



October 2017 – Paradigm Shift for CA Petroleum Refinery PSM/CalARP

Steven T. Maher, PE CSP
Risk Management Professionals

TH-A2 - Part 1
March 23, 2023

**25th California Unified Program
Annual Training Conference**
March 20 – 23, 2023



Steven T. Maher, PE CSP

Risk Management Professionals

- 43-Year Engineer – 39 in Process Safety Consulting Specializing in Hazard Analysis and QRA
- Mechanical Engineering
 - BS – Duke University
 - MS – Carnegie-Mellon University
- Professional Engineer – Mechanical & Chemical Engineering
- CCPS Technical Steering Committee – mid-1980s
- Past-President Southern CA Society for Risk Analysis
- Landmark Efforts
 - Platform Safety Shutdown System Effectiveness Study
 - Torrance Refinery Safety Advisor for MHF Conversion
- Paper & Book Publications – See www.RMPCorp.com

Key Topics

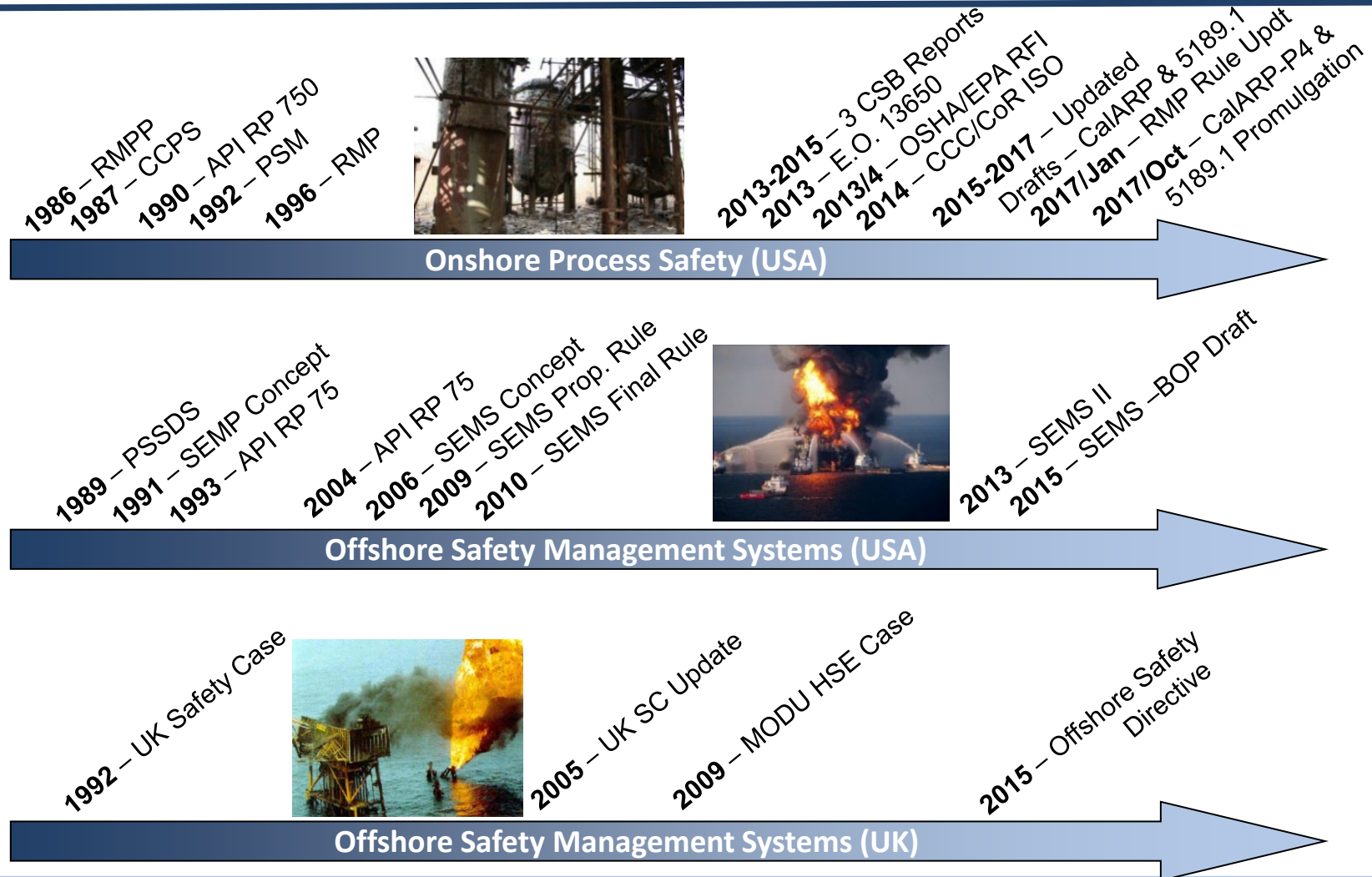
- Current SMS Program Elements & Overlap
- SMS Expansion/Modernization Initiatives Overview – 2017 Developments
- Key Elements of Regulatory Expansion/Modernization Efforts
- Status, Impact, & Strategies
- Summary & Conclusions
- Questions?



Current Safety Management System (SMS) Program Elements & Overlap



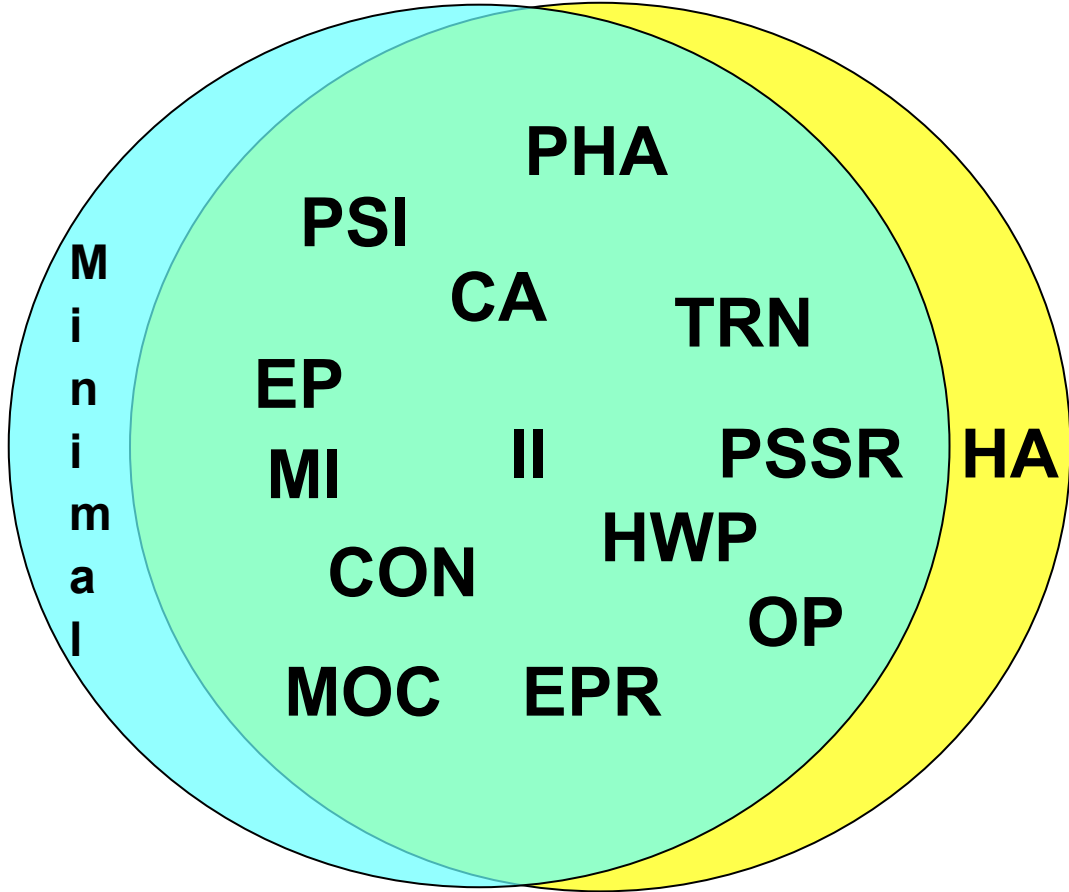
Evolution of SMS Guidelines & Regulations to Performance (Goal) – Based Standards



Overlap of Key Current CA SMS Programs (Onshore Facilities)

PSM

CalARP/RMP



SMS Expansion/Modernization Initiatives Overview – 2017 Developments



Key Modernization Activities (Onshore Facilities)

CSB

www.RMPCorp.com/SMS_Regulatory_Updates/

CalOES/CalEPA

IRTF

EPA

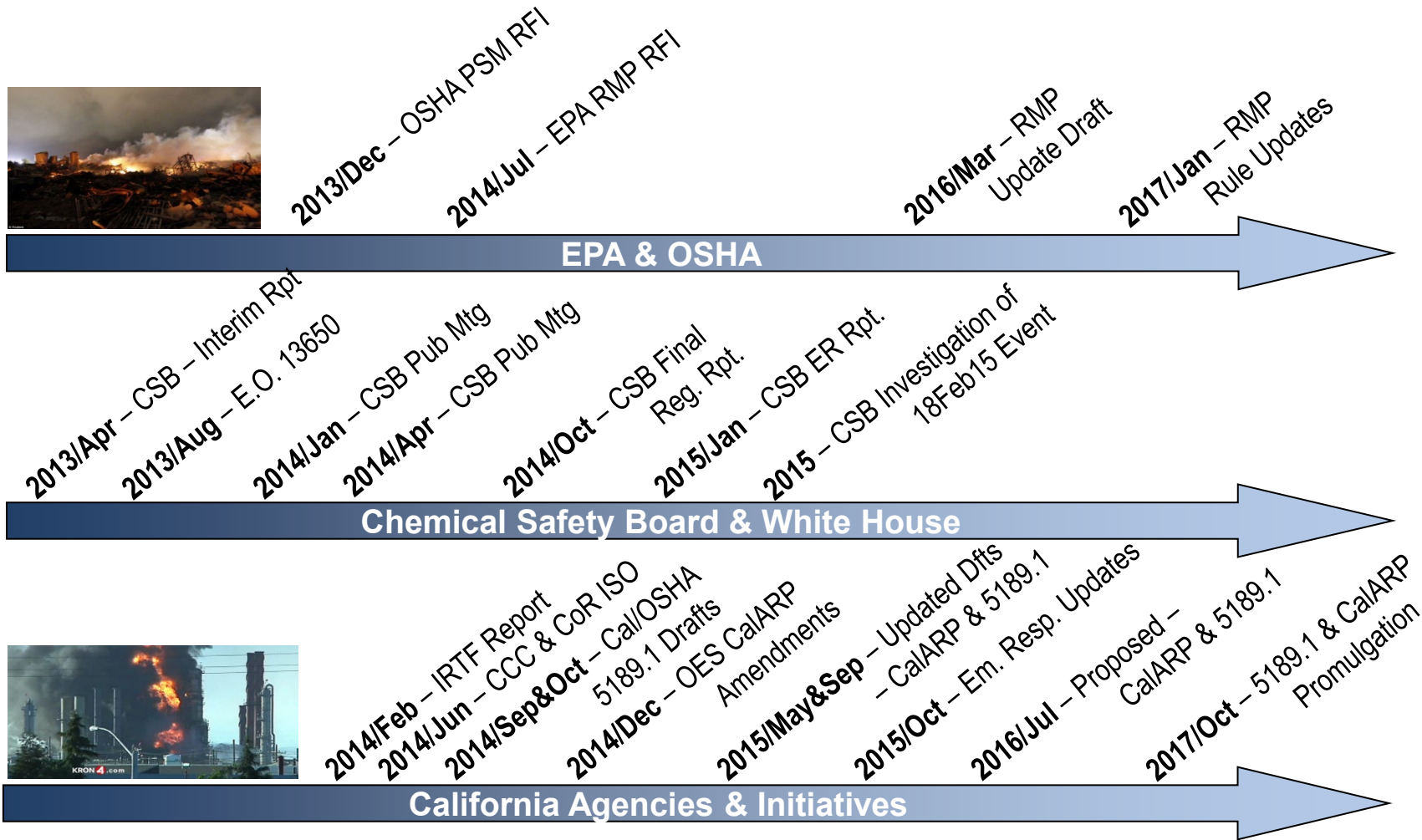
CCC & CoR

OSHA

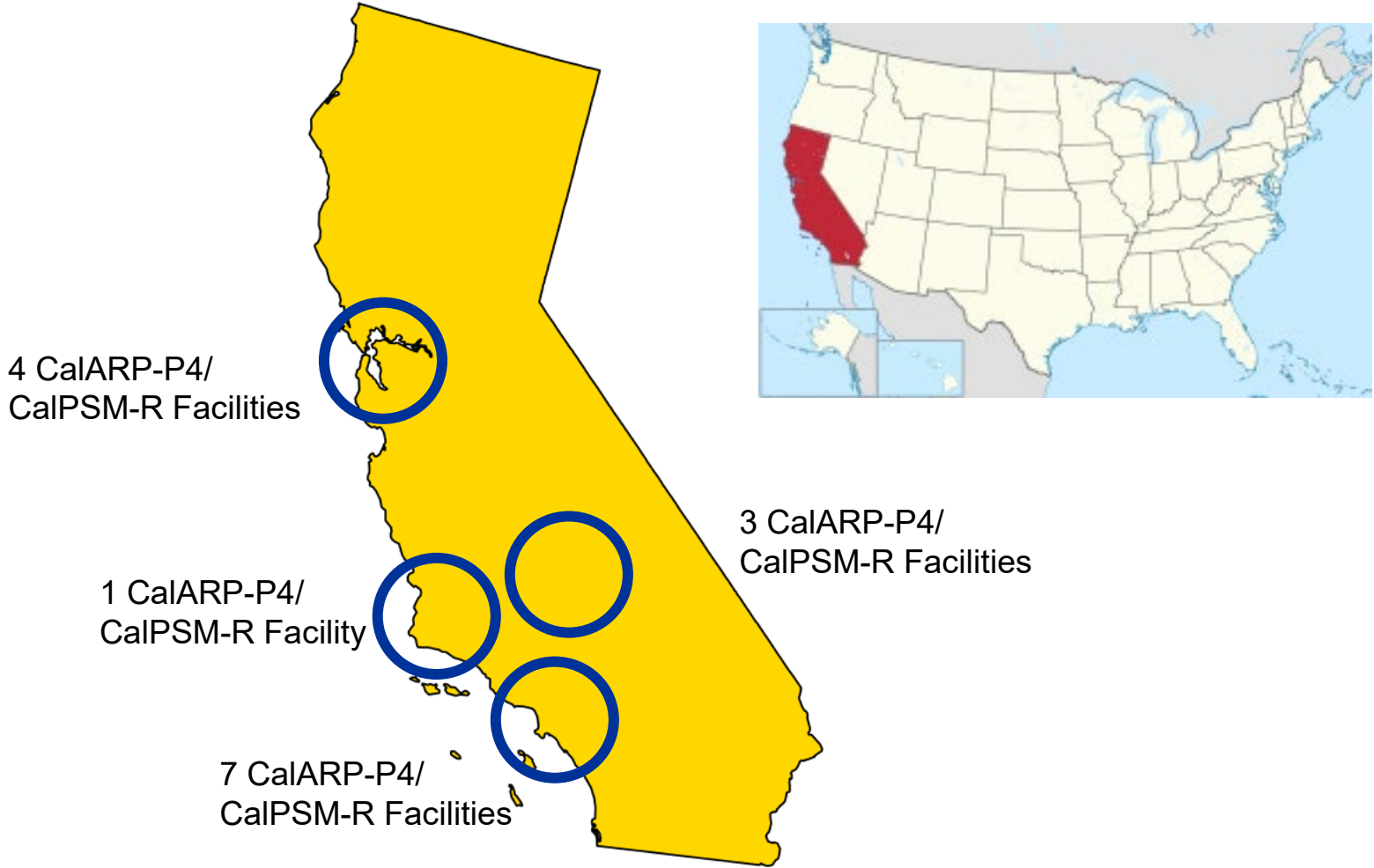
Cal/OSHA

CalOES: California Office of Emergency Services; Cal/OSHA: California Occupational Safety & Health Administration;
CSB: Chemical Safety Board; EPA: United States Environmental Protection Agency; IRTF: Interagency Refinery Task
Force; OSHA: U.S. Occupational Safety & Health Administration; CalEPA: California Environmental Protection Agency;
CCC: Contra Costa County; CoR: City of Richmond

Recent US SMS Regulatory Activities (Onshore Facilities)



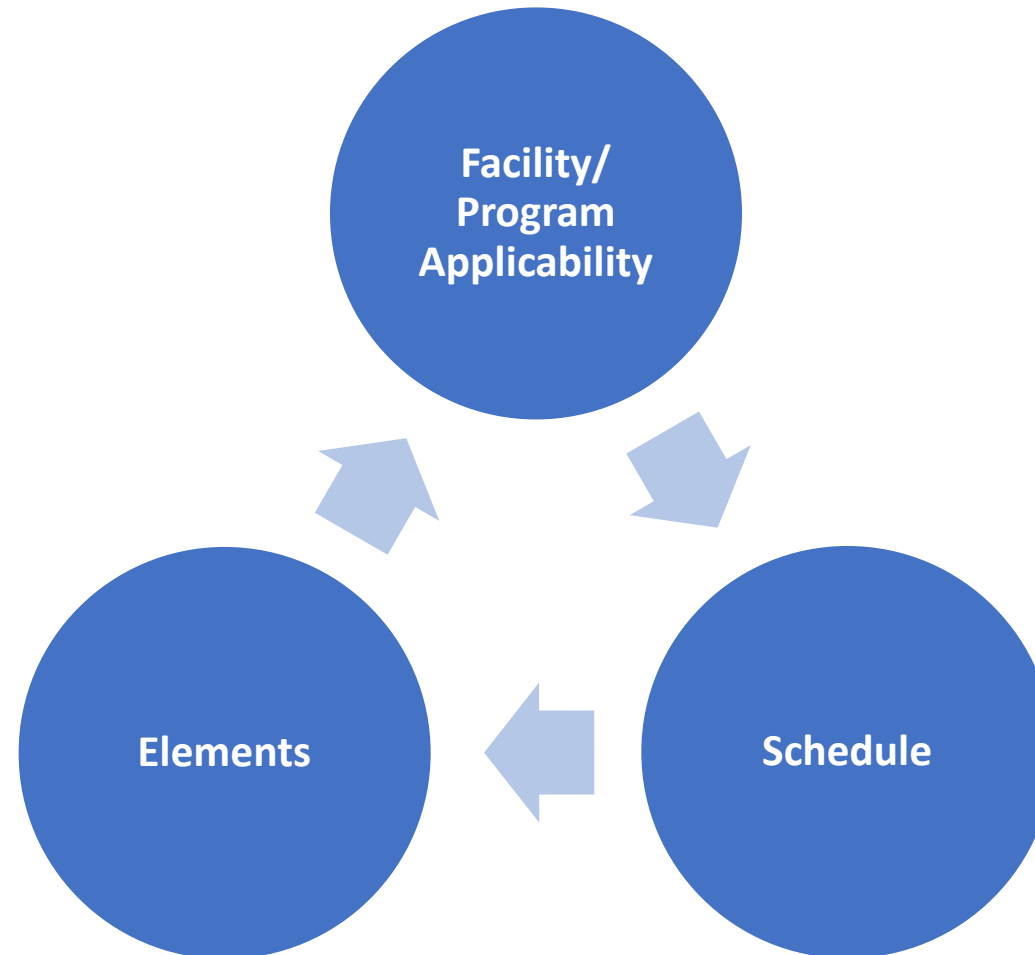
CalARP-P4/CalPSM-R Affected Facilities



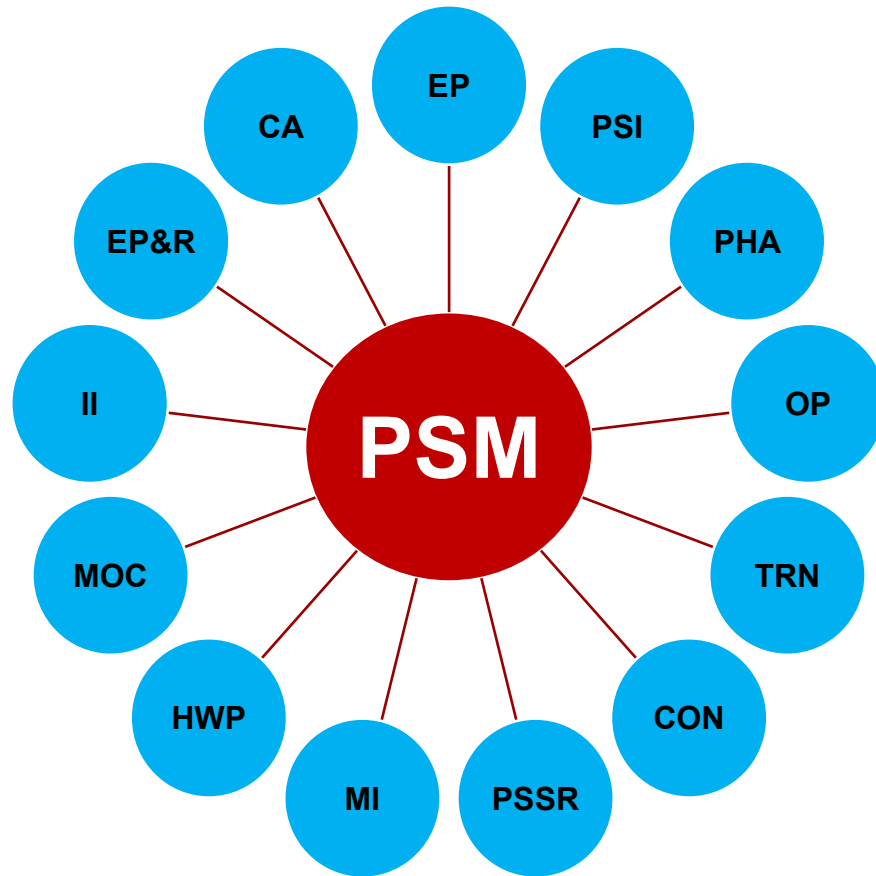
Key Elements of CalARP & CalPSM-R Regulatory Expansion/Modernization Efforts



Types of Changes



Current PSM Elements

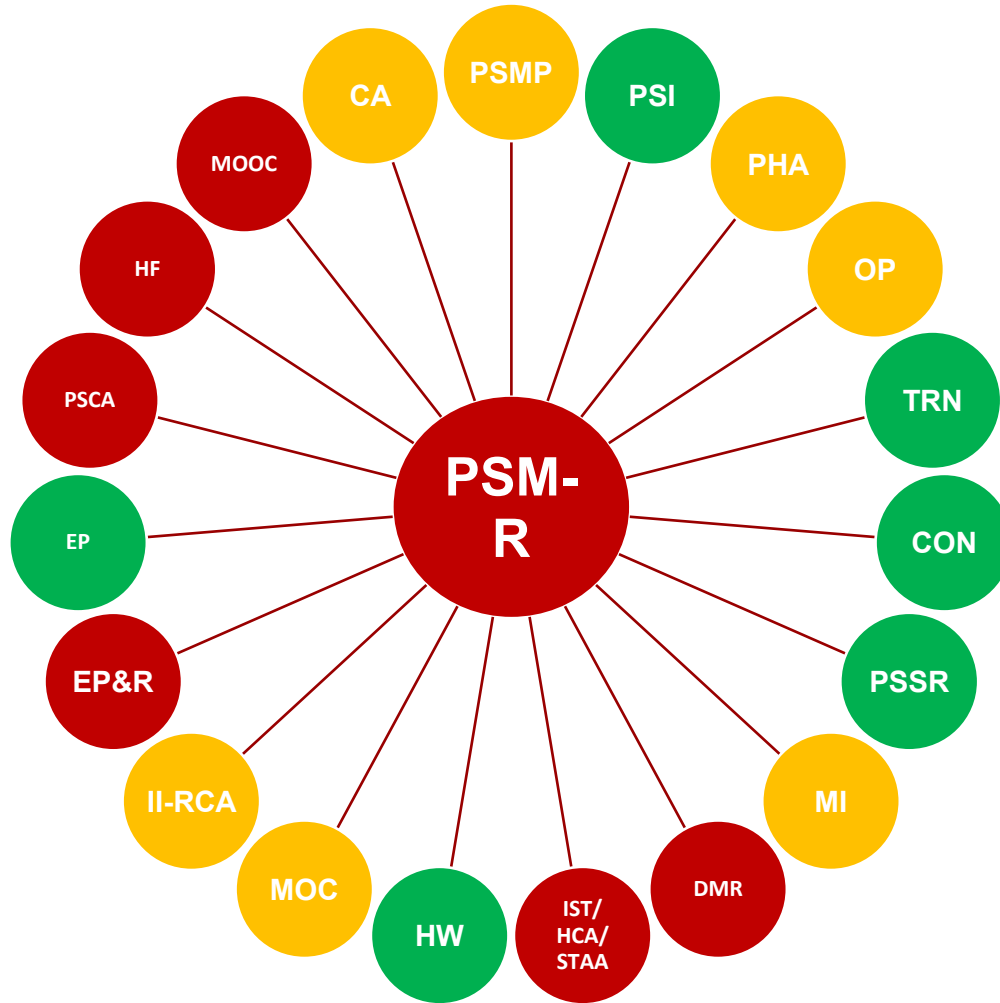


- Employee Participation
- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Training
- Contractors
- Pre-Startup Safety Review
- Mechanical Integrity
- Hot Work Permit
- Management of Change
- Incident Investigation
- Emergency Planning & Response
- Compliance Audits (CA-IIPP)

Impact Categories

- The changes in CalARP-P4 and CalPSM-R are expected to have different implementation challenges:
 - * minimal changes to regulation or minimal effort needed for compliance
 - ** moderate changes to regulation or moderate effort needed for compliance
 - *** new element or significant effort needed for compliance

CalPSM-R Elements



- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Training
- Contractors
- Pre-Startup Safety Review
- Mechanical Integrity
- Damage Mechanism Review
- Hierarchy of Hazard Control Analysis (IST/HCA/STAA)
- Hot Work
- Management of Change
- Incident Investigation - RCA
- Emergency Planning & Response
- Employee Participation
- Process Safety Culture Assessment
- Human Factors
- Management of Organizational Change
- Compliance Audits
- PSM Program (PSMP)

CalPSM-R & CalARP-P4 Summary Matrix

Program Element	CalPSM-R	CalARP-P4	Key Scheduler Requirements
Process Safety Information (PSI) *	5189.1(d)	2762.1	<ul style="list-style-type: none"> Keyed to Process Safety Needs (e.g., prior to PHA, DMR, HCA, SPA)
Process Hazard Analysis (PHA) * Safeguard Protection Analysis (SPA) **	5189.1(e)	2762.2 2762.2.1	<ul style="list-style-type: none"> Not-Previously-Required PHAs – 01Oct20 SPA – 6 Months of Completing the PHA Five-Year Revalidation
Operating Procedures (OP) **	5189.1(f)	2762.3	<ul style="list-style-type: none"> Same Annual Certification, with Updates As Needed
Training (TRN) *	5189.1(g)	2762.4	<ul style="list-style-type: none"> CalARP-P4 Training – 01Oct19 Triennial Refresher Training
Contractors (CON) *	5189.1(h)	2762.12	<ul style="list-style-type: none"> No Schedule Changes
Pre-Startup Safety Review (PSSR) *	5189.1(i)	2762.7	<ul style="list-style-type: none"> Perform PHA, HCA, DMR, and SPA as Applicable Prior to Start-up
Mechanical Integrity (MI) * Damage Mechanism Review (DMR) ***	5189.1(j) 5189.1(k)	2762.5	<ul style="list-style-type: none"> Complete DMR Prior to PHA & Prior to Changes Affecting Chemistry, Metallurgy, or Operating Limits Initial DMR – 01Oct22 (50% by 01Oct20) Five-Year Revalidation Review DMR As Part of II Review/Complete As Part of MOC

CalPSM-R & CalARP-P4 Summary Matrix

Program Element	CalPSM-R	CalARP-P4	Key Scheduler Requirements
IST / HCA / STAA ***	5189.1(l)	2762.13	<ul style="list-style-type: none"> Initial HCA – 01Oct22 (50% by 01Oct20) Five-Year Revalidation For Any PHA Recommendation Addressing a Major Hazard Potential – 90 Days Following Recommendation Completion Major Change (MOC), Major Incidents (II), New Processes, Per UPA Request
Hot Work (HW) *	5189.1(m)	2762.11	<ul style="list-style-type: none"> No Schedule Changes
Management of Change (MOC) **	5189.1(n)	2762.6	<ul style="list-style-type: none"> No Schedule Changes
Incident Inv. – Root Cause Analysis (II-RCA) **	5189.1(o)	2762.9	<ul style="list-style-type: none"> Assemble Team – 48 Hours Initial Report – 90 Days, Plus Monthly Status Reports, If Delayed Final Report – 5 Months
Emergency Planning and Response (EP&R) ***	5189.1(p)	2745.8 2765.2/3	<ul style="list-style-type: none"> Annual Review [Potential Future Changes]
Employee Participation (EP) *	5189.1(q)	2762.10	<ul style="list-style-type: none"> Develop Anonymous Reporting System and Stop Work Procedures – 01Feb18 (CalARP Section 2762.16)
Process Safety Culture Assessment (PSCA) ***	5189.1(r)	2762.14	<ul style="list-style-type: none"> Initial Report – 01Apr19 Five-Year Revalidation Send Report to UPA within 90 Days of PSCA Implement Corrective Actions – 24 Months Assess Effectiveness of Corrective Actions – 3 Years After Each Report/Revalidation – If Corrective Action ineffective, Correct within 6 Months Deadlines for Communicating PSCA to Affected Personnel

CalPSM-R & CalARP-P4 Summary Matrix

Program Element	CalPSM-R	CalARP-P4	Key Scheduler Requirements
Human Factors (HF) ***	5189.1(s)	2762.15	<ul style="list-style-type: none"> Program Creation – 01Apr19 50% Assessment – 01Oct19 100% Assessment – 01Oct20
Management of Organizational Change (MOOC) ***	5189.1(t)	2762.6	<ul style="list-style-type: none"> Complete MOOC for Changes > 90 Days
Compliance Audits (CA) ** (Fed Rqmt. for 3rd Party)	5189.1(u)	2762.8	<ul style="list-style-type: none"> Same Triennial Requirement 18-Month Corrective Action Closeout
Process Safety Management Program (PSMP) ** [CalPSM-R] Accidental Release Prevention Program Management System ** [CalARP-P4]	5189.1(v)	2762.16	<ul style="list-style-type: none"> Triennial Update Create Process Safety Performance Indicators (PSPI) – 01Apr18 (CalARP-only) Update PSPI Annually on June 30 for January 1 – December 31 of the Previous Year – Starting 30Jun19 (CalARP-only) Submit Findings and Recommendations to Owner within 14 Days of Completion (CalARP-only)
CalARP Submittal Requirements	---	2745	<ul style="list-style-type: none"> Submit Updated CalARP to UPA – 01Oct19
Corrective Action Item Closure	5189.1(x)	2762.2	<ul style="list-style-type: none"> Not Requiring Process Shutdown (30 Months) Requiring Process Shutdown (Next Scheduled Turnaround, Unless Documented as Infeasible) Potential for Serious Physical Harm (Promptly)

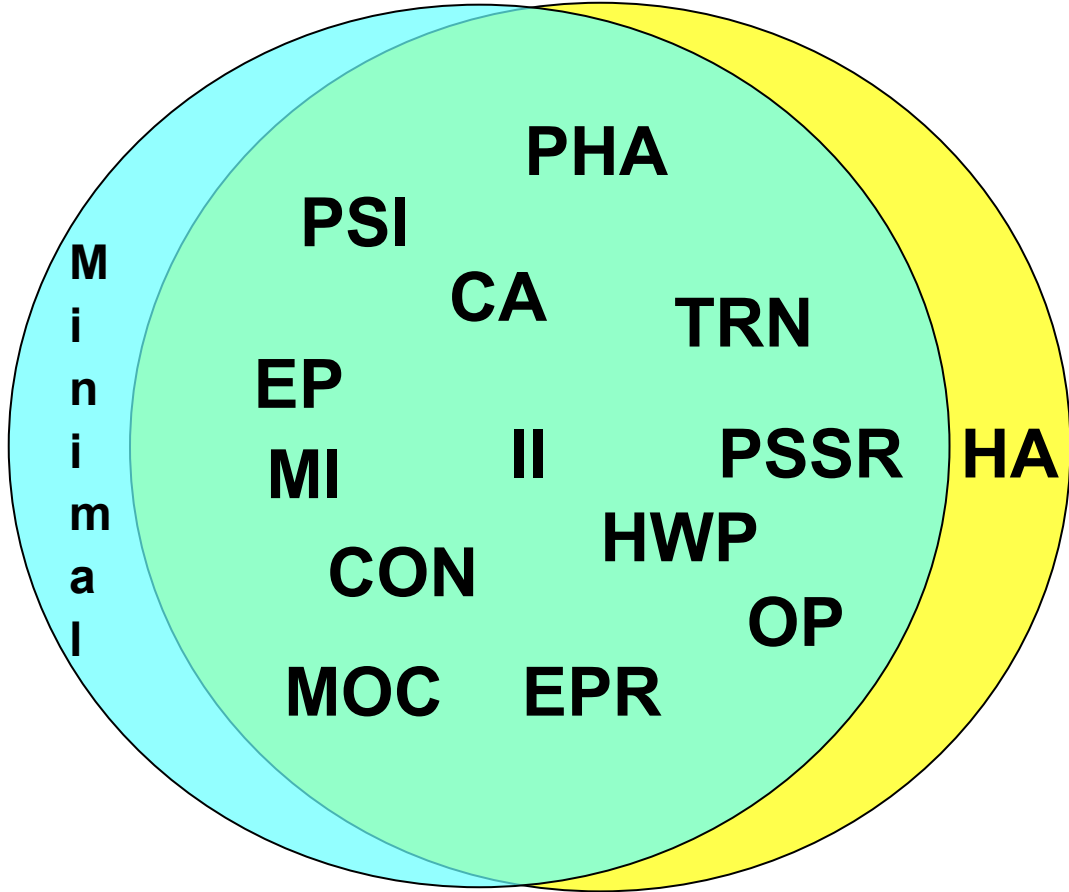
Status, Impact, & Strategies



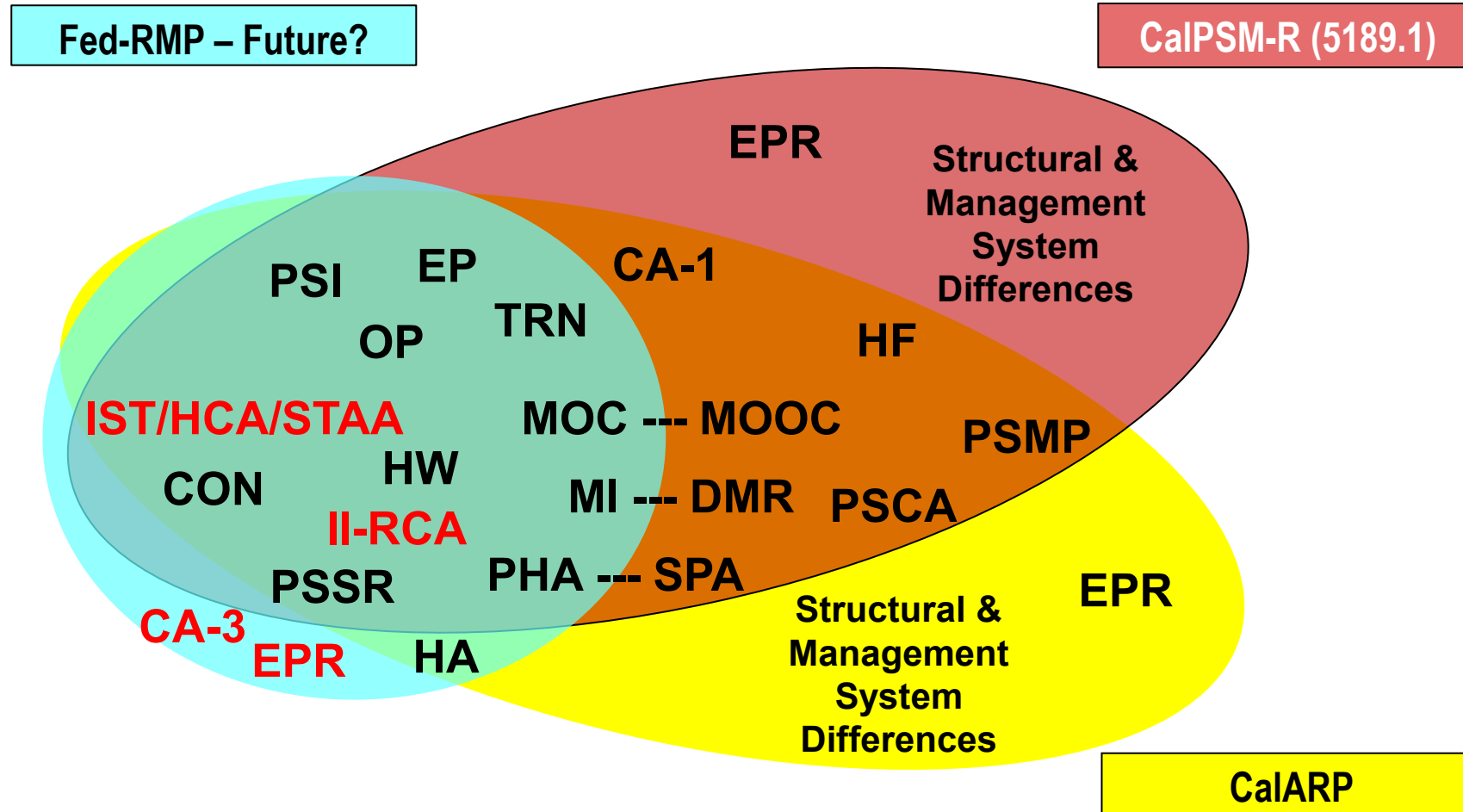
Overlap of Key Current CA SMS Programs (Onshore Facilities)

PSM

CalARP/RMP



Overlap of Post-01Oct17 CA SMS Programs (Onshore CA Petroleum Refineries)



Tips for Addressing CalARP-P4 Guidelines



From www.ishn.com

Damage Mechanism Review (DMR)

- Reference
 - CSB Recommendation 2012-03-I-CA-9
 - 5189.1(k) / 2762.5
- Focus – California Petroleum Refineries
- Objective
 - Improve Identification of Mechanical Failure Vulnerabilities
 - Minimize Failure Potential
- Stated CSB Requirements
 - Conduct Damage Mechanism Hazard Review
 - Include MI Review During PHA

Damage Mechanism Review (DMR)

- Potential Challenges
 - Effective Use of PHA Team Resources
 - Minimizing Overlap with Other MI Program Elements
- Tips
 - Infuse the DMR into the PHA, Using Additional Expertise As Necessary, Document How the DMR is Being Conducted in the Report
 - If DMR Separate, 1-2 hour Briefing to PHA Team
 - For Each High/Low Pressure & High/Low Temp Scenario, Review Specifications of Associated Piping & Equipment
 - If Not a Separate DMR Report, for Each Node – Review Materials Diagram
 - Understand Extent & Status of MI Program & Corrosion Control Evaluations, Identifying Potential Gaps

Safeguard Protection Analysis (SPA)

- Reference
 - CSB Recommendation 2012-03-I-CA-6
 - CSB Recommendation 2012-03-I-CA-12
 - 5189.1(e) / 2762.2.1
- Focus – California Petroleum Refineries
- Objective
 - Validate Effectiveness of Safeguards
- Stated CSB Requirements
 - Document “recognized methodologies, rationale, and conclusions used to claim that safeguards intended to control hazards will be effective”
 - Qualitative, Quantitative, or Semi-Quantitative Basis
- California Regulatory Objectives – 5189.1(e)(5) / 2762.2.1(a)

Safeguard Protection Analysis (SPA)

- Challenges

- “Blending Issues” is Human Nature
- Common-Mode Failures Between Causes & Safeguards
- Over-crediting Operator Response Reliability

- Tips

- Identify Root Transmitters for Causes & Safeguards
- Facilitator to Frequently Train the PHA Team on Risk-Ranking
- Facilitator to Frequently Challenge the PHA Team on Safeguard Effectiveness, Availability, & Reliability
- Structure HAZOP Safeguards as IPLs in Documentation
- May Group Alarms as a Single Safeguard
- Apply LOPA for High Consequence/Risk Scenarios to:
 - Address Requirements & Provide Additional Insights
 - Validate that a SIF is Not Needed

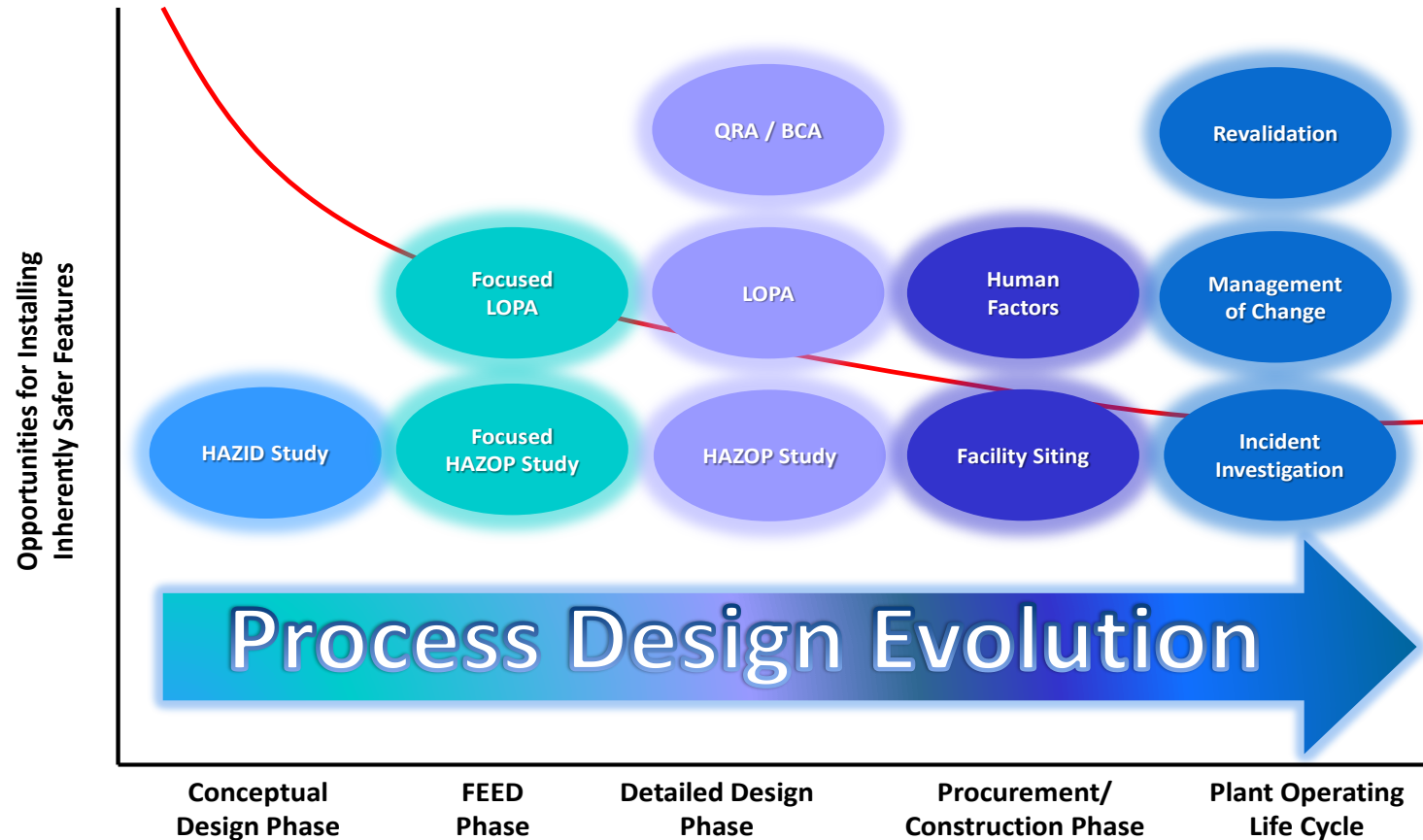
Safeguard Protection Analysis (SPA)

- More Tips – Operator Response to Alarms – Reliability & Timing
 - Must Hear the Alarm (setpoint, presence)
 - Operator Response Time (Human Factors)
 - Alarm Prioritization & Diagnosis
 - Permission for Corrective Action
 - Initiating the Corrective Action
 - Time for the Corrective Action to Mitigate the Event

Inherently Safer Designs (ISD)

- Reference
 - CSB Recommendation 2012-03-I-CA-7
 - CSB Recommendation 2012-03-I-CA-13
 - 5189.1(I) / 2762.13
- Focus – California Petroleum Refineries
- Objective
 - Minimize Risk to the Public, Personnel, and the Environment
- Stated CSB Requirements
 - Perform an Inherently Safer Systems (ISS) Analysis Triggered by All MOC and PHA Reviews

Implementation of Inherently Safer Design Features During Process Design



Hierarchy of Hazard Control Analysis (HCA)

- Tips

- Briefing During PHA Synchronization Training

- List of ISD Considerations in the PHA Quick Reference:

- Minimize
- Substitute/Eliminate
- Moderate
- Simplify – More Robust
- Simplify – Human Factors
- Simplify – Facility Siting

- Checklist for ISS Review on www.CSB.gov

- Documentation

- Inherently Safer Systems (ISS) Review as Separate Node
- For CA Petroleum Refineries, Document Separate HCA that Includes ISS Review

Technical Resources

- www.RMPCorp.com – RMP Home Site with Links to Webinar Recordings, Handouts, and Other Training Materials
- “Assimilating Design Formulation and Design Review into a HAZOP” – See <http://www.RMPCorp.com/publications/>
- “Design an Inherently Safer Plant” – See <http://www.RMPCorp.com/publications/>
- HAZOP/LOPA Facilitation Webinar Series (Module 10) – Effective approaches to handling CSB recommendations and PSM and CalARP changes
 - **DMR**
 - **SPA**
 - **Inherently Safer Technology/Design (i.e., IST/HCA/STAA)**
- 2015 Global Congress on Process Safety – Papers
 - **Maheer, Nour, Schultz, “Effectively Addressing New PSM/RMP Damage Mechanism Review Requirements with an Integrated PHA (iPHA)”**

Summary & Conclusions



Summary & Conclusions

- Various agencies have taken a fresh look at SMS Programs
- California Refineries are the initial focus of changes to state PSM and accidental release prevention program requirements
 - Initial promulgation harmonizes CalARP-P4 & CalPSM-R
 - No current plan to synchronize California and federal requirements
- Potential for:
 - Later expansion to other highly-hazardous facilities in California
 - Later expansion to non-California petroleum refineries & others
 - Inference to new requirements as best practice
 - General Duty Clause Correlation - SB 612 clarifies Owner/Operator responsibilities

Summary & Conclusions

- Risk Management & Process Safety Professionals should:
 - Focus on charting the course for the long-term success of your facility's programs
 - Develop a strategy for effective implementation
 - Be aware that some elements (e.g., IST/HCA/STAA) are significantly more cost-effective in the design-phase



Questions?

Steven T. Maher, PE CSP

Steve.Maher@RMPCorp.com

(949) 282-0123

www.RMPCorp.com



Risk Management Professionals