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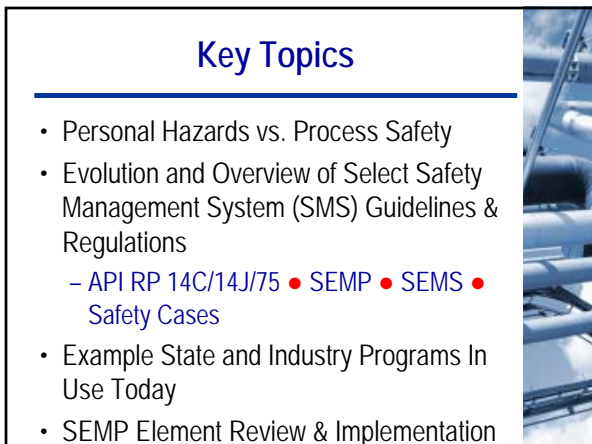
**Offshore Facility
Process Safety Overview**

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Seminar Objectives

- Familiarization with Categories of Offshore Facility Safety Issues
- Understanding of Safety Management Systems Concepts
- Overview of Applicable Tools & Guidelines
 - API
 - SEMP
 - SEMS
 - Safety Case
 - Analogous Onshore Facility Process Safety Programs
- Practical Approaches for Loss Prevention Programs
- 2010 Update – Offshore Facility Federal SMS Regulatory Framework



Key Topics

- Personal Hazards vs. Process Safety
- Evolution and Overview of Select Safety Management System (SMS) Guidelines & Regulations
 - API RP 14C/14J/75 • SEMP • SEMS • Safety Cases
- Example State and Industry Programs In Use Today
- SEMP Element Review & Implementation

Unique Hazard Characteristics

- Drilling Operations
 - Frequently Changing Activities
- Drilling & Production Operations
 - Variable Well Conditions
- Compact Environment
 - Higher Consequences
- Emergency Response Limitations
 - Evacuation
 - Agency Support

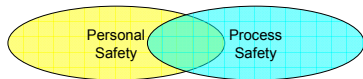


Offshore Facility Safety Categories

- Personal Safety
 - LTI
 - Primarily Controlled by PPE and Job Activity Attentiveness
- Process Safety
 - Primarily Controlled by (Safety) Management Systems



Offshore Facility Safety Categories



- Yes – There is some overlap
- Examples:
 - Correlation of Airline Baggage Handling Injuries to Airplane Crashes – LIMITED CORRELATION
 - Correlation of Offshore Facility "Slips, Trips, and Falls" Events to Major Accidents – LIMITED CORRELATION
- Involvement of Multiple Disciplines
- Involvement of Personnel from Multiple Facilities

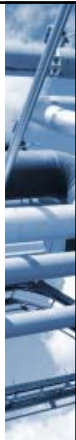


Offshore Facility Safety Categories

Yes – Serious accidents represent the “tip of the iceberg”, but there are two icebergs.

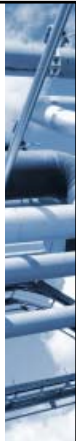


- Personal Safety Indicators
 - Lost Time Injury (LTI) Statistics
- Process Safety Indicators
 - Typically no direct consequences or injuries – typically summed up as a “maintenance Work Order”
 - “Near Misses” – if it hadn’t been discovered and corrected in time, a release or injury could have occurred.



Examples of “Near Misses”

- Having to station an operator at the vessel to drain it off constantly is a deviation from the design intent and is a **Process Safety Indicator**
- That liquid isn’t supposed to be in that tank. Oops, forgot that valve hidden beneath the deck plate.
- Regulating via the Bypass is a deviation from the design intent and is a **Process Safety Indicator**
- Relief valves relieving is not meant to be normal practice. A relief valve is not a regulator and this is a deviation from the design intent.
- ESDs or BOPs actuated are not normal shutdown practices.
- Increased corrosion rates – Why? Its great that inspection picked it up but what do we do about it. What’s causing it? Is the metallurgy adequate?
- Fouling of equipment or repeated premature failure of controls and devices




Lessons Learned from Key Offshore Facility Incidents



Piper Alpha Platform - 1988

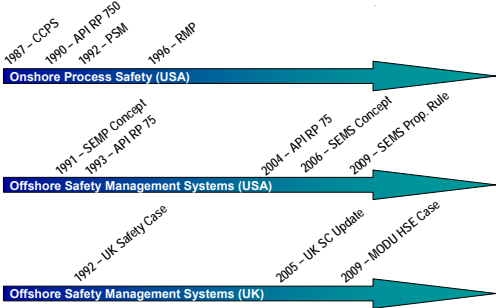
- Gas condensate vapor cloud generated
 - Work permit system not operating
 - Spare pump relief valve maintenance
 - Opening left unblinded
 - Spare pump startup
 - Significant vapor release
 - Significant explosion/fire
 - 167 lives lost



Observations from Major Incidents Safety Management Systems Concepts

- Major Accidents have Caused Significant Loss of Life and Property, as well as Significant Indirect Costs, e.g.:
 - Business Interruption
 - Lost Confidence and Contracts
 - Increased Regulation
- Typical Characteristics of Major Accidents:
 - Relatively-Simple Precursors & Initiating Events
 - Root Causes - Failure to Maintain Design Intent (first line of defense)
- MOST EFFECTIVE MECHANISM FOR IMPROVEMENT – Not by Addressing the Specific Actions, but by Effecting Changes in the Way Business is Done (i.e., **SAFETY CULTURE & “MANAGEMENT SYSTEMS”**)

Evolution of Select SMS Guidelines & Regulations



Onshore Process Safety (USA)

- 1987 - CCPS
- 1990 - API RP 750
- 1992 - PSM
- 1996 - RMP

Offshore Safety Management Systems (USA)

- 1991 - SEMR Concept
- 1993 - API RP 75
- 2004 - API RP 75
- 2006 - SEMS Concept
- 2009 - SEMS Prop. Rule

Offshore Safety Management Systems (UK)

- 1992 - UK Safety Cases
- 2005 - UK SC Update
- 2009 - MDDU HSE Case

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Offshore Jurisdiction Regions

- 1892 opinion in *Illinois Central Railroad v. Illinois* [146 U.S. 387], the U.S. Supreme Court declared that the "Sovereign Lands" of a state are held in trust by the State for all present and future generations, and that such land may not be sold for development incompatible with uses covered by the **Public Trust Doctrine**.
- The Submerged Lands Act was established in 1953 which gives the States jurisdiction over natural resources out to 3 nautical miles (3.45 miles). Texas and the west coast of Florida (9 nautical miles)
- The United States Exclusive Economic Zone was established in 1983 and claims rights to all waters up to 200 nautical miles from the coastline for the United States.

State SMS Governing Regulations


	Agency	Regulation/Guideline
Texas (9 Nautical Miles)	Texas Railroad Commission	Primarily Design & Operating Requirements, but no Explicit SMS
California (3 Nautical Miles)	California State Lands Commission (Certified Unified Program Agencies may have some overlapping jurisdiction for some Onshore Facilities)	California Public Resources Code (PRC) 6103, 6108, 6216, 6301, 6873 (d), CCR, Title 2, Div 3, Chapter 1, Articles 1-11. PRC 8757 (a) provide the basis for SMS inspections, audits, & enforcement
Louisiana (3 Nautical Miles)	Department of Environmental Quality / Department of Natural Resources	Primarily Design & Operating Requirements, but no Explicit SMS
Alaska (3 Nautical Miles)	Alaska Oil and Gas Conservation Commission	Primarily Design & Operating Requirements, but no Explicit SMS

Federal SMS Governing Regulations

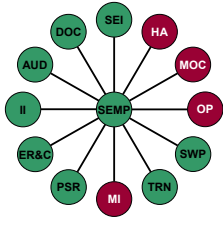
Agency	Regulation/Guideline
MMS (Outer Continental Shelf)	SEMP Guideline SEMS Proposed Regulations
EPA RMP (OCS, State Waters, and Onshore)	Offshore Facilities and Onshore Production Facilities Typically Exempt - However, "General Duty Clause" can be Evoked in Some Cases
OSHA PSM (State Waters and Onshore)	Offshore Facilities and Onshore Production Facilities Typically Exempt - However, "General Duty Clause" can be Evoked in Some Cases
Coast Guard (OCS, State Waters, and Onshore)	Primarily Equipment Functionality, Design, & Operability, but no Explicit SMS

PSM & RMP Applicability


- OSHA PSM and EPA RMP have jurisdiction over the offshore facilities, but the facilities are typically exempt due to the flammables being naturally-occurring hydrocarbons.
- Furthermore, many offshore and onshore facilities would not fall under OSHA PSM or EPA RMP due to some or all of the following criteria:
 - Storage in atmospheric tanks,
 - The flammables are not classified as NFPA-4 (RMP) and flashpoint below 100 °F (PSM),
 - Storage or processing of a threshold quantity (10,000 lbs) is not present.



SEMP/SEMS Element Identification




- Safety & Environmental Information
- Hazard Analysis
- Management of Change
- Operating Procedures
- Safe Work Practices
- Training
- Mechanical Integrity
- Pre-Startup Review
- Emergency Response & Control
- Investigation of Incidents
- Audit of SEM/Elements
- Records & Documentation



API RP 75 Overview

- "Development of a Safety and Environmental Management Program for Offshore Operations and Facilities"
- Industry Response to 1991 MMS SEMP Concept
- Third Edition – 2004
- Applicability – Drilling & Production Facilities
- Twelve Key Elements
- Recommendations for Effective Implementation



API RP 14C/14J Overview

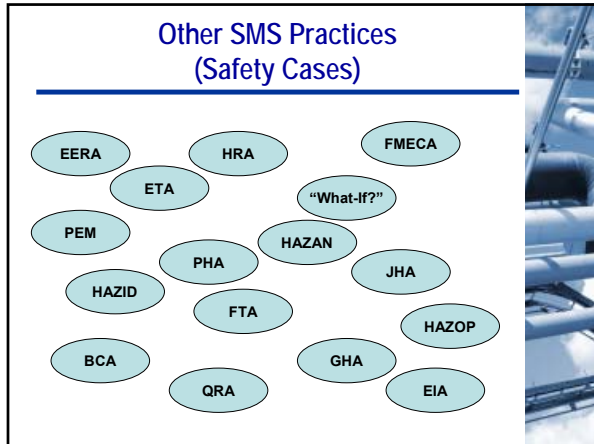
- **API RP 14C** – "Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms"
 - Representative Safety System Designs
 - Component Configurations
 - Process Flow Diagrams
 - P&IDs
 - Alarm Features
 - Associated Safety Analysis Checklist
- Safety Analysis Methods & Development of SAFE Charts
- **API RP 14J** – "Design and Hazards Analysis for Offshore Production Facilities"
 - Details for Support of Two Critical SEMP Elements
 - Safety & Environmental Information
 - Hazard Analysis
- Identification of Good Design Practices
- Primary Applicability – Offshore Production Facilities and Production Processing Systems of Mobile Offshore Units

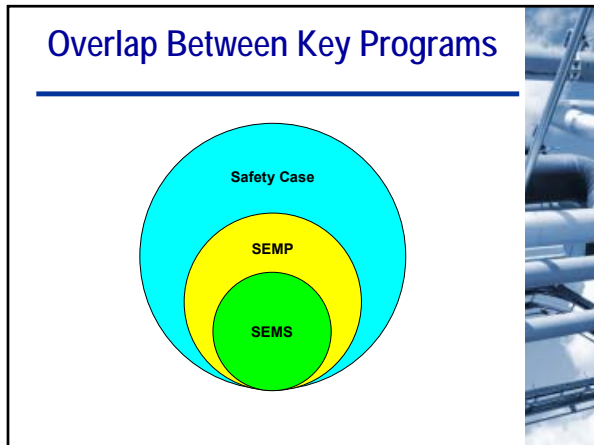
Other SMS Practices (Safety Cases)

- Offshore Installations (Safety Case) Regulations
- Definition – "A documented body of evidence that provides a convincing and valid argument that a system is adequately safe for a given application in a given environment"
- Original 1992 Requirements
 - Fire Risk Analysis
 - Assessment of the risk of ingress of smoke or gas into the accommodation
 - Review of the ability of emergency systems to withstand severe accident conditions
 - Evacuation, escape and rescue analysis
- 2005 Updates
 - Early design notification
 - Thorough and fundamental review of safety cases at least every five years
 - Removal of safety case re-submittal requirements (although still auditable)
 - Licensees to ensure Operators are capable of fulfilling their legal responsibilities for safety

Other SMS Practices (Safety Cases)

- Typical Safety Case Contents
 - Facility Description
 - HSE Management System
 - Formal Safety Assessment (FSA) Summary
 - Safety Critical Elements and Performance Standards
 - ALARP Demonstration
 - Fitness to Operate





No Need to Reinvent the Wheel! Example State & Industry Programs IN USE TODAY

- CA State Lands Commission (CSLC) established API RP 14C to be the basis for offshore production facilities
- Subject to applicable federal, state, and local requirements including Cal/OSHA PSM and other analogues regulations
- Safety Audit Program has five main areas or teams:
 - Equipment Functionality and Integrity
 - Technical design
 - Electrical condition, maintenance, and design
 - Administrative
 - Human Factors and Safety Management (Includes SAMS program)
- The teams identify action items with priorities in a written report
- 5100 action items resulting in \$5 million dollars in needed facility upgrades
- Implements "Safety Assessment of Management Systems" (SAMS) designed to develop a [practical field application in safety and environmental protection](#)

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No Need to Reinvent the Wheel
Example State & Industry Programs IN USE TODAY

•Aera Energy LLC (an offshore company) utilizes the “System of Operating Excellence” (SOE) which involves a top-to-bottom corporate commitment.

The following figure was taken from Aera's presentation at the "Prevention First 2006 Symposium" that encapsulates their internal program:

Aera's System of Operating Excellence (SOE)

The EHS vision The rear view mirror Look here for Leading Indicators & Process Measures

No Need to Reinvent the Wheel
Example State & Industry Programs IN USE TODAY

- **High-Risk Industrial Settings use of Behavioral Based Safety Programs (BBS)**
 - Objective is to reduce hazard and risks through **changes in the underlying Safety Culture** through looking at employee behaviors and understanding the culture and factors leading to these behaviors. People do not inherently want to put themselves, co-workers, & the environment at risk.
 - Current BBS approaches emphasize the **influence** managers, systems, and practices have on at-risk behavior and conditions. **Must have upper level management buy-in and support.**
 - Behavioral observations, feedback, and process improvement in a non-blaming environment – encourages honest feedback and allows everyone to move forward.
 - Intended to flush out Process Safety Indicators and risks that have become “normalized” through repeated practice with No Consequences.

No Need to Reinvent the Wheel
Example State & Industry Programs IN USE TODAY

- **Many times the deficiencies in Process Safety Management are an organizational problem and not due to people unwilling to follow procedures and perform record keeping. Examples of BBS findings when accessing Safety Management Systems in high-risk industrial settings:**
 - Mechanical Integrity is not kept up because there is not adequate maintenance staff or parts to close the work orders
 - Informal pressures like performance-oriented culture in which employees are praised for saving time and taking shortcuts – THIS IS A COMMON FINDING IN APPLICABLE CHEMICAL SAFETY BOARD (CSB) CASE STUDIES.
 - When auditing - Resolving the deficiency involves WHY is the procedure, form, or policy not being implemented – Is it too cumbersome or confusing? Does it fold easily into their operations and day-to-day activities?
 - Not having the resources to get it done – no body available to reline and CAD the Piping & Instrumentation Diagrams (P&IDs) and Process Flow Diagrams (PFDs)
 - Allocating time for personnel to update operating procedures is not supported.

SEMP Element Review & Implementation Suggestions



Safety & Environmental Information

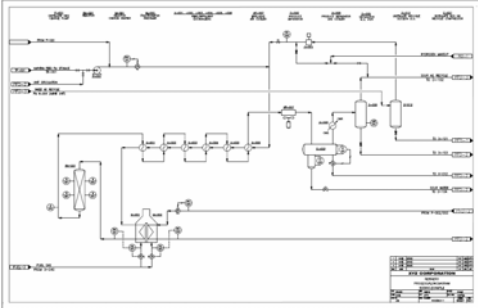
API RP 14J Contains Guidance on Process Design Requirements Process Design Information:

- A block flow diagram or simplified process flow diagram
- Safe upper and lower limits for such items as temperatures, pressures, flows, or compositions
- Material and energy balances

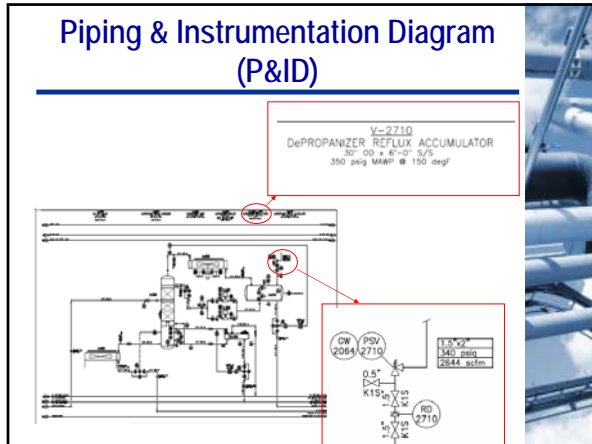
Mechanical and Facilities Design Information:

- Equipment specifications and materials of construction
- Piping and Instrumentation Diagrams (P&IDs)
- Electrical classification
- Relief system design and design basis
- Well Control Systems
- Design Basis for Passive and Active Fire Protection
- Evacuation Procedures

Process Flow Diagram



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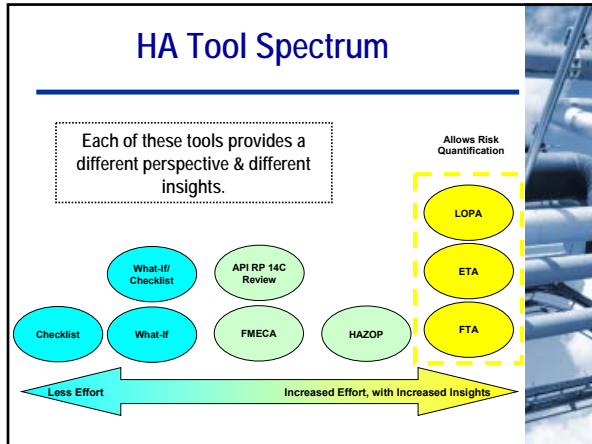


Material Safety Data Sheets

ISOBUTANE Material Safety Data Sheet

EMERGENCY PHONE NUMBERS / MANUFACTURERS NAME		
(800)244-8300 CHEMTREC	(951)399-4270 Sevens Resource Corporation 2131 Main Court, Bakersfield, CA 93308-6830	
I. MATERIAL IDENTIFICATION		
Material Trade Name: Synonyms: Chemical Family/Formula: CAS No.:	Isobutane 2-Methyl Propane, Trimethyl Methane Aliphatic Hydrocarbon, Alkane Series C ₄ H ₁₀	
II. INGREDIENTS		
Composition:	Occupational exposure limits	CAS No.
> 95% Isobutane < 5% Normal Butane < 5% Propane < 0.5% Methane	ACGIH OSHA TWA 800 ppm ACGIH OSHA TWA 800 ppm Simple asphyxiant Simple asphyxiant	106-97-8 106-97-8 67-88-0 74-87-4
III. PHYSICAL DATA		
Boiling Point: Specific Gravity: Vapor Pressure: Solubility in H ₂ O: Evaporation Rate: Vapor Density: %Viable by volume: Appearance and Odor:	11°F @ 14.7 psia (760mmHG) 559 22 Insoluble NA Gas at standard temp and pressure 2.01 (Air = 1) 100 Gas, slight hydrocarbon odor	

- ### Hazard Analysis
- Identifies hazards of the process chemical, operation and external events that could affect the facility
 - Identifies risk to property, health and life
 - Lists the worst-case consequences
 - Identifies the safeguards in place
 - Provides an objective method to measure the effectiveness of safeguards and need for additional safety features



Management of Change

- Ensure a safe and systematic method is used to make changes to processes
- Identify the process and mechanical design basis for any proposed change.
- Ensure that the changes have been designed utilizing good engineering practices and regulatory requirements
- Ensure all required modifications to operating procedures, safe work practices, training and safety and environmental information, and/or other SMS have been made
- Inform and train involved employees of process change and new requirements
- Increased emphasis on personnel changes

Operating Procedures

Procedures:

- Initial startup
- Normal operations
- Temporary operations
- Emergency shutdown including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators, to ensure that emergency shutdown is executed in a safe and timely manner
- Normal shutdown

Operating Procedures


Operating Limits:

- Safety and Environmental consequences of deviation
- Steps required to correct or avoid deviations

Environmental and Occupational Safety and Health Considerations:

- Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment
- Control measures to be taken if physical contact or airborne exposure occurs
- Disposal of materials within terms of applicable permits

Operating Procedures should be reviewed periodically.



Safe Work Practices

Provide Guidelines for Selection and Performance Evaluation of Contractors


- Contractor selection should include evaluation of safety records
- API RP 76 contains guidance for contractor selection

Safe Conduct of Work Activities:

- Opening of pressurized or energized equipment or piping
- Lockout/Tagout
- Hotwork
- Confined space entry
- Crane operations


Control of Hazardous Materials

- Document and communicate potential safety and environmental hazards due to toxic and hazardous materials



Training

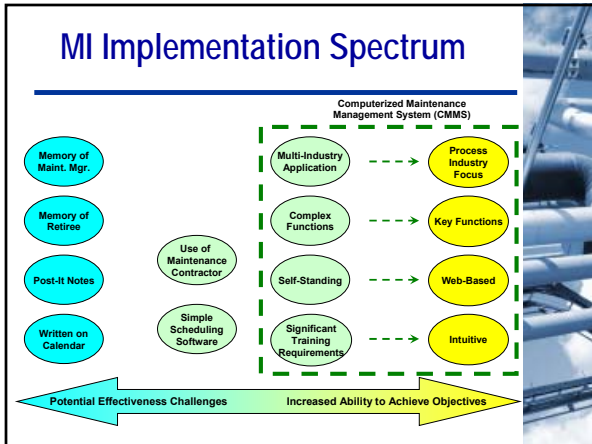
- The training program must address operating procedures, safe work practices, emergency response and control.
- The initial training must include a series of API trainings listed on next slide.
- Periodic training should be conducted to verify retention of required knowledge and skills.
- Whenever changes are made, appropriate personnel should be trained on change as part of MOC program.
- Contractors should be trained on site-specific safety and job requirements.

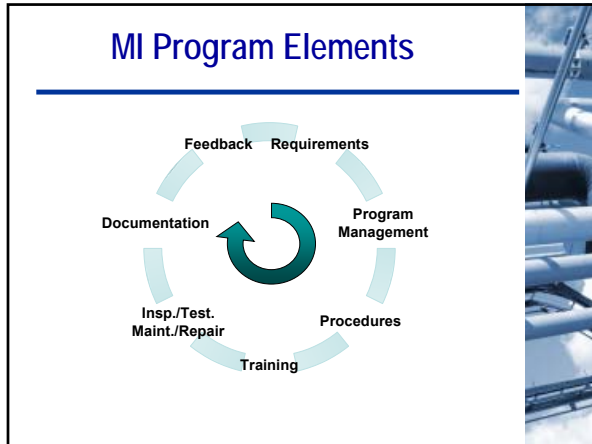


Training

API RP	Title
T-1	Orientation Program for Personnel Going Offshore for the First Time
T-4	Training of Offshore Personnel in Non-Operating Emergencies
T-7	Training Personnel in Rescue of Persons in Water
14G	Fire Prevention and Control on Open Type Offshore Production Platforms
T-2	Qualification Programs for Offshore Production Personnel Who Work with Anti-Pollution Safety Devices
2D	Operation and Maintenance of Offshore Cranes
T-6	Training and Qualification of Personnel in Well Control Equipment and Techniques for Completion and Workover Operations on Offshore Locations
59	Well Control Operations
49	Drilling and Well Servicing Operations Involving Hydrogen Sulfide
55	Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide

- ### Mechanical Integrity
- Describes the process and safety equipment, preventive maintenance, and inspection schedules
 - Can not have a Fix-at-Failure Maintenance Strategy
 - Must have a Preventive Maintenance program based on manufacturer recommendations
 - If a contractor is used, you still must develop a written schedule of what he is replacing, overhauling, cleaning, etc. and on what frequency





Pre-Startup Review

- Conducted for all new process construction and modified processes to ensure that the system is safe for initial and continued operation
- Confirms that elements of the Management of Change have been completed

Emergency Response and Control



- Assign Authority to Appropriate Qualified Person - ICS
- Address Emergency Reporting
- Address Events Such As:
 - Spills of Hazardous Substances
 - Collisions
 - Fire and/or Blowout
- Training and Drills for Emergency Response should be Conducted Periodically

Incident Command System

- NIMS Requirements
- Purpose:
 - Carefully planned and executed system designed to manage an emergency
 - Creates a "Chain of Command"
 - Defines roles and responsibilities of each group or person at an incident

ICS Features



- Common Terminology
- Consistent Organizational Structure
- Consistent Position Titles
- Integrated Communications
- Common Incident Facilities
- Modular Organization
- Unified Command Structure
- Consolidated Action Plans
- Manageable Span of Control
- Comprehensive Resource Management
- Scalability

Investigation of Incidents

- Describes the process of Incident Investigation
 - All incidents must be investigated and reported including near-miss incidents
 - Initiate the incident investigation as promptly as possible
 - The conclusions of investigations should be distributed to similar facilities and appropriate personnel

Investigation of Incidents


- The investigation of an incident should address the following:
 - Nature of the incident
 - Factors (human or other) that contributed
 - Recommended changes identified as a result of the investigation

Audit of SEMP Elements

SEMP Audit Requirements:

- Conducted 2 years after initial implementation of management program and then at least every 4 after that
- Document findings
- Address deficiencies
- Can be addressed by developing checklists to address:
 - Technical compliance
 - Actual effectiveness



Records & Documentation

- Information on applicable regulations
- Complaint records
- Training records
- Process information
- Product information
- Inspection, maintenance and calibration records
- Contractor and supplier information
- Incident report
- Emergency preparedness and response
- Significant environmental aspects
- Audit results
- Management reviews



**Regulatory Dynamics
&
Available SMS Resources
Within Your Company**



**2010 Update – Offshore Facility
Federal SMS Regulatory Framework**

- 1991, 1993, 2004 – SEMP Proposed & Evolved into API RP 75
- 2006/2009 – SEMS Concept / Proposed Rule
- 2010 – May 19 – MMS Restructuring Order 3299
- 2010 – May 27 – DOI Brief to the President
- 2010 – May 30 – Six-Month Moratorium on Deepwater (>500') Drilling
- 2010 – June 8 – DOI Directive to Shallow Water (<500') Drilling Operators
 - June 17 – BOP Reporting Requirements
 - June 28 – Submit Required Safety Certifications
- 2010 – September (target) – Rulemaking Expansion of June 8 Directive
- 2010 – Updated/Consolidated "SEMS" – As a follow-up to the May 27 DOI Brief, MMS is taking a hard look at "performance-based safety measures".
- 2011 – January 1 – DOI Bureau of Safety & Environmental Enforcement

**Comparison of Offshore
SMS Regulations/Guidelines**

Business Issues in the Application of Safety Management Systems

- The bulk of SMS elements are common to other loss prevention programs (e.g., PSM, RMP) (see next page for comparison with SEMP elements).
- Offshore Facility Companies that also operate Onshore Facilities already have the infrastructure and expertise to implement Offshore SMS efficiently.



SMS Program Overlap Compliance Matrix

Section	API (RP 75)	OSHA (29 CFR)	EPA (40 CFR)
Safety & Environmental Information	2	1910.119 (d)	68.65
Hazard Analysis	3	1910.119 (e)	68.67
Management of Change	4	1910.119 (l)	68.75
Operating Procedures	5	1910.119 (f)	68.69
Safe Work Practices	6	---	---
Training	7	1910.119 (g)	68.71
Assurance of Quality & Mechanical Integrity of Critical Equipment	8	1910.119 (j)	68.73
Pre-Startup Review	9	1910.119 (i)	68.77
Emergency Response & Control	10	1910.119 (n)	68.95
Investigation of Incidents	11	1910.119 (m)	68.81
Audit of SEMP Elements	12	1910.119 (o)	68.79
Records & Documentation	13	---	---



Stay Tuned!

**Updated Webinar
 July 22**



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2. 1990 – API RP 750, First Edition – "Management of Process Hazards"
3. 1992 – PSM – 29 CFR 1910.119, "Process Safety Management (PSM) of Highly Hazardous Chemicals, Explosives and Blasting Agents"
4. 1992 – UK Safety Case – Offshore Installations (Safety Case) Regulations 1992
5. 1996 – RMP – 40 CFR Part 68, "Risk Management Programs (RMP) for Chemical Accidental Release Prevention"
6. 2004 – API RP 75, Third Edition – "Development of a Safety and Environmental Management Program for Offshore Operations and Facilities"
7. 2005 – UK SC Update – "Statutory Instrument 2005 No. 3117, The Offshore Installations (Safety Case) Regulations 2005"
8. 2006 – SEMS Concept – 22May06 Federal Register – "Oil and Gas and Sulphur in the Outer Continental Shelf (OCS) – Safety and Environmental Management Systems"
9. 2009 – SEMS Proposed Rule – 17Jun09 Federal Register – "Safety and Environmental Management Systems for Outer Continental Shelf Oil and Gas Operations"
10. 2009 – MODU HSE Case – International Association of Drilling Contractors – "Health, Safety and Environmental Case Guidelines for Mobile Offshore Drilling Units," May 2009
11. API RP 14B, Fourth Edition – "Design, Installation, Repair and Operation of Subsurface Safety Valve Systems"
12. API RP 14C, Seventh Edition – "Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms"
13. API RP 14J, Second Edition – "Design and Hazards Analysis for Offshore Production Facilities"



Questions?

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