator challenging the Team and only crediting effective, and typically independent, safeguards during the PHA. This objective can be achieved by careful application of PHA best practices by a qualified Facilitator during a PHA, and this can be accomplished especially well during an integrated HAZOP/LOPA exercise. The SPA is designed to validate that these best practices are adhered to. Thus, the balance of this subsection will provide tips on the performance of a quality PHA (which, of course, addresses the requirements of a SPA). Tips on maximizing the quality of your PHA effort can be found in a free on-line webinar series that addresses HAZOP/LOPA Facilitation Best Practices.[31] Module 11 is especially well-tuned to best practices that support SPA objectives.

Practical PHA Facilitation Tips to Apply Best Practices and Address SPA Objectives:

- Clearly Identify and Document Transmitters/Controllers Affecting Causes & Safeguards
- Frequently Train the Team on Risk-Ranking
- Frequently Challenge the Team on Safeguard Effectiveness, Availability, & Reliability
- Partition Safeguards as IPLs
- Typically Group Alarms as a Single Safeguard
- Apply Risk-Graph & LOPA to Provide Additional Insights
- Apply Risk-Graph & LOPA for High Consequence/Risk Scenarios to Validate that a Safety Instrumented Function (SIF) is Not Needed
- Considerations for Reliability & Timing of Operator Response to Alarms
  - Present to Hear the Alarm
  - Alarm Prioritization & Diagnosis
  - Permission for Corrective Action
  - Initiating the Corrective Action
  - Time for the Corrective Action to Mitigate the Event

5.2.3 Safer Technology and Alternatives Analysis / Hierarchy of Hazard Control Analysis (HCA)

The evaluation of inherently safer technologies was identified as an important issue in CSB Recommendations 2012-03-I-CA-7 and 2012-03-I-CA-13, and HCA is specifically required by the proposed Cal/OSHA PSM §5189.1(e) and §5189.1(l) to identify the inherent safety features
associated with the process and evaluate the feasibility of applying Inherently Safer Systems (ISS). CSB’s recommendations apply to all CalARP Facilities, and Cal/OSHA’s proposed requirements are initially focused on California Refineries. The specific CSB guidance is to minimize risk to the public, personnel, and the environment by performing an ISS Analysis triggered by all MOC and PHA reviews. The stated objective of §5189.1(l) is to “identify and evaluate relevant safety measures and safeguards (or where appropriate, combinations of measures and safeguards) in an iterative manner to reduce each risk to the greatest extent feasible.”

Best practices for PHA implementation already include the application of a module to perform an ISS Analysis. This is done during the course of the PHA, and there are many guidance documents and resources available. Reference 33 provides a technical paper from GCPS 2011 that summarizes the use of a HAZID Study, HAZOP Study, and LOPA to generate ideas for Inherently Safer Designs, and identifies (See Figure 5.1) optimal timing for introducing the concepts into the design process. It should be noted that the opportunity to cost-effectively make significant changes to the process to introduce inherently safer design concepts decreases over time. References 19, 34, 35, and 36 provide guidelines and agency checklists for evaluating the feasibility of implementing ISS concepts into a process.

Practical PHA Facilitation Tips to Apply Best Practices and Address ISS/HCA Issues:

- Provide a briefing during PHA Synchronization Training.
- Provide a list of ISS Considerations in the PHA Quick Reference provided to the team.
  - Minimize
  - Substitute
  - Moderate
  - Simplify – More Robust
  - Simplify – Human Factors
  - Simplify – Facility Siting
- Apply a “Deviation” to discuss ISS/HCA issues in each node.
- At the end of the PHA, apply an ISS Checklist and document as separate node.
6. Summary & Conclusions

The aftermath of the August 2012 Richmond Refinery Fire resulted in the CSB and other agencies reflecting on industry's application of Process Hazard Analysis (PHA) and Mechanical Integrity (MI), as well as the agencies' oversight of all PSM and RMP activities. This has resulted in a number of agencies proposing ideas for improvements in both the specific areas associated with the root cause(s) of the event and the application of other Safety Management System (SMS) elements. These SMS Program modernization initiatives have focused on PSM, RMP, CalARP, and Cal/OSHA’s PSM, with a special emphasis on petroleum refineries in California. Although California Refineries are the current focus, it would be prudent to anticipate that many of these initiatives will eventually affect PSM/RMP facilities throughout the United States.

The months to come are likely to see significant changes to the programs promulgated by the various agencies. There will also be significant efforts by industry to implement changes, and even more significant will be the challenges to both industry and the regulatory community due to differences in implementation, timing, and the SMS elements highlighted by these different regulatory requirements. The only certainty is the uncertainty in what will be the final outcome and when implementation will be required. Although there will likely be significant near-/medium-term variances in the different SMS Regulatory Requirements, it would be appropriate to anticipate a long-term movement towards synchronization.

This paper has provided relevant background information, summaries of the various SMS Regulatory Program Modernization Initiatives, and tips for practical actions to take as part of current PSM/RMP/CalARP efforts. These tips are also conducive towards maximizing the value associated with the implementation of these best-practices and minimizing the later impact of these updated SMS Regulatory Requirements.

It is critical that the process safety and risk management industrial and regulatory community carefully monitor the modernization concepts being proposed and potential implementation timing (Figure 6.1). Process safety and risk management professionals at the plant sites should focus on charting the course for long-term success for their programs. Being aware of these upcoming changes will facilitate planning a strategy for effective implementation will best serve the interests of those being regulated (and regulators), as well as minimizing risks to plant personnel, the public, and the environment.

7. References

[28] Clean Air Act (CAA) Section 112(r)(1) – General Duty Clause.
[29] Section 25534 of Chapter 6.95, Risk Management and Prevention Programs, 1986.