



# WHAT IS A PIPELINE SMS?

ELEMENTS OF A PIPELINE SAFETY MANAGEMENT SYSTEM

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The image features a blurred background of an industrial facility, possibly a refinery or chemical plant, with tall distillation columns and piping. The entire scene is overlaid with a semi-transparent teal color. At the bottom, there is a white text box containing the text "MANAGING THE SAFETY OF A COMPLEX PROCESS." in a bold, sans-serif font. A thin teal horizontal line is positioned directly below the text box.

**MANAGING THE SAFETY OF A COMPLEX PROCESS.**

# TABLE OF CONTENTS

- Introduction: Why A Pipeline SMS? ..... 5
- Pipeline SMS Framework ..... 9
  - Flexibility and Scalability ..... 11
  - Plan-Do-Check-Act Cycle ..... 13
  - Pipeline SMS Elements
    - Leadership and Management Commitment ..... 15
    - Stakeholder Engagement ..... 17
    - Risk Management..... 19
    - Operational Controls..... 21
    - Incident Investigation, Evaluation, and Lessons Learned ..... 23
    - Safety Assurance..... 25
    - Management Review and Continuous Improvement ..... 27
    - Emergency Preparedness and Response ..... 29
    - Competence, Awareness and Training ..... 31
    - Documentation and Record Keeping ..... 33
    - Safety Culture ..... 34



**CORE VALUES: SAFETY, LEARNING FROM EXPERIENCE, & IMPROVEMENT**

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# INTRODUCTION

**What is a Safety Management System (SMS)?** A safety management system is a systematic approach to managing safety, including the structures, policies and procedures an organization uses to direct and control its activities. The American Petroleum Institute (API) has developed API Recommended Practice (RP) 1173 Pipeline Safety Management Systems to provide an SMS tailored for pipeline operators.

API RP 1173 provides pipeline operators with a framework to review an existing Pipeline SMS or develop and implement a new Pipeline SMS. There are ten essential elements to the Pipeline SMS included in API RP 1173. This booklet will describe those ten elements and their importance to improved pipeline safety performance. A Pipeline SMS, as do all SMS, relies upon the **Plan-Do-Check-Act (PDCA)** cycle to apply to all its essential elements. This booklet will describe the PDCA cycle and its relation to industry-wide pipeline core values of safety, learning from experience, and continuous improvement. This booklet will also describe how each of the essential elements in API RP 1173 will improve safety culture.



**INDUSTRY-WIDE GOAL OF ZERO INCIDENTS.**

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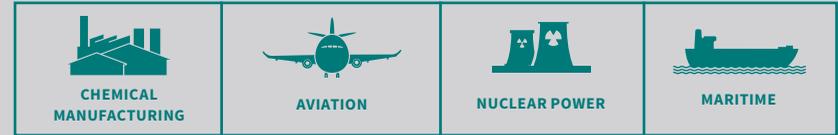
# WHY A PIPELINE SMS?

The U.S. National Transportation Safety Board (NTSB) recommended that both liquid and gas pipeline operators develop a pipeline-specific SMS. Collaborating with the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), NTSB, state regulators and expert members of the public, API RP 1173 Pipeline Safety Management Systems was developed to help pipeline operators gain the safety benefits of an SMS.

## Benefits

Pipeline SMS will help pipeline operators improve their pipeline safety performance. Managing the safety of complex processes involved in the design, installation, operation, maintenance, and integrity of a pipeline, requires coordinated actions to address multiple, dynamic activities and circumstances. Pursuing the industry-wide goal of zero incidents requires comprehensive and systematic effort.

The following industries are successfully using SMS to improve their safety performance:



## Goals

The goal of a Pipeline SMS is to enhance risk management and enable continuous improvement in pipeline safety performance. A Pipeline SMS is intended to provide operators the tools they need to continuously and comprehensively track and improve their safety performance.

## Pipeline SMS users will:

- Gain better information on the hazards that can impact the safety of their pipeline systems
- Identify how to minimize those hazards to pipeline safety
- Measure their progress toward improved pipeline safety



**HELPING OPERATORS STRUCTURE THEIR OWN PROGRAMS.**

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## PIPELINE SMS FRAMEWORK

API RP 1173 provides a framework to pipeline operators developing and maintaining a Pipeline SMS. The elements of API RP 1173 are intended for use by operators to structure their own system(s) and programs. The framework builds upon an operator's existing practices by drawing upon industry experiences, lessons learned, and existing standards.

Particular emphasis is placed on proactive thinking of what can go wrong in a systematic manner, clarifying safety responsibilities throughout the pipeline operator's organization (including contractor support), the important role of top management and leadership at all levels, encouraging the non-punitive reporting of and response to safety concerns, and providing safety assurance by regularly evaluating operations to identify and address risks. These factors plus a strong safety culture work together to make safety programs and processes more effective, comprehensive, and integrated.



**OPERATORS OF ALL SIZES BENEFIT.**

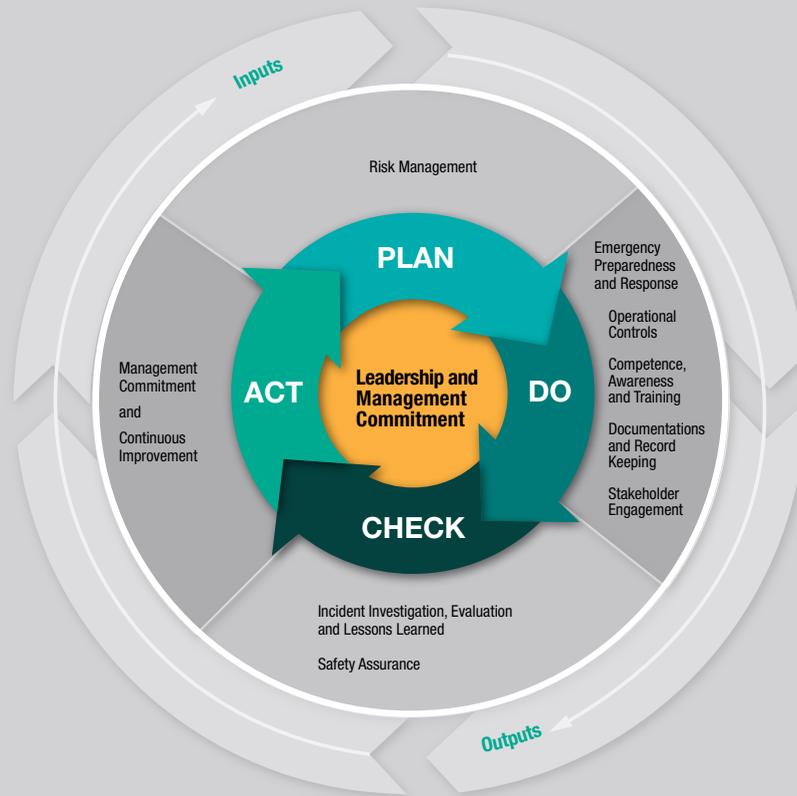
## FLEXIBILITY AND SCALABILITY

Application of API RP 1173 is intended to be flexible to account for existing management processes within a company. Some operators may have more or fewer than 10 elements in their management processes organized in different combinations. In cases where an operator is already operating under its own comprehensive Pipeline SMS, this framework serves as a basis of comparison and review for potential gaps between the industry recommended practice and the operator's system.

Other operators may have some number of individually established pipeline safety processes, but no comprehensive Pipeline SMS. For those operators, adoption of the framework will be a starting point to build a Pipeline SMS. To claim conformance with the recommended practice, an operator's Pipeline SMS needs to reflect the requirements of all 10 elements of the RP 1173.

The framework of API RP 1173 is also intended to be scalable for pipeline operators of varying size and scope. The number of employees at a pipeline operator can range from a handful to thousands.

The ten essential elements of API RP 1173 apply to organizations of any size and complexity. Specific application of those elements to the operations and processes of a given operator will reflect the scale of that operator. The elements and principles underlying them are broadly applicable, and strongly recommended for pipeline operators of all sizes. The level of detail in each pipeline operator's pipeline SMS should be appropriate for the size of their operations and risk to the public and environment.



## PLAN - DO - CHECK - ACT

## PLAN-DO-CHECK-ACT CYCLE

The PDCA cycle is central to every safety management system and is a vital tool for continuous improvement of pipeline safety performance.

The cycle reflects creating strategies and plans, executing those strategies and plans, checking the outcomes and effectiveness of those actions, and using those results to adjust the next generation of strategies and plans.

**PLAN** – The ‘Plan’ step includes the establishment of goals and objectives, including output expectations and setting key performance indicators.

**DO** – The ‘Do’ step is the execution of planned activities.

**CHECK** – The ‘Check’ step is a review of performance indicators and activity results compared with planned objectives.

**ACT** – The ‘Act’ step develops and implements improvements identified through the ‘Check’ step. Activities in the ‘Act’ step may feed into establishment of a new round of goals, objectives and performance indicators in the ‘Plan’ step and a new round of the PDCA cycle.



**LEADERSHIP FROM TOP MANAGEMENT IS VITAL TO SUCCESS.**

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# LEADERSHIP AND MANAGEMENT COMMITMENT

Leadership from management, including top management, is essential for the success of a Pipeline SMS and improved safety performance.

**Top management shall** – Demonstrate its commitment to the development, implementation, continuous improvement, and evaluation of the maturity of the Pipeline SMS.

Establish goals and measurable objectives for its Pipeline SMS with clear accountability for implementation and continuous improvement.

Make communication, risk reduction, and continuous improvement routine for the organization and the processes they oversee, including resource allocation, providing for employee incentives and processes for assessment, audit, evaluation, review, and operational decision-making.

**Management, supported by top management, shall** – Ensure there is a clear connection between the objectives of the Pipeline SMS and day-to-day work activities.

Ensure company plans, processes and procedures are in place for the integration and sharing of safety-related data, results and findings, all of which are vital for safe performance and continuous improvement.

Identify personnel responsible for Pipeline SMS elements, establish performance measures for each element, and conduct regular reviews of progress toward Pipeline SMS and safety performance measures.

**Employees** – Employees have a leadership role in their company's Pipeline SMS and improving pipeline safety performance. Employees are needed to identify and reveal risks to management, identify potential safety improvements to operations and take action to prevent or minimize incidents.

A large pipe, likely for water or wastewater, is covered in a green tarpaulin. The pipe is situated in a lush green forest with many trees and undergrowth. The tarpaulin has a small tear or hole on its surface. The overall scene is bright and green, suggesting a natural or environmental setting.

**EXTERNAL & INTERNAL STAKEHOLDER ENGAGEMENT IS PARAMOUNT.**

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## STAKEHOLDER ENGAGEMENT

Communication with internal and external stakeholders is needed to raise safety concerns, identify risks and generate additional recommendations for safety improvements.

**Internal Engagement** – A pipeline operator is expected to establish processes to communicate its Pipeline SMS goals, objectives, policies and procedures. A process for employees and contractor personnel to raise concerns to management and make recommendations for pipeline safety improvement is also necessary.

**External Engagement** – Two-way communication with external stakeholders is similarly important for providing information about the operator and its system, engaging regulatory bodies and gathering and responding to feedback from external stakeholders including representatives of the public including those along our rights of way. At a high level, communication should address the company's safety operations, risk management efforts and safety performance measures.



**EVALUATE AND REDUCE THREATS.**

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## RISK MANAGEMENT

Risk management is used to understand, evaluate and reduce threats to a pipeline operator. Preventing and mitigating risks reduces the likelihood and consequences of an incident.

A pipeline operator is expected to develop, maintain and execute procedures for performing risk management. They shall identify threats to pipeline safety and assess those threats, their likelihood and severity, including increased risk from multiple threats interacting.

Risk assessments shall be reviewed at least annually and updated as warranted using data and information gained from operations and maintenance, inspection and testing, integrity-related work and incident investigations. Additional relevant risk management information includes data on the pipeline, its materials, construction, operation history, safety record and environment in which it operates. Risk management results, including selected risk mitigation methods and their intended effectiveness, shall be documented and reviewed with top management at least annually.



**MINIMIZE HUMAN ERROR.**

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# OPERATIONAL CONTROLS

Operating and maintenance procedures help minimize human error and promote consistently safe employee actions. Quality control procedures ensure adherence to established standards for pipeline materials, equipment and construction.

**Operating Procedures** – A pipeline operator shall maintain written procedures that address safe work practices when conducting operations, maintenance and emergency response activities. Where an employee believes that following a procedure will cause an unsafe condition, he/she shall have responsibility and authority to stop work.

**System Controls** – A pipeline operator shall ensure pipeline systems are designed, manufactured, fabricated, installed, operated, maintained, inspected and tested subject to applicable requirements, recommendations and standards.

**Management of Change** – Procedures for management of change (MOC) are needed to identify the potential risks associated with a given change and the approvals and required activities prior to the introduction of such changes. Changes in equipment, technology, organization or procedures all require MOC procedures.



**LEARNING FROM EXPERIENCE IS VITAL.**

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# INCIDENT INVESTIGATION, EVALUATION, AND LESSONS LEARNED

Learning from experience is a core value within the pipeline industry and a vital component of improving safety performance through a Pipeline SMS.

**Investigation of Incidents** – Pipeline operators shall maintain a procedure for investigating incidents and near-misses that led, or could have led, to an incident with serious consequences. Investigation of an incident includes: identifying causes and contributing factors, producing findings and lessons learned, recommendations for pipeline safety performance improvement, including changes to processes and procedures identified through the investigation, and recommendations for specific transferring of lessons learned to risk assessment and operating controls.

**Follow-up on Lessons Learned** – In addition to investigating incidents, pipeline operators shall maintain a procedure for determining and documenting the response to each finding and lesson learned from investigations. Actions to implement risk assessment and pipeline safety performance improvement recommendations shall be tracked and completed. The process must also include how to evaluate external events and incorporate recommendations from peers, regulators and other sources. Specific examples of external sources include NTSB recommendations and PHMSA advisory bulletins.



**EVALUATING PROGRESS TO IMPROVE SAFETY PERFORMANCE.**

# SAFETY ASSURANCE

An operator shall demonstrate both the proper application of its Pipeline SMS to its practices and how these practices improve risk management and pipeline safety performance.

**Audits** – A pipeline operator shall perform audits of its conformity with API RP 1173 and the implementation of its Pipeline SMS. It is critical that operators know that each of the Pipeline SMS elements are in place and effective. The pipeline operator identifies the audit scope, frequency and methods, with each of the elements of the Pipeline SMS audited at least once every three years. An audit may be performed by external professionals or internal personnel not involved in the work of the Pipeline SMS or the operations being audited.

**Evaluations** – A pipeline operator shall perform evaluations to assess the effectiveness of its risk management and progress made toward improving pipeline safety performance. Evaluations will include stakeholder engagement results, risk analysis, MOC, incident investigations, findings, recommendations, and lessons learned

(both internal and external), audits, management reviews, as well as emergency response, personnel and documentation issues. Pipeline operators will also need to assess their safety culture.

**Audit & Evaluation Review and Closure** – Management within a pipeline operator shall define response times for addressing audit and evaluation findings. The management responsible for audited or evaluated area shall ensure findings are addressed within the defined response times. Audit results and corrective action status shall be reported in management reviews.

**Performance Measurement** – A pipeline operator shall establish and maintain a procedure to identify key performance indicators (KPIs) to measure the effectiveness of risk management, and the effectiveness and adequacy of the PSMS. KPIs to be monitored include, at a minimum, fatalities, injuries, and property damage resulting from planned as well as unplanned releases. Other measures will consist of leading KPIs, i.e. those measures demonstrating risk reduction and process KPIs, i.e. those measures that demonstrate completion or improvement of elements and their supporting processes and procedures. A pipeline operator shall define the frequency with which to review the KPIs and trend performances to identify adverse trends and take corrective action.



**ENSURING AN EFFECTIVE PIPELINE SMS.**

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# MANAGEMENT REVIEW AND CONTINUOUS IMPROVEMENT

Management review of its Pipeline SMS and safety performance results is necessary to provide management awareness of progress in achieving performance goals and objectives. Top management shall, at least annually, review and approve the output of management reviews.

**Input Requirements** – Under the direction of top management, management shall conduct a review of the effectiveness of the Pipeline SMS guided by products of the Pipeline SMS including:

- Goals and objectives of the Pipeline SMS
- Status of corrective actions from past management reviews
- Performance measures and KPIs
- Results of the risk management review
- Results and recommendations of incident investigations, evaluations and lessons learned

- Results of internal and external audits and evaluations
- Changes that could affect the Pipeline SMS including legal, regulatory or other requirements, stakeholder feedback, and evaluation of safety culture

**Output Requirements** – The output from the management review shall include a summary assessment of the effectiveness of the Pipeline SMS and any resulting improvements in risk management and pipeline safety performance. The assessment shall include any decisions and actions, changes to required resources, and improvements to the processes and procedures required to meet requirements of the Pipeline SMS.

**Continuous Improvement** – To facilitate continuous improvement, Management shall continuously evaluate the effectiveness of the Pipeline SMS by using pipeline safety audit and assessment results, data analysis, and management review to identify corrective and preventative measures. Action on these corrective and preventative measures will foster improvements in pipeline safety performance.



**EFFECTIVE EMERGENCY RESPONSE MINIMIZES IMPACTS.**

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## EMERGENCY PREPAREDNESS AND RESPONSE

Operators shall maintain procedures for preparing for and effectively responding to a pipeline incident.

Emergency preparedness and response procedures need to include a determination of emergency types, internal and external notification requirements, identification of response resources and interfaces, recognition of the Unified Command/Incident Command Structure, communication planning, training and drill programs, program and plan review process and improvement processes.



**BUILDING EMPLOYEE COMPETENCY BUILDS CONFIDENCE.**

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## COMPETENCE, AWARENESS AND TRAINING

A pipeline operator shall assure that personnel have an appropriate level of competence in terms of education, training, knowledge and experience. Where contractors are used, the pipeline operator shall assure that they also have the requisite competence. The pipeline operator shall provide training and updates as necessary so that personnel and contractors are aware of the following:

- applicable elements of the Pipeline SMS that affect their job requirements
- newly emerging or changing risks, problems in execution of the Pipeline SMS, and opportunities to improve processes and procedures
- potential consequences of failure to follow processes or procedures



**APPROPRIATE DOCUMENT CONTROL ENSURES SUCCESS.**

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## DOCUMENTATION AND RECORD KEEPING

A pipeline operator shall identify, distribute and control documents and records required to fulfill the elements of the Pipeline SMS. Procedures created shall specify responsibilities for document approval and re-approval, and shall identify the controls needed to assure that the documents required by the Pipeline SMS, including revisions, translations, and updates comply with the below:

- reviewed and approved for adequacy prior to issue and use
- identify changes and revision status
- remain legible and readily identifiable
- readily available and accessible to workers performing an activity

# SAFETY CULTURE

Implementing Pipeline SMS elements strengthens an organization's safety culture. Establishing safety as a core value, and more importantly demonstrating actions which reflect safety as a core value, strengthens the organization's safety culture. The Pipeline SMS with each of its discrete elements supports safety culture, and that culture feeds back in to the management system in a continuous process. The result is a strengthened safety culture and an increasingly mature safety performance improvement focus within the organization.

**Leadership and Management Commitment's Contribution to Safety Culture** – All management fosters a positive safety culture when it demonstrates its commitment to safety improvement not just through communication, but also through actions and decision making. Employees will understand safety is valued if they see management in the constant practice of acting on recommendations, assessments and evaluations, improving plans and processes, and allocating resources to address safety findings and improvements.

## **Stakeholder Engagement Contribution to Safety Culture**

– An environment encouraging two-way communication of safety issues strengthens safety culture, as does more importantly the communication of how lessons learned were applied by the operator.

## **Risk Management Contribution to Safety Culture**

– The practice of risk management builds employee confidence in management's commitment to safety. Appropriate allocation of resources to evaluate and manage risk visibly demonstrates that commitment and improves safety culture.

## **Contribution of Operational Controls to Safety Culture**

– Operational controls enhance safety culture is enhanced from the intentional commitment to safety operational controls. Employees having confidence that they can stop work and identify problems for management resolution are reflective of a positive safety culture.

### **Contribution of Incident Investigation, Evaluation and Lessons**

**Learned to Safety Culture** – Safety culture is enhanced through the discovering, communicating, and acting upon safety lessons. These activities also contribute to an environment where personnel are comfortable about identifying and speaking up about risk and safety concerns, knowing that their actions will result in safety improvements.

**Safety Assurance Contribution to Safety Culture** – The quality of audits, evaluations and the seriousness of response to their findings conveys the priority of safety.

### **Management Review and Continuous Improvement**

**Contribution to Safety Culture** – Safety culture is enhanced with management attention to safety improvement and actions correcting and preventing safety issues.

### **Emergency Preparedness and Response Contribution to Safety Culture**

– Preparation for potential incidents leads to a realistic sense of vulnerability and further describes the consequences of a safety performance failure, both of which enhance safety culture.

### **Documentation and Record Keeping Contribution to Safety Culture**

– Documentation and record keeping leads to greater certainty that safety is valued and the pipeline operator is taking action to improve safety.

### **Competence, Awareness and Training Contribution to Safety Culture**

– Investment in training and building employee competency builds confidence that management prioritizes safety for their employees and the public.

# Pipeline SMS

PLAN • DO • CHECK • ACT

GROUP



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