01

WHY A PIPELINE SMS WILL BENEFIT **PIPELINE SAFETY**

Introduction to Pipeline SMS Implementation

Pipeline SMS


Managing the safety
of a complex process.

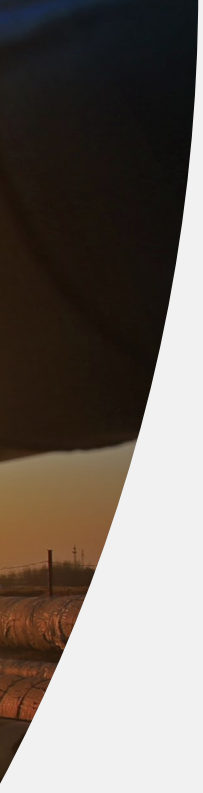


TABLE OF CONTENTS

“SMS has generated wide support in the aviation community as an effective approach that can deliver real safety and financial benefits.”

– U.S. Federal Aviation Administration (FAA)

INTRODUCTION

Our modern industrial world is complex. A large number of interrelated activities are needed to develop a resource, manufacture a product, or operate a facility or machine. A single refinery can use 5,000 miles of pipe with just as many valves, gauges and pumps. A modern 747 jumbo jet requires over 100 miles of wiring to operate its systems.

Managing the safety of a complex process requires coordinated actions to address multiple, dynamic activities and circumstances. Simple management oversight focused on a single activity or process may not be enough to account for all the variables contributing to safe operations. Many industrial sectors, including chemical manufacturing, refining, nuclear power and aviation are using safety management systems (SMS) to improve their safety performance. SMS help industrial operators continuously and comprehensively track and improve their safety performance. SMS users gain better information on the safety of their systems, learn where they can improve safety and measure progress toward improved safety performance.

In 2015, the pipeline industry completed development of a framework for Pipeline Safety Management Systems (Pipeline SMS) designed specifically for pipeline operators. Created at the recommendation of the U.S. National Transportation Safety Board (NTSB), this **API Recommended Practice 1173 (RP)** was developed in collaboration with the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), NTSB, state regulators and expert members of the public to help pipeline operators gain the safety benefits of an SMS. The RP's framework is flexible enough to help those new to SMS, as well those with sophisticated, existing systems. It is scalable to allow operators large and small to benefit. In all cases, a Pipeline SMS similar to the RP framework will improve the safety culture essential to achieving maximum safety performance.

Strong management is essential to safe operations.

A PIPELINE SAFETY MANAGEMENT SYSTEM WILL HELP IMPROVE PIPELINE SAFETY

Operating a pipeline safely requires staying on top of many different factors. Pipelines can run hundreds of miles across multiple states, in several different climates, in different topographies and in urban and rural areas. Pipelines are commonly operated with multiple pumping facilities, hundreds of valves, and dozens of storage tanks using sophisticated control and monitoring technologies. Pipeline organizations include engineers, managers, operators, workers and support personnel. Each one of these factors provides a potential risk to pipeline safety but also a potential opportunity to make operations safer.

Pipeline SMS will help pipeline operators 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, will identify how to minimize those hazards to pipeline safety and measure their progress toward improved pipeline safety performance.

Learning from experience is a core value of the pipeline industry. Every near miss or past incident offers an opportunity to not only correct a problem, but also help all pipeline operators avoid those mistakes or potential incident causes. Pipeline SMS brings a consistent, formal structure to safety management ensuring operators incorporate learnings from industry trends, incident findings and recommendations, regulatory notices and advisories, internal audits and evaluations, or changes in operations.

Strong management is essential to safe operations. Implementation of the Pipeline SMS will help managers and employees improve the safety culture. Pipeline SMS emphasizes and brings forward the management activities that impact pipeline safety. Management sets measurable pipeline safety goals and tracks progress toward those goals. Management will regularly identify and incorporate safety improvements into the Pipeline SMS and link those improvements and goals to everyday operation activities.

Strong management leads to resilient safety culture. Fervent managers, willing to lead, know they cannot do it all by themselves. They actively seek the input of others involved in the numerous areas of pipeline operation. Together, stakeholders and decision makers discuss and take the necessary steps to improve, involving all stakeholders in pipeline safety.

Many industries are using SMS.

SAFETY MANAGEMENT SYSTEMS HAVE HELPED OTHER INDUSTRIES

Many industries are using SMS to improve their safety performance.

Chemical Manufacturing - Responsible Care® is the management system standard developed by the Chemical Industry Association of Canada, promoted by the American Chemistry Council and has been adopted by most chemical manufacturers and transport organizations around the world. Chemical process safety improvements have allowed participants to increase productivity, reduce production costs, reduce maintenance costs and reduce insurance costs.[5]

Maritime – The ISM Code is the safety management system developed by the International Maritime Organization and is a requirement for the shipping industry. Shipping companies have seen efficiency improvements, improved safety performance, improved compliance, improved evaluation of hazardous tasks resulting in fewer near misses/incidents and improved safety culture.[6]

Aviation – SMS have been a standard throughout the aviation industry worldwide and is evolving through continuous improvement. For the U.S. Federal Aviation Administration, SMS provides a structured decision-making process for safety risk management issues, means of demonstrating safety management capability before system failures occur, increases confidence in risk controls though structured safety assurance processes, knowledge sharing between regulator and operator and a safety promotion framework to support a sound safety culture. The Joint Planning and Development Office (JPDO), International Civil Aviation Organization (ICAO), Civil Aviation Authorities (CAA) and service providers recognized SMS as the next step in the evolution of safety in aviation.[7]

Nuclear - According to the International Atomic Energy Agency, there is increasing recognition of the importance of a strong safety culture to ensure that high standards of safety are achieved by both organizations and individuals. Organizations having a strong safety culture will have an effective SMS with the support and ownership of all staff. However, the SMS has a broader role in that it provides a framework by means of which the organization ensures good safety performance throughout the planning, control and supervision of safety related activities. The SMS, in turn, provides a means by which the organization promotes and supports a strong safety culture.[8]

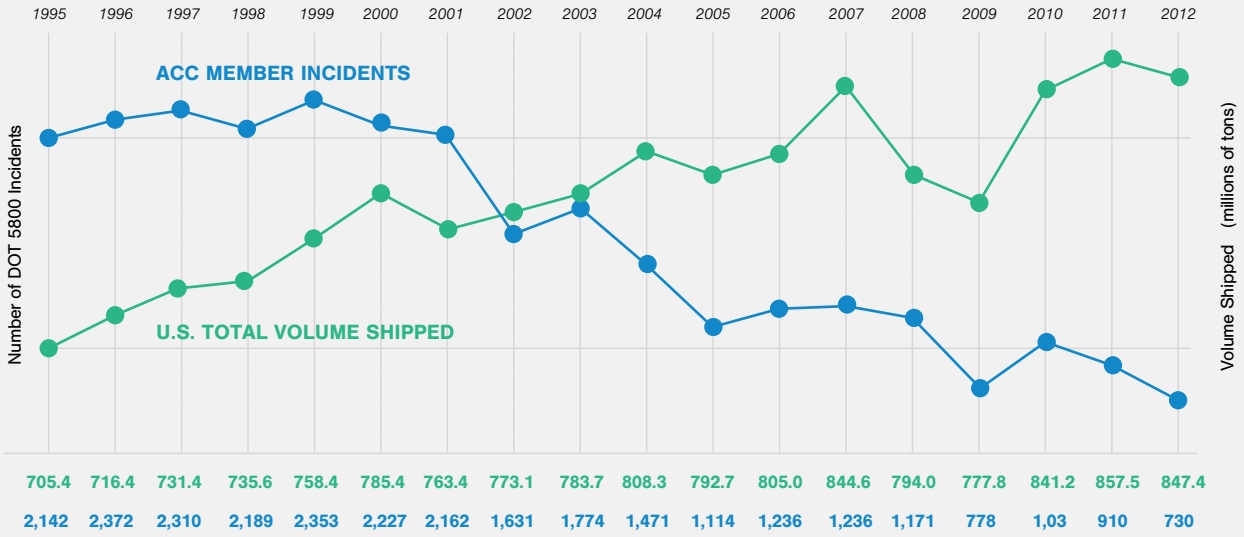
“SMS has generated wide support in the aviation community as an effective approach that can deliver real safety and financial benefits.”[3]

– U.S. Federal Aviation Administration (FAA)

RESPONSIBLE CARE

Responsible Care® is the management system standard developed by the Chemical Industry Association of Canada, promoted by the American Chemistry Council and has been adopted by chemical manufacturers and transport organizations around the world.

Reportable Distribution Incidents Data for Responsible Care Companies and Volume of Chemicals shipped by the Business of Chemistry[4]



Safe workplaces are more efficient, more productive, and the substantial costs of injuries and occupational illnesses should be significantly reduced by implementing a Safety Management System.[9]

Rochester Institute of Technology (RIT)

5% increase in productivity.
3% reduction in production costs.
5% reduction in maintenance costs.
1% reduction in capital budget.
20% reduction in insurance costs.[10]

American Institute for Chemical Engineers (AICHE)

A Safety Management System enables you to better comply with regulations and other requirements, will help your business minimize injuries and occupational illnesses (or both), and it will help keep your business costs down.[13]

Rochester Institute of Technology (RIT)

According to the Liberty Mutual Research Institute for Safety, for every $1 invested in safety, there is between a $3 and $6 savings.[11]

National Safety Council

For such an investment, the benefits include: (a) more opportunities to achieve business objectives such as improved process availability, fewer unwanted incidents, and increased market share; (b) greater changes to motivate, educate, and retain employees; (c) greater likelihood to manage the public image and be viewed as a good neighbor, noble employer, a reliable supplier, and a strong competitor; and (d) more opportunities to gain a competitive advantage and lead the industry.[12]

American National Standards Institute (ANSI)

BENEFITS BEYOND SAFETY

Implementation of a SMS can also generate a variety of other benefits. Here are some of those benefits as described by those industries:

- **Reduced administrative costs** (per Center for Chemical Process Safety, Canada National Energy Board).
- **Reduced insurance and liability costs** (per Center for Chemical Process Safety, American Society of Safety Engineers, US OSHA).
- **Improved employee morale, loyalty, retention and worker health protection** (per Center for Chemical Process Safety).
- **Enhanced company image for employee, to the community, clients, customers, and stakeholders** (per Center for Chemical Process Safety, National Safety Council).
- **Reduced costs from injuries and illnesses** (per Liberty Mutual Research Institute for Safety, National Safety Council).
- **Improved relations with OSHA and other regulatory agencies** (per Rochester Institute of Technology).
- **Similar businesses/activities can learn how they can do better** (per Center for Chemical Process Safety).
- **Competitive advantage due to reduced costs and better use of capital and resources** (per Center for Chemical Process Safety, National Safety Council).
- **Improved level of compliance to regulations and conformance to company requirements** (per Rochester Institute of Technology).
- **Informed decision-making** (per Center for Chemical Process Safety).
- **Employee involvement** (per Center for Chemical Process Safety).

PLAN – DO - CHECK - ACT

HOW A SAFETY MANAGEMENT SYSTEM IMPROVES PERFORMANCE

Continuous improvement, along with a goal of zero incidents and learning from experience, are core pipeline industry values. The goal of zero incidents cannot be approached without continuous improvement over time. Learning from experience does not occur reliably over time without an established mechanism. A vital tool for continuous improvement is the **Plan-Do-Check-Act (PDCA**) cycle.

The PDCA cycle is central to every SMS including the Pipeline SMS. A cycle encourages creating strategies and plans, executing those strategies and plans in line with guidelines, checking those actions for quality and outcome, and using those results to adjust the next generation of plans. This cycle is iterative and is maintained to achieve continuous improvement.

Plan – The 'Plan' step is the establishment of the objectives and processes necessary to deliver results in accordance with the organization's policies and the expected goals. Planning includes establishing output expectations and setting key performance indicators for the SMS elements.

Do – The 'Do' step is the portion of the cycle where the activities are done. The activities are done within the organization's policies, processes and procedures identified in the 'Plan' step.

Check – The 'Check' step is when the system is inspected for conformance to the standard, conformance to the organization's procedures and for the maturity of the safety management system and the safety culture. 'Check' also monitors key performance indicators established in the 'Plan' step.

Act –The 'Act' step is where management collects the data generated in the 'Check' step and evaluates actual performance against the objectives set in the 'Plan' step. This is the input for the management review. Management review connects 'Act' to the next 'Plan' step. The management review output includes the adjusted objectives and goals, as needed, for the next cycle.

> *Safety culture may be described as the values and practices that management and personnel share to ensure that risks are always minimized and mitigated to the greatest degree possible. In other words, with an effective safety culture, safety is always the highest priority. The company and its staff will always, and automatically, think about the implications for safety of every action, rather than simply following safety procedures because they have been imposed from outside. In an effective safety culture, everyone employed by the company... truly believes in and understands the purpose of established procedures, and will think about safety, and the means of improving it, as a matter of course* [15]
>
> International Chamber for Shipping

> *Safety culture involves moving beyond compliance with external rules to a culture of self regulation, with every individual - from the top to the bottom - feeling responsible for actions taken to improve safety, rather than seeing them as being imposed from the outside.*[16]
>
> API RP 1173

SAFETY MANAGEMENT SYSTEMS ENHANCE SAFETY CULTURE

Implementing a Pipeline SMS strengthens an organizations safety culture. Establishing safety as a core value strengthens the organizations belief in its importance, acting as a unifying force to improve safety performance.

Management leading and demonstrating their responsibilities as outlined in the Pipeline SMS is essential to improved safety and a positive safety culture. Employees will understand safety is valued if they see management in the constant practice of acting on assessments and evaluations, improving plans and processes, allocating resources, and connecting critical safety functions and improvement findings.

The practice of risk management, and particularly the thoroughness of the process and the responsiveness to employee-identified risks builds employee understanding and confidence in management's commitment to safety. Operational controls lead to greater certainty that the pipeline operator and system are performing as expected. A greater sense of certainty about all aspects of operations contributes to the perception that there is an intentional commitment to safety.

Robust incident investigation, evaluations and lessons learned reinforce the commitment to safety performance improvement. The timeliness of sharing information and tracking corrections demonstrates the sense that safety is a top priority and complacency about risk is unacceptable.

Companies who already have in place an ISO system, like ISO 9001 or 14001, will find that their new Safety Management System will easily incorporate the safety elements and activities into these management systems. These systems can merge together into one management system for the company, as there are very similar elements in all three systems, and your business can build on what is already in place.[15]

PIPELINE SAFETY MANAGEMENT SYSTEM INTENDED FOR OPERATORS OF ALL SIZES AND EXPERIENCES

API Recommended Practice 1173 provides a framework for applying Pipeline SMS to pipeline operators of all sizes and levels of sophistication. The RP developers understand pipeline operators can range from very small businesses to global corporations. Similarly, some pipeline operators have employed comprehensive management systems for many years. Some pipeline operators have management systems that are not integrated or comprehensive across the organization. Some pipeline operators are just now starting to use an SMS with this RP. This Pipeline SMS is intended to be both flexible and scalable for all of those operator sizes and experiences.

Flexibility – Pipeline operators are intended to have the flexibility to apply this Pipeline SMS framework as appropriate to their specific circumstances. In cases where a pipeline operator is already operating under its own comprehensive SMS, this framework serves as a basis of comparison and review between the pipeline industry's recommended practice and the operator's system. Other operators may have some number of individually established safety systems but no comprehensive SMS. For them, this RP provides a mean to integrate and add to those efforts resulting in a more comprehensive SMS. Still other operators have no formal safety systems. For those operators, adoption of the recommended practice would be a starting point to build a Pipeline SMS, including the possibility of learning from more advanced operators.

Scalability – The Pipeline SMS is also intended to be scalable for pipeline operators of varying size and scope. A local gas distributor or municipal operator may have only a few employees. An interstate transmission pipeline company may have entire divisions of subject matter experts. The ten essential elements comprising the framework apply to organizations of any size and sophistication and does not require exactly the same process at all organizations. The SMS elements and the principles underlying it are broadly applicable to energy pipeline operators of all sizes. Specific application of those elements to the operations and processes of a given operator will reflect the scale of that operator. The level of detail in each pipeline operator's Pipeline SMS should be appropriate for the size of their operations and the risk to the public and the environment.


Each employee is expected to be a champion.

THE ROLE OF A LEADER IN THE PIPELINE SAFETY MANAGEMENT SYSTEM

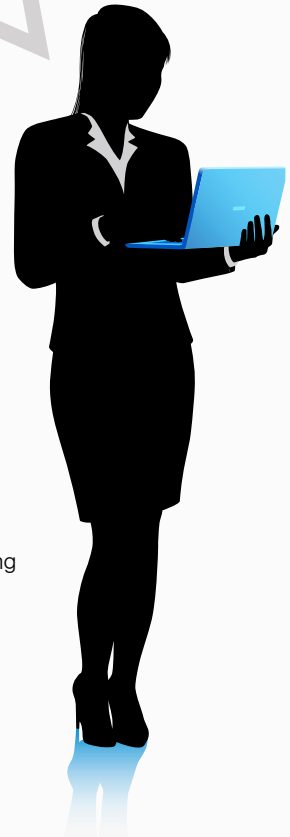
The Pipeline SMS recommended practice divides the employees of a pipeline operator into three categories but identifies them all as leaders.

Employees – Any person who works for the pipeline operator is referred to as an employee. Each employee is expected to be a champion for the SMS and lead by example. All employees are encouraged to identify and communicate risks to the company so they can be appropriately evaluated. Employees also play a vital role in identifying improvement opportunities to the Pipeline SMS.

Management – Management is any person or group of people 'who direct and control all or part of a facility, location, department or other function' per the RP's definition. Management leads by taking responsibility and accountability for the organization and its performance towards compliance to requirements. Management leads by facilitating others in their roles within the organization by removing obstacles, prioritizing objectives and providing resources. Management may also be top management in some organizations.

Top Management – The RP defines top management as 'A person or group of people, as defined by the operator, who direct and control the organization at the highest level'. Top management leads by first setting the objectives and goals of the organization and then helping the organization be successful in obtaining their individual contributions to the organization's goals and objectives. Top management is first in promoting mutual trust and engaging the organization in communication.

FAQS



Q. What is a Pipeline SMS?

A. Pipeline SMS is a management tool that will help a pipeline operator comprehensively manage all the many aspects of pipeline safety.

Q. Why is Pipeline SMS needed?

A. Managing a pipeline, like other manufacturing and industrial activities, requires multiple different factors contributing to safe operations. A comprehensive safety management tool like a Pipeline SMS is needed to maximize safety performance.

FREQUENTLY ASKED QUESTIONS

Q. How will a Pipeline SMS help improve pipeline safety?

A. Pipeline SMS provide pipeline operators a structured, comprehensive, regular method of assessing the risks of their operation, knowing their safety performance, learning from experience, and continuously improving pipeline safety.

Q. Who else has benefited from similar efforts?

A. The aviation, nuclear, chemical manufacturing and refining industries have all seen increased safety performance from SMS.

Q. Who encouraged pipeline operators to develop a Pipeline SMS?

A. Pipeline operators are following the recommendation of the U.S. National Transportation Safety Board (NTSB) and the encouragement of the U.S. Pipeline & Hazardous Materials Safety Administration, state regulators and safety experts.

Q. How was API RP 1173 and its framework developed?

A. In response to an NTSB recommendation, a joint group of pipeline safety stakeholders including gas and liquids pipeline operators, federal and state regulators, safety experts and public representatives developed the API RP 1173 and its framework.

Q. Will I need to change my management or organizational structure?

A. The framework of API RP 1173 is intended to apply flexibly to different organizational structures and management approaches. Similarly, the Pipeline SMS is meant to help operators large and small. Pipeline SMS activities are functional, regardless of organization size or structure. The ability to make plans, undertake activities, review results and make improvements is the core requirement of the Pipeline SMS. An operator may choose to make changes in their organizational structure or management, but the Pipeline SMS makes no judgment or recommendation on whether operators should make such changes.

Q. How do I get started on implementation?

A. Implementation of the Recommended Practice and setting up your own Pipeline SMS is best done in a step-by-step manner until the continuous improvement cycle is working. Industry-wide materials are available to assist operators with Pipeline SMS implementation. As an introduction, implementation steps will include:

- Assessing your current management systems
- Familiarizing yourself with the Recommended Practice
- Conducting a gap analysis
- Developing an action plan to address the identified gaps

Q. Why should I choose API RP 1173 instead of a different safety management system standard?

A. The American Petroleum Institute and Association of Oil Pipe Lines recommend pipeline operators use API RP 1173 to help improve pipeline safety performance. The framework of API RP 1173 is designed to be flexible with existing or other SMS. Operators are encouraged to perform a gap analysis with API RP1173 and adopt any benefits which supplement other management systems adopted by the company.

Q. How long does it take to implement API RP 1173?

A. Implementation of a Pipeline SMS is expected to be an ongoing process. No matter an organization's level of experience with SMS, growth and maturity of the systems is always possible. The important measures are committing to implement a Pipeline SMS and then over time improving the Pipeline SMS and safety performance.

Q. Will someone be looking over my shoulder as the Recommended Practice is being implemented?

A. Actually, no. Management will be part of the implementation. Because this is a recommended practice and not a regulatory requirement or a requirement to be part of an industry group, there is not an external audit/assessment component. However, getting an external perspective at the right time may be beneficial to your organization and its implementation efforts.

Q. Where can I go to get help?

A. API/AOPL has prepared some tools for implementation. There are a variety of courses and seminars available for the various SMS. Other industry trade organizations have informational material available on safety management in their industry sector. Some regulatory agencies include information about SMS on their web sites for their regulated industries. Many companies are very willing to take some time to talk about their experiences with safety management.

Q. I already have a management system in place for environmental management (ISO 14001). Will I have to develop a second management system?

A. No. API RP 1173 was developed after looking at many different management system standards. There are many common management activities between those standards. If you already have a working management system under a different standard, implementation of API RP 1173 will be a much easier activity. There will be differences between management system standards and those differences can be harmonized into your existing management system.

helping the organization be successful.

– U.S. Federal Aviation Administration (FAA)

EXAMPLES OF SAFETY MANAGEMENT SYSTEMS

SMS have been developed and implemented by various industry sectors. These SMS are, more often than not, now part of the regulations for that industry.

SMS	SMS Implementing Organization	Applies to...
International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code)	International Maritime Organization (IMO) US Coast Guard	International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code)
Global Aviation Safety Plan (GASP)	International Civil Aviation Organization (ICAO) US Federal Aviation Administration	Global Aviation Safety Plan (GASP)
Fundamental Safety Principles	International Atomic Energy Agency (IAEA)	Fundamental Safety Principles
Voluntary Protection Programs (VPP)	US Occupational Safety and Health Administration	Voluntary Protection Programs (VPP)
Process Safety Management	US Occupational Safety and Health Administration	Process Safety Management
Risk Management Program	US Environmental Protection Agency	Risk Management Program
Safety and Environmental Management System	US Bureau of Safety and Environmental Enforcement	Safety and Environmental Management System
Safety Management System Guidelines Public Passenger Transportation Systems	American Public Transport Association US Federal Transit Administration	Safety Management System Guidelines Public Passenger Transportation Systems
Risk Reduction Program	US Federal Railroad Administration	Risk Reduction Program
Seveso	Agencies of various European Union member countries	Seveso
Responsible Care®	American Chemistry Council (ACC)	Responsible Care®
Occupational Health and Safety Assessment Series (OHSAS) 18001	British Standards Institution (BSI) Group	Occupational Health and Safety Assessment Series (OHSAS) 18001

DISCLAIMER

This booklet provides a basic overview of SMS. API is not affiliated with or endorsed by the organizations (ACC, IMO, ICAO, ISO, OSHA) identified in this booklet and information from these organization are used only as examples of SMS.

ACC is the American Chemistry Council, Inc.
IMO is the International Maritime Organization.
ICAO is the International Civil Aviation Organization.
ISO is the International Organization for Standardization.
OSHA is the US Occupational Safety and Health Administration.
APTA is the American Public Transport Association.
Responsible Care is a registered service mark of the American Chemistry Council, Inc.

REFERENCES

[1] http://responsiblecare.americanchemistry.com/Performance-Results/Safety

[2] Jeff Wiese, U.S. Pipeline and Hazardous Materials Safety Administration, https://www.youtube.com/watch?v=PVksrQ-xGIQ&list=PL4wHDsuQ-uKnwUyBHgkzRQfGB_DSKD9J

[3] U.S. Federal Aviation Administration, https://www.faa.gov/about/initiatives/sms/explained/basis/#benefits

[4] Presentation The Business Case for Process Safety, Center for Chemical Process Safety.

[5] Id.

[6] Assessment of the impact and effectiveness of implementation of the ISM Code, Maritime Safety Committee, IMO, December 21, 2005.

[7] U.S. Federal Aviation Administration, 2015

[8] Management of Operational Safety In Nuclear Power Plants, International Atomic Energy Agency, 1999

[9] Rochester Institute of Technology, Risks and Benefits Of A Safety Management System. https://www.rit.edu/academicaffairs/outreach/ training/Intro/RisksBenefits.pdf

[10] The Business Case for Process Safety, slide 14. http://www.aiche.org/ccps/about/business-case

[11] National Safety Council reprint of 'The ROI of Safety, The bottom line on safety; It starts at the top', BuisinessWeek, September 12, 2005

[12] Stavrianidis, Paris, Map Your Way to Strategic Investments in Process Safety, CEP, July 2001

[13] Rochester Institute of Technology, Risks and Benefits Of A Safety Management System. https://www.rit.edu/academicaffairs/outreach/ training/Intro/RisksBenefits.pdf

[14] Pipeline Safety Management Systems, API Recommended Practice 1173, 2015

[15] Implementing an Effective Safety Culture, Basic Advice for Shipping Companies and Seafarers, International Chamber of Shipping, 2013.

[16] Pipeline Safety Management Systems, API Recommended Practice 1173, 2015

[17] Rochester Institute of Technology, Risks and Benefits Of A Safety Management System. https://www.rit.edu/academicaffairs/outreach/ training/Intro/RisksBenefits.pdf

Pipeline SMS

API | AOPL Association of Oil Pipe Lines

www.pipeline101.org

www.youtube.com/user/energy

@Energy.Tomorrow

@Energy.Tomorrow

www.PipelineSMS.org

www.aopl.org

@oilpipelines

@AssociationofOilPipeLines

API Communications | 2020-353-SMS | 11.20 | PDF