



American Gas Association
Pipeline Safety Management Systems Workshop
API RP 1173 Development Perspectives
March 1, 2016

What is a Safety Management System?

Framework of goals, objectives, processes, and procedures -- applied by people, enabled by technology -- ensures organization can fulfill the tasks required to achieve safety and business success.

Enables people to execute tasks using risk management, established controls, assessment and continuous improvement to meet safety and business objectives.

Built on processes providing more discipline in use of data and other information for better decision making.

It is a journey, not a project

What Role Did the NTSB Play in the API Standard Development?

- U.S. National Transportation Safety Board (NTSB) review of past pipeline incidents and safety practices found that adoption of safety management systems would help operators improve their safety and organizational performance
- In 2012, NTSB recommended the American Petroleum Institute lead a multi-stakeholder process to develop and adopt a pipeline specific industry-wide safety management system standard
- Industry Commissioned a Work Team to develop API RP 1173

What these accidents have in common:

- **Multiple contributing causes**
- Involve **people at numerous levels** within an system organization
- Pervasive **lack of measures to ensure** a positive safety culture
- **Catastrophic events**, often involving substantial loss of life, and/or significant damage to property .
- **Require complex organizational changes** to avoid them.

NTSB: Indicators of Organizational Failure

- **Lack of top-level management commitment**
- **Conflicts** between production and safety goals
- **Poor planning, communications, monitoring, control or supervision**
- **Organizational deficiencies** leading to blurred safety and administrative responsibilities
- **Deficiencies in training**
- **Poor maintenance management or control**
- **Oversight failures** by regulatory or safety agencies

Significant Improvements Offered By RP 1173



1. Leadership and Management Commitment
1. Stakeholder Engagement
1. Role of Safety Culture
2. Maturity Models
3. Management Reviews
1. Bibliography

Key Provisions

- “What, . . . Not How”
- Fostering a learning environment
 - Other industries
 - Among peers
- Non-punitive reporting
- Use of contractors
- Audits and evaluations
- Performance metrics
- Stop work authority
- Scale – “I am a small operator”

Why SMS is the Right Thing to Do

- Pipeline operators no matter their size can benefit :
 - A PSMS will bring a **more regular, formal structure** to those already applying many of the PSMS elements
 - Operators with an SMS will be able to **identify gaps and make improvements**
 - Those new to SMS will benefit from a **structured approach to track, measure and improve** their safety programs and performance
 - **Decreases risk - organizational compliance risk**

API 1173 Timeline

- Dec 2012 - API worked with trades to form work group
- Jan thru Dec 2013 – monthly meetings of Work Group
- Feb 2014 – PHMSA Workshop and draft of 1173 issued for public comment
- Monthly 2014 - Work Group met monthly
- July 2014 – PHMSA Workshop and draft of 1173 issued for public comment (official ballot)
- Oct 2014 – Comment period closed; work group resolved comments
- Early 2015 – Re-ballot
- July 2015 – Publication of API RP 1173

PSMS Development Committee Members



- Ron McClain, Kinder Morgan , Chair
- Mark Hereth, P-PIC, Content Editor
- Scott Collier, Buckeye Partners
- Tom Jensen , Explorer Pipeline
- Paul Eberth, Enbridge Pipelines
- Mark Weesner, Exxon Mobil
- Brianne Metzger-Doran, Spectra Energy
- Tracey Scott, Alliance Pipeline
- William Moody, Southwest Gas
- Nick Stavropoulos, Pacific Gas and Electric
- Steve Prue, Small Gas Distribution
- Bill Hoyle, Public – Subject Matter Expert
- Stacey Gerard, Public – Subject Matter Expert
- Jeff Wiese, PHMSA
- Linda Daugherty, PHMSA
- Robert Miller, AZ Corporation Commission
- Massoud Tahamtani, VA State Corporation Commission
- Bob Beaton, NTSB (Ex Officio)
- John Erickson, APGA
- Kate Miller, AGA
- Scott Currier, INGAA
- Peter Lidiak, API
- John Stody, AOPL
- Edmund Baniak, API

How Have Other Industries Approached SMS?

Must It Be Ten Elements?

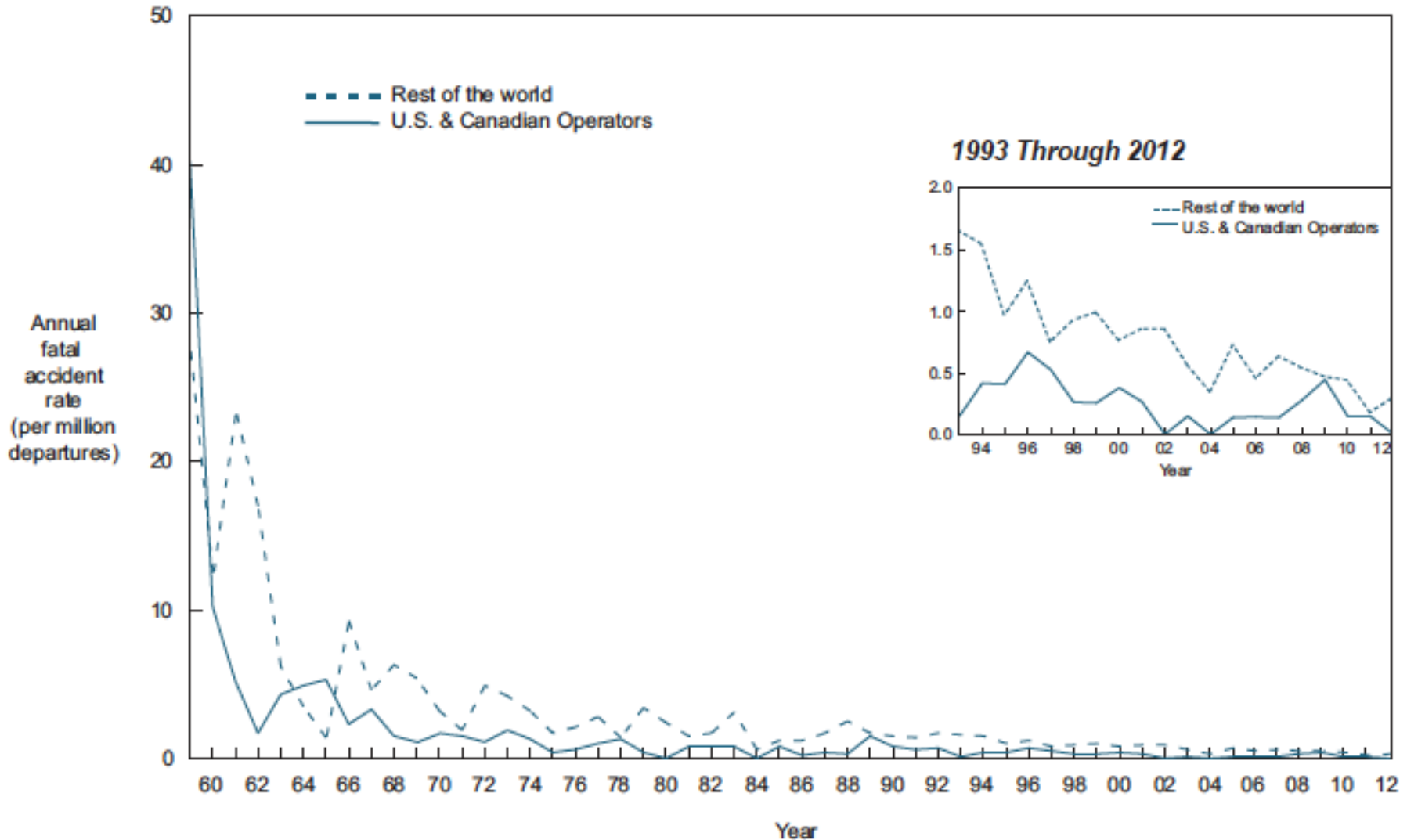
And How Do We Know This Will Improve Safety?

API 1173 Team Learned By Studying Other High Risk Industries Where Failure is Intolerable

- Commercial aviation, petrochemicals, petroleum refining, nuclear power and medical, are using SMS and adhere to standards to improve their safety performance.
- Their results really impressed the work group

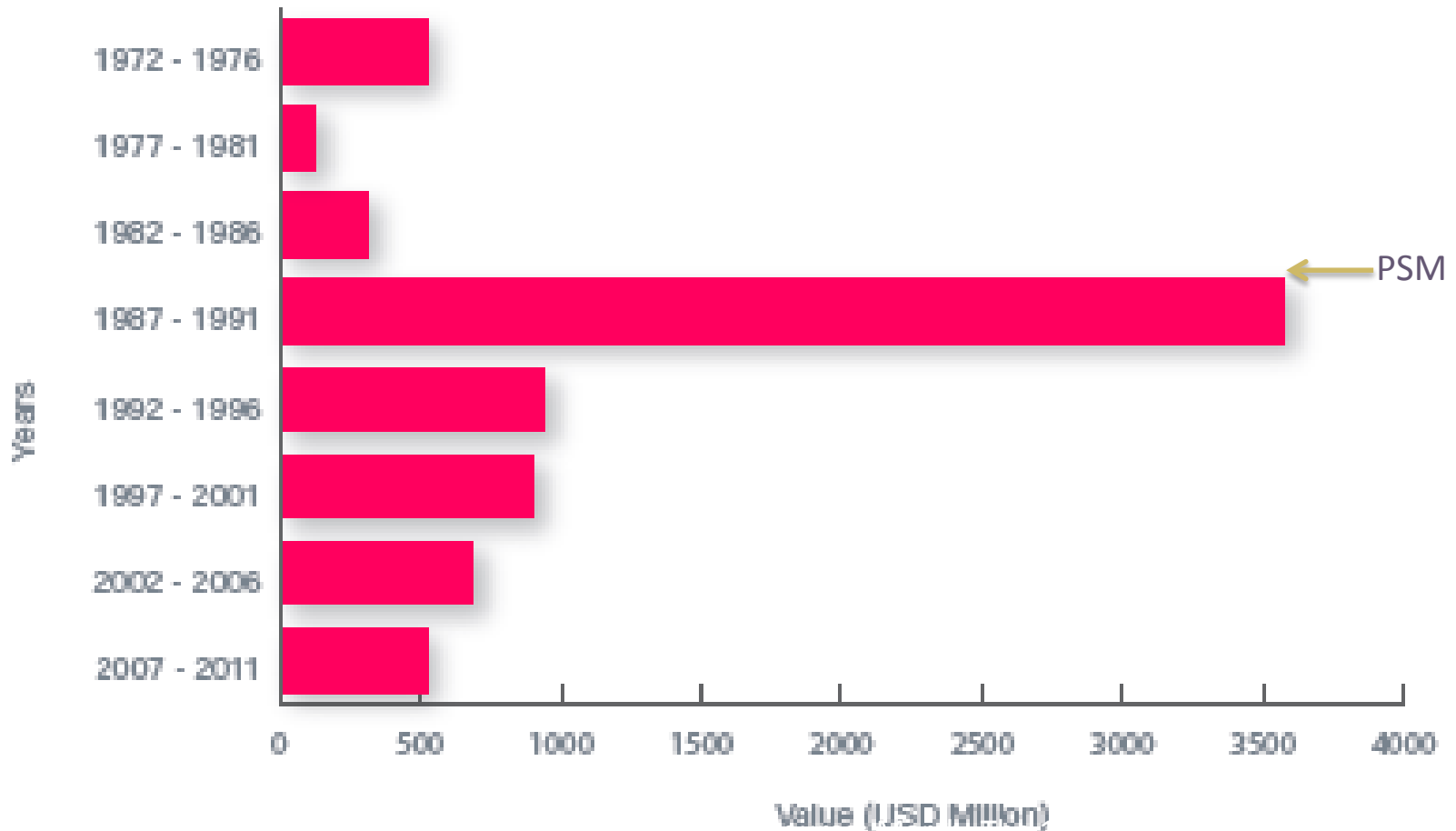
U.S. and Canadian Operators Accident Rates by Year

Fatal Accidents – Worldwide Commercial Jet Fleet – 1959 Through 2012



Experience From Petrochemicals

PETROCHEMICAL LOSSES IN FIVE YEAR PERIODS



Source: Marsh, The 100 Largest Losses (in the Hydrocarbon Industry) 1974-2013.

Many Standard Platforms Already Exist.....

- Industry Standards already in publication
 - API RP 75 – MS for Offshore Operations and Facilities
 - API RP 750 – Management of Process Hazards
 - ANSI Z10-2012 Standard on Occupational Health and Safety Management
 - CSA-Z662-11 – Section 3.1- Management Systems
 - API 1173
- Implemented Corporate Systems for Consideration
 - Marathon – Responsible Care Management System
 - Exxon Mobil – OIMS
 - Kinder Morgan – Operations Management System
 - Chevron – Operational Excellence Management System
 - DuPont – Excellence in Safety

Comparison of SMS Elements

Table 1 Comparison of Various Management System Standards

Management System Elements	Regulatory Requirements / Consensus Standards			International Standards				Industry Standards		
	ASME B31.8S- 2010	FAA	CSA Z662-11	ISO 14001:2004	BS OHSAS 18001: 2007	PAS 99:2006 Integrated Management Systems	PAS 55 Asset Management	API RP 75	ExxonMobil OIMS	Chevron OEMS
1.0 Management commitment		x	x	x	x	x	x	x	x	x
2.0 Management Review	o	x	x	x	x	x	x	x	x	x
3.0 Stakeholder engagement	x	o		x	x	x	x	x	x	x
4.0 Responsibility, accountability and authority (applied to each process)	o	x	x	x	x	x	x	x	x	x
5.0 Risk management	x	x	x		x	x	x	x	x	x
6.0 Safety culture		x			o			o	o	x
7.0 Work force planning, training, development and qualification	x	x	x	x	x	x	x	x	x	x
8.0 Engineering and construction	x		x				x	x	x	x
9.0 Learning culture and continuous improvement	o	x	o	o	o	o	o	x	x	x
10.0 Management of change	x	x	x		x		x	x	x	x

Comparison of SMS Elements (Continued)

Management System Elements	Regulatory Requirements / Consensus Standards			International Standards				Industry Standards		
	ASME B31.8S- 2010	FAA	CSA Z662-11	ISO 14001:2004	BS OHSAS 18001: 2007	PAS 99:2006 Integrated Management Systems	PAS 55 Asset Management	API RP 75	ExxonMobil OIMS	Chevron OEMS
11.0 Quality assurance and quality control	x	x	x					x	x	x
12.0 Performance measurement	x	x	x	x	x	x	x	x	x	x
13.0 Incident investigation and lessons learned	x	x	o		x	x	x	x	x	x
14.0 Emergency preparedness and response	x	x	x	x	x	x	x	x	x	x
15.0 Documentation and records management	x	x	x	x	x	x	x	x	x	x

Legend:

x = the element is covered explicitly in the compared standard.

o = the element is partially covered in the compared standard, but is not explicitly or completely addressed.

Blank = the element is not addressed in the compared standard.

Source: The Role of Management Systems in Achieving our Goal of Zero Incidents, INGAA, October 2012

Proposed Elements For Work Group To Consider	PAS 55: 2008	DuPont Excellence In Safety	CSA Z662 Safety and Loss Management System	API 75/750 Management of Process Hazards
Leadership and Management Commitment	AM Policy (4.2), AM Strategy, Objectives and Plans (4.3), Structure Authority and Responsibility (4.4.1)	Management Commitment Policies and Principles	Management Responsibility Financial Resources	General (Leadership and Commitment)
Risk Management -Risk Assessment -Risk Mitigation	Risk Management (4.4.7)	Risk Assessment and Process Hazard Analysis	Risk Management (under Operational Control)	Process Safety Information Process Hazard Analysis
Operational Controls - Management of Change - Quality Assurance and Control	Legal and Other Requirements (4.4.8) Management of Change (4.4.9)	Procedures and Performance Standards Management of Change Contractor Safety Management Pre-Start Up Review Mechanical Integrity	Operational Control Management of Change	Operating Procedures Management of Change Assurance of Quality and Mechanical Integrity
Incident Investigation, Evaluation and Lessons Learned	Investigation of asset-related failures, incidents and nonconformities (4.6.2)	Incident Investigation	Incident Investigation (under O&M, under Operational Control)	Investigation of Process-Related Incidents
Performance Plan QA/QC, Continuous Improvement, Performance Measures Audits, Feedback Into Management Review	Performance and Condition Monitoring (4.6.1); Evaluation of Compliance (4.6.3); Audit (4.6.4); Improvement Actions (4.6.5); Management Review (4.7)	Observations and Audits Quality Assurance	Continual Improvement Management Review (under Management Responsibility)	Audit of Process Hazards Management Systems
Training, Qualification and Development	Training, Awareness and Competence (4.4.3); Outsourcing (4.4.2)	Training and Development Motivation and Awareness	Resource Management (People and Budget)	Training Safe Work Practices
Emergency Preparedness and Response	Contingency Planning (4.3.4)	Emergency Preparedness and Contingency Planning	Emergency Preparedness and Response (Under Operational Control)	Emergency Response and Control
Documentation and Recordkeeping -System Data and Information	AM Documentation (4.4.5) Information Management (4.4.6) Records (4.6.6)	Process Safety Information	Documents and Records	Documentation and Recordkeeping
Stakeholder Engagement	Communication, Participation and Consultation (4.4.4)	Effective Communication	Communications w/I Mgt. Responsibility	NA

Exxon Mobil – Operations Integrity Management System (OIMS)



Responsible Care



PROCESS SAFETY CODE

1. Leadership and Culture
2. Accountability
3. Knowledge, Expertise and Training
4. Understand and Prioritize Process Safety Risks
5. Comprehensive Process Safety Management System
6. Information Sharing
7. Monitor and Improve Performance



Risk Management

- Personnel
- Facilities
- Technology

Culture

- Leadership
- Organization
- Processes & Actions

Chevron Operational Excellence Management System

- Leadership Accountability
- Management System Process
- OE Expectations

Apply to All OE Areas of Focus

- Operating Procedures
- Competency Management
- Management of Change
- Incident Investigation
- Compliance Assurance
- Leadership Accountability
- Management System Process

Key

- Apply to All OE Areas of Focus
- Apply to HES Areas of Focus
- Apply primarily to the specified OE Area of Focus

Apply to HES Areas of Focus

- Risk Management
- Managing Safe Work
- Contractor HES Management
- Product Stewardship
- Community and Stakeholder Engagement
- Emergency Management
- Legislative and Regulatory Advocacy

Process Safety

- Operational readiness and Pre-Startup Safety Review
- Technical Codes and Standards
- Process Safety Information
- Asset Integrity

Personal Safety & Health

- Workforce Security
- Safety in Design
- RSI Prevention
- Motor Vehicle Safety
- Behavior-Based Safety
- Fitness for Duty
- Occupational Hygiene

Environmental Stewardship

- Environmental, Social and Health Impact Assessment
- Property Transfer
- Third-Party Waste Stewardship

Reliability

- Reliability Opportunity Identification and Resolution
- Equipment Criticality Assessment
- Surveillance
- Condition Monitoring
- Work Management
- Resolution of Recurring Failures

Efficiency

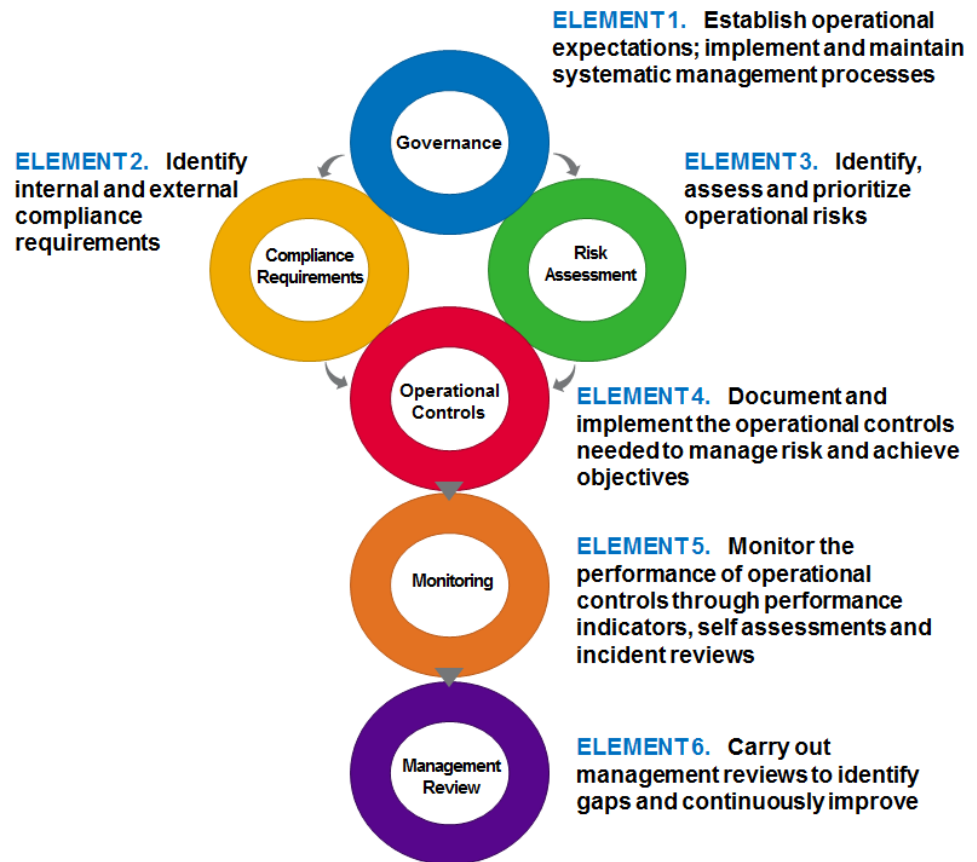
- Capital Project Energy Optimization VIP
- Facility/Equipment Optimization Practices
- Efficiency Opportunity Identification

One Operator's Perspective: Spectra Energy Operations Performance Assurance

Operations Performance Assurance (OPA) is designed to support systemic management of operations risk and support answers to these questions...

- **What are our prioritized risks?**
... regarding asset integrity and reliability, compliance, personal safety and environmental performance
- **What are our operational controls?**
... that manage the risk to achieving our objectives for asset integrity and EHS and deliver compliance with internal and external requirements
- **How do we monitor our controls?**
... through audits and performance metrics to assess if controls are working as intended
- **How does management review and improve operations management processes?**
... through periodic management reviews and continuous improvement action plans

... using this framework, which is based on the Plan, Do, Check, Act cycle



So “We Compared Standards, Assessed Gaps & Picked Up Where “IMP” Left Off”....



Formalizing a standard for Leadership and Management Commitment

Advancing the requirements for Risk Management

Adding new requirement for safety assurance – focusing on the “check and act” in Plan, Do Check, Act model (PDCA)

- independent audit and evaluation of performance;
- review and closure; reporting and feedback system

Raising priority on Stakeholder Engagement to help reduce risk

Strengthening requirements for Management Review

Essential Safety Management System Elements

Leadership and
Management
Commitment

Stakeholder
Engagement

Risk Management

Operational
Controls

Incident
Investigation,
Evaluation, and
Lessons Learned

Safety Assurance

Management
Review and
Continuous
Improvement

Emergency
Preparedness and
Response

Competence,
Awareness, and
Training

Documentation
and Record
Keeping

The Technical Starting Point: Will Differ Among Members

- PAS 55 – Asset management system
- Environmental management systems
- Nuclear operations - INPO
- OSHA Process safety management – operated gas plants and chemical plants – [CCPS]
- NEB Management System and Protection System
- All members can build from:
 - Elements developed and matured during the first 12 years of Integrity Management
 - AGA Safety Culture Statement
 - AGA Lessons Learned Case Studies

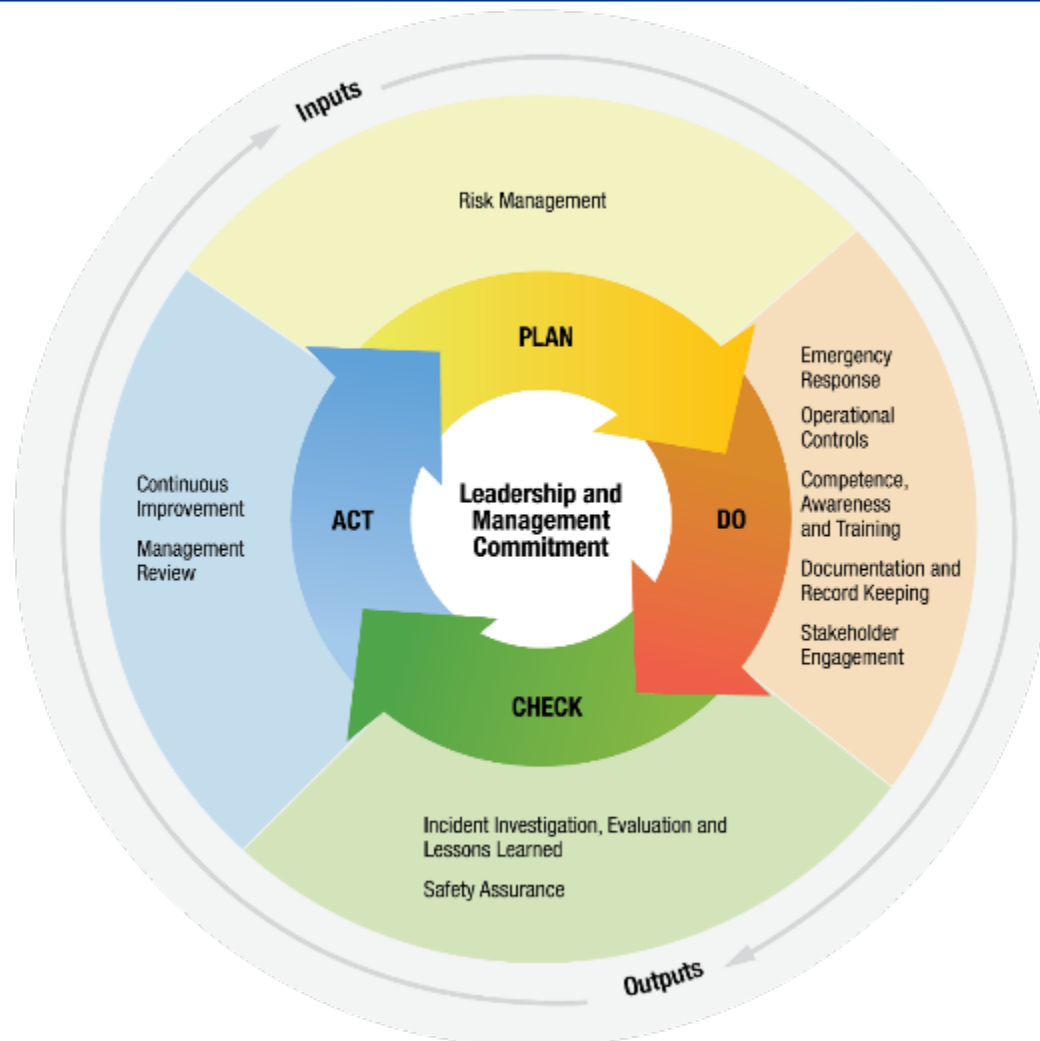
Model for a High Level Self Assessment

Building Upon Existing Programs

Element	TIMP	DIMP Public Awareness	Trans O&M	Dist O&M	Safety Environmental	Engineering	Corp
Leadership and Management Commitment							
Stakeholder Engagement							
Risk Management							
Operations Controls							
Incident Investigation Lessons Learned							
Safety Assurance							
Management Reviews and Continuous Improvement							
Emergency Preparedness and Response							
Competence, Awareness and Training							
Documentation and Recordkeeping							
Safety Culture							

Element	TIMP Public Awareness	DIMP Public Awareness	Trans O&M	Dist O&M	Safety Environmental	Engineering	Corp
Leadership and Management Commitment							-Delegation of Authority -Values
Stakeholder Engagement	-Public Awareness		-Damage Prevention	-Damage Prevention			
Risk Management	-Risk Assessment	-Risk Assessment					
Operations Controls	-Procedures -MOC -QA/QC	-Procedures	-Procedures	-Procedures	-EH&E Procedures	-Engineering Procedures -QA/QC	-QA/QC
Incident Investigation Lessons Learned			-Incident Investigations	-Incident Investigations	-Incident Investigations		
Safety Assurance							-Auditing -Employee Feedback
Management Reviews and Continuous Improvement							-Management Reviews
Emergency Preparedness and Response			-Emergency Preparedness and Response Plan	-Emergency Preparedness and Response Plan			-Emergency Preparedness and Response Plan
Competence, Awareness and Training			-Operator Qualification	-Operator Qualification			-Training and Development
Documentation and Recordkeeping	-Documents and Records	-Documents and Records	-Documents and Records	-Documents and Records	-Documents and Records	-Documents and Records	-Documents and Records
Safety Culture					-Safety Policies		-Safety Policies

Plan, Do, Check, Act - The Core of the Standard...



Continuous Improvement is the Goal

Starting the Journey

What other management systems do you have? *And how will they be connected?*

For example:

- IMP
- Environmental
- Quality Management

What is the scope of your system?

Just pipeline operations?
Design and construction?
Other assets?

How integrated do you want to be?

Each business unit with its own MS?
One central system?

What resources do you need to support?

Implementing a Management System does not mean starting over; rather, *build on existing programs* to move to the next level of safety performance

The Key: Have a Plan in Mind: “Building a House...”



Needs, wants,
future...



Moving in
and
Adapting

(Remodel
to a New
Standard)



Future Use;
Design,
Construction
Standards,
Code, Budget...



Interior
Design and
Material for
Standard
Function

Foundational
Principles



Solid Frame
built to the
Standard and
the Foundation



Exterior Material
designed for the
Business/Environmental
Standard



Challenges

- Top management commitment and participation
- **Spans broad swaths across organization**
- Organizational commitment
- **Letting the Perfect Be The Enemy of Good**
- Process owner accountability
- Process documentation
- Staffing – “Not My Day Job!”
- **Pace – Not too fast and not too slow – organizational capacity**

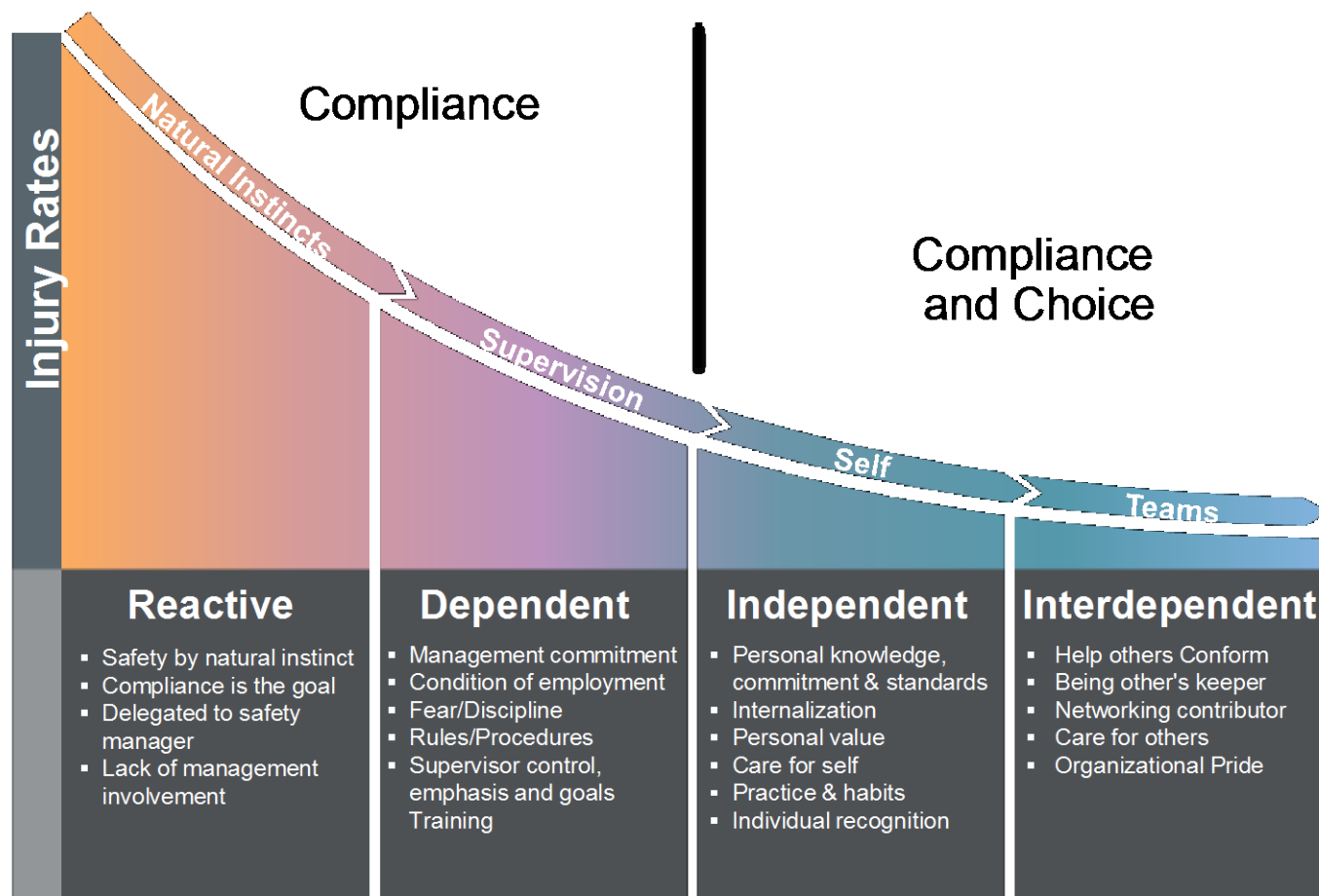


Critical Success Factors



PSMS Maturity

The DuPont Bradley Curve



DuPont Sustainable Solutions

Example Maturity Models

Based on NEB Audit Protocol

MANAGEMENT SYSTEM ELEMENTS	Implemented	Systematic	Integrated	Comprehensive	Documented	Measured
1 Policy and Commitment						
1.1. Policy and Commitment Statements						
2 Planning						
2.1. Hazard Identification, Risk Assessment and Control						
2.2. Legal Requirements						
2.3. Goals, Targets and Objectives						
3 Implementation						
3.1. Organizational Structure, Roles and Responsibilities						
3.2. Management of Change						
3.3. Training, Competence and Evaluation						
3.4. Communication						
3.5. Documentation and Document Control						
3.6. Operational Control – Normal Operations						
3.7. Operational Control – Upset or Abnormal Operating Conditions						
4 Checking and Corrective Action						
4.1. Inspection, Measurement and Monitoring						
4.2. Corrective and Preventive Actions						
4.3. Records Management						
4.4. Internal Audit						
5 Management Review						
5.1. Management Review						

Small Not-for-Profit

Management Element	Developed	Deployed	Evolving
Finance			
People			
Program			
Technology			
Compliance			

Based on INGAA work

Management System Elements	Documented	Implemented	Measured	Systematic	Comprehensive	Integrated
I MANAGEMENT COMMITMENT						
a. Management commitment (e.g., policy, objectives, communication, advocacy)						
b. Management review						
c. Stakeholder engagement						
d. Responsibility, accountability and authority (applied to each process)						
II RISK MANAGEMENT/ INTEGRITY MANAGEMENT						
a. Work force planning, training, development and qualification						
b. Engineering and construction						
c. Incident investigation and lessons learned						
d. Emergency preparedness and response						
e. Learning culture and continuous improvement						
III. SAFETY ASSURANCE						
a. Management of change						
b. Quality assurance and quality control						
c. Performance measurement						
d. Documentation and records management						

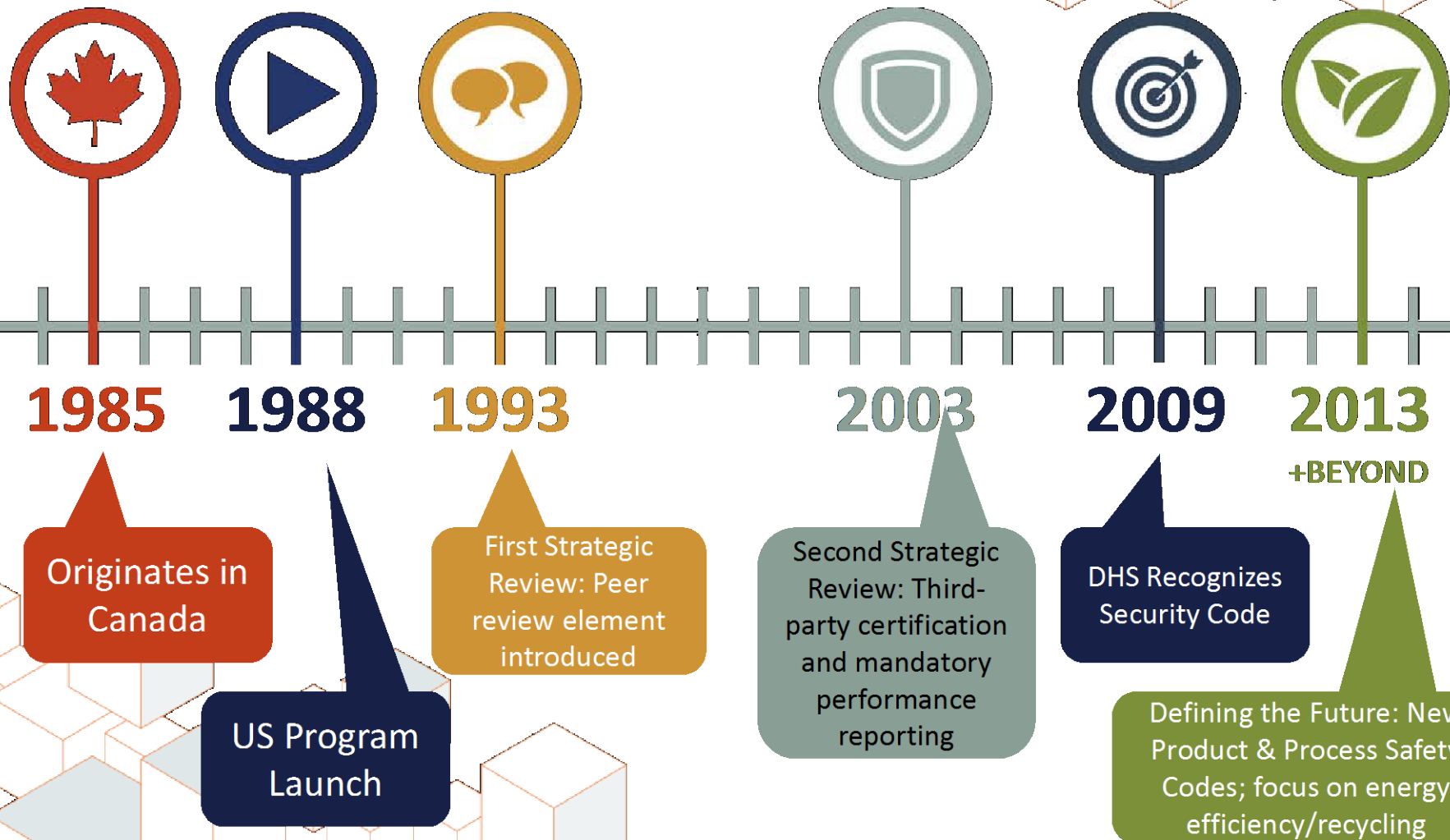
Using Maturity Models to Assess Current State and Plan Areas of Focus

MANAGEMENT SYSTEM ELEMENTS	Implemented	Systematic	Integrated	Comprehensive	Documented	Measured
1 Policy and Commitment						
1.1. Policy and Commitment Statements						
2 Planning						
2.1. Hazard Identification, Risk Assessment and Control						
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4.2. Corrective and Preventive Actions						
4.3. Records Management						
4.4. Internal Audit						
5 Management Review						
5.1. Management Review						

Illustrative Example

A View of the Journey

Responsible Care[®]: 25 Years of Continuous Improvement



Source: American Chemistry Council

The Key....A Strong Safety Culture...

...What is the role of a strong safety culture in a successful Safety Management System?.....

Safety Culture – It's the Glue

“The collective set of attitudes, values, norms, beliefs and practices that the operator’s employees and contractor personnel share with respect to risk and safety”

“It is the glue”



Strong Safety Culture and Management Systems Are Both Needed

One Company's View on How Culture and Systems Fit Together

Organizational Culture

- Ensure safety
- Execute work in compliance
- Improve reliability
- Manage risk
- Measure and continuously improve performance

Core Values

Behavioral Norms

- Execute work with diligence and integrity
- Actively participate
- Develop talent
- Raise our hand
- Respect one another
- Seek input
- Become an owner

Systems Thinking for Operational Excellence

Operating Outcomes

Safe, reliable, and compliant operations programs that increase the long-term value of the company.

Management Systems

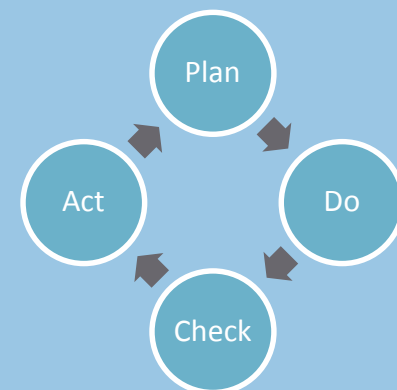
- Integrates all dimensions of operations performance to achieve objectives

- Explicit structure and processes
- Fostered by leaders

Systematic Management

Operating Norms

- Accepted processes
- Learned through training, mentoring, practice
- Monitored by leaders



SMS Elements Produce Safety

SMS Elements Result in Culture



- Leadership
- Stakeholder Engagement
- Risk Management
- Incident Investigation
- Safety Assurance
- Emergency Preparedness
- Vision, confidence, resolve
- Comprehensive commitment/partnership
- Employees connect to “Guardian” duty
- Insistence on learning
- Rigor, culture of trust
- Situational Awareness, resiliency & realism

Evaluation of Safety Culture

- Perception
 - Questionnaires (surveys)
 - Interviews
 - Focus groups
- Effectiveness of Safety Culture Foundation
 - Observations
 - Audits

Indicators of a Positive Safety Culture **P·PIC**

- Embraces safety (**personnel, public and asset**) as core value,
- **Ensures everyone understands** the operator's safety goals,
- Fosters systematic consideration of risk, including **what can go wrong**,
- **Allocates adequate resources** to PSMS execution,
- **Encourages** employee and contractors **engagement and ownership**,
- Promotes a **questioning and learning environment**,
- **Continuous vigilance and mindfulness**
- **Fosters mutual trust at all levels**, with open and honest communication,
- **Reinforces positive behaviors** and why they are important,
- Encourages two-way conversations about **learning and applying lessons learned**.
- **Encourages non-punitive reporting and ensures timely response to issues**.

Leadership and Management Commitment

Leadership and Management Commitment

Leadership

- Top Management
- Management
- Recognized Leaders

Use of Contractors

- Communicating requirements of the PSMS
- Defining RAA for managing the outsourced activities
- Incorporating work and findings
- Training and orientation on safety policies
- Evaluating contractor safety performance
- Communicating risks at the work sites, and
- Communicating the MOC procedure.

Management Review and Continuous Improvement

The pipeline operator's PSMS and safety performance shall be reviewed at least annually by top management to evaluate whether the performance goals and objectives have been met.

Management Review and Continuous Improvement



- Management review **ensures the connection with top management**
- **Inputs are work products** of PSMS elements
- **Continuous improvement** is an important theme
- **At least annually**
- Yields a **summary of effectiveness and opportunities to continuously improve**
- The RP explicitly **addresses the need to evaluate technology improvements**

Performance Measurement

Performance Measures

Integrity Program Example



Tier 1 Measures

- # program related incidents/ injuries/ fatalities

Tier 2 Measures

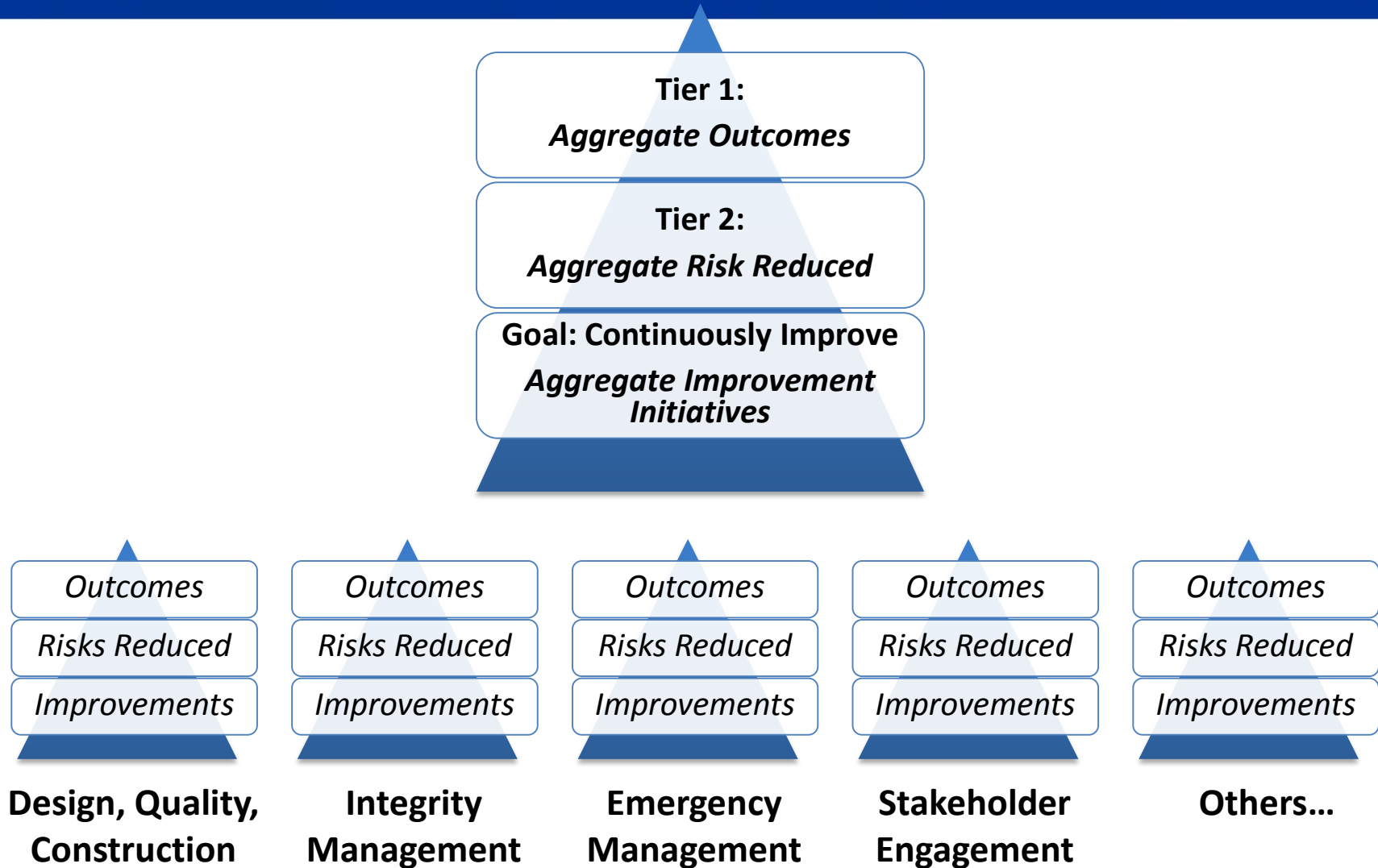
- # near term repairs identified
- # conditions being monitored

Tier 3 Measures

- # program/ process improvement initiatives planned
- # program/ process improvement initiatives completed

Performance Measures

Safety Management System Example



Incident Investigation, Evaluation and Lessons Learned

- Investigation of Incidents
- Follow-up and Communication of Lessons Learned
- Learning From Past Incidents
 - Generating new lessons learned from past events
 - Evaluating the effectiveness of organizational learning from the known lessons learned
- Learning From External Events

In Summary: Outcomes Sought in API 1173

- Enlisting employees top to bottom in a commitment to safety
- Driving leaders to engage stakeholders inside and out
- Clarifying responsibilities for safety initiatives and oversight
- Driving leaders to proactively address safety issues early
- Routinizing and formalizing safety procedures
- Advancing investigating, learning from failures as an opportunity to improve, not punish, and tracking correction
- Ensuring a safe environment for employees to report safety concerns and widening communications up, down and sideways
- Systemizing regular evaluation of operations to identify and address risks, and measure risk reduction

Questions?

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Make The Tie to “Organizational Values”

- **Values serve as a foundation – but how do you use them?**

- **An ideal starting point for driving leadership and management commitment**
 - Re-commit to the company’s values
 - Re-align the leadership team and communicate across the organization
 - Use as a vehicle for extending commitment across the business
 - Present the values in the context of the desired culture and performance

- **Use as a basis for defining how we work together...**
 - Consistent set of behaviors demonstrating and reinforcing commitment
 - Tool for hiring employees, setting expectations, measuring and rewarding
 - Platform for engaging and aligning third party team members

... basis for defining and advancing Safety Culture

Expectations and Behaviors

- **Top Management**

- Connect values to culture to behavior and process
- Empower and create environment of trust
- Demonstrate commitment, integrate into business rhythm
- Create leaders and extend across the organization

- **Management**

- Clearly understand the vision and foster across the organization
- Wire into every aspect of the work (hiring, performance management, goals)
- Recognize role as a leader in driving culture
- Create leaders and extend across the organization

- **Employees**

- Empowerment – Employees must own and advance
- Recognize leadership is not a title, it's a set of behaviors that advance the culture
- Establish systems and processes to facilitate alignment