



2021 PIPELINE CONSTRUCTION SAFETY MANAGEMENT SYSTEMS

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CONTENTS

Introduction	1
Implementing and Maintaining a Safety Culture	2
Critical Elements of Pipeline Construction SMS	3
1 Leadership and Management Commitment	3
a. Top Management	
b. Management	
c. Employees/Workers	
2 Stakeholder Engagement	4
a. Internal Focus	
b. External Focus	
3 Risk Management	4
a. Procedures	
4 Verification of Qualifications	4
a. Verification	
b. Welding Construction	
c. Plastic Pipe Joining Qualification	
5 Project Initiation	5
a. Workers	
b. Crew Leader/Foreman	
c. Supervisor/Project Managers	
d. Inspector	
6 Compliance with Specifications & Procedures	6
7 Review of Design Drawings and As-Built Documentation	6
8 Traceability	6
9 Damage Prevention	7
10 Pipe Lowering/Installation	7
11 Safe Work Practices and Monitoring Performance	7
12 Pipe Handling and Protection of Materials	8
13 Directional Drilling	8
14 Safety Assurance	8
15 Incident Investigation, Evaluation, and Lessons Learned	9
16 Management Review and Continuous Improvement	9
17 Emergency Preparedness and Response	9
18 Competence, Awareness and Training	10
19 Documentation and Recordkeeping	10
The “Plan – Do – Check – Act” Cycle	11
Conclusion	12

INTRODUCTION

According to the National Safety Council, a Safety Management System (SMS) is “a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.” Pipeline SMS facilitates the comprehensive and holistic management of all aspects of safety related to pipeline construction. While pipeline contractors maintain effective and elaborate safety *programs*, this document is intended to serve as a template for contractors to move towards a systematic approach to safety management, or to improve their existing SMS programs.

In 2015, the American Petroleum Institute (API) issued the First Edition of API Recommended Practice (RP) 1173 *Pipeline Safety Management Systems*, which established a pipeline SMS framework for operators of natural gas and hazardous liquid pipelines jurisdictional to the U.S. Department of Transportation’s (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA).

SMS has become a main focus at PHMSA, and while the agency has said it does not intend to require this approach to safety as part of the federal pipeline safety regulations, SMS is strongly supported and encouraged by PHMSA and other DOT regulatory agencies. As API and other associations representing pipeline operators work to promote and implement SMS in throughout the industry, leading associations representing contractors who build, maintain and repair natural gas and oil pipelines are collaborating to develop a template to guide interested contractors looking to implement or improve current SMS maintained in their operations.

While the concepts included in this document are consistent with those described in API RP 1173, adjustments have been made to ensure SMS elements in the contractor template are appropriate for construction contractors. Therefore, the concepts presented in API RP 1177, *Recommended Practice for Steel Pipeline Construction Quality Management Systems* (Nov. 1, 2017) are also referenced in this paper. Finally, this document includes certain recommendations presented in the American Gas Association’s White Paper, entitled *Contractor Construction Quality Management Guide* (Nov. 22, 2016). On May 20, 2019, AGA “The AGA board recommends that members commit to implement API Recommended Practice (RP) 1173, PSMS, within three (3) years.”



IMPLEMENTING AND MAINTAINING A SAFETY CULTURE

Whether maintained by a small or large contractor, SMS requires a “safety culture” throughout the organization. A safety culture is the collective set of values, attitudes, and beliefs that employees share with respect to risk and safety. According to API RP 1173, a “positive safety culture is one where employees and contractor personnel collaborate; have positive attitudes towards compliance (meeting and exceeding minimum standards); feel responsible for public safety, for each other’s safety, and for the health of the business; and fundamentally believe in non-punitive reporting.”

While contractors should feel empowered through the encouragement of collaboration and likeminded attitudes about compliance and non-punitive reporting, they should also work to instill these concepts within their own company. Consistent with API RP 1173, contractors with an effective safety culture:

- ▶ Embrace safety of employees and the public, the equipment used to build the infrastructure, and the pipeline system itself;
- ▶ Assure employees at all levels understand the company’s safety goals;
- ▶ Maintain systematic consideration of risk to workers and the public;
- ▶ Enable, encourage, and provide resources to make changes when necessary;
- ▶ Encourage employee engagement by establishing mutual trust at all levels and providing for “two-way” conversations about safety issues; and
- ▶ Provide for non-punitive reporting and timely response to reported issues.

SMS requires intentional and systematic actions as well as methods to address multiple and continual circumstances. Management commitment from top-to-bottom is a must, and obligations include:

- ▶ Demonstrating management commitment;
- ▶ Structuring safety risk-management decisions;
- ▶ Increasing confidence in risk prevention and mitigation;
- ▶ Providing for sharing knowledge and lessons learned; and
- ▶ Promoting a safety-oriented culture.

Finally, contractors should complete an annual safety culture assessment and share results, trends and actions plans with their operator customers.



CRITICAL ELEMENTS OF PIPELINE CONSTRUCTION SMS

While the critical elements described in this template are generally consistent with those included in API RP 1173 and API RP 1177, they are intended for use by contractors working on gas distribution and gas and oil transmission pipeline construction projects.

1. LEADERSHIP AND MANAGEMENT COMMITMENT

The contractor's top management establishes goals and measurable objectives for the company's SMS and provides for processes and procedures defined to support its elements. This includes ensuring data, results and findings being shared across other relevant processes, teams and/or employees.



Top Management

- ▶ Appoint an Executive for overall SMS responsibility;
- ▶ Establish measurable goals and objectives;
- ▶ Accountable for continuous improvement;
- ▶ Provide regular reviews of company's safety performance and communications about safety issues;
- ▶ Assess "safety culture" of the company;
- ▶ Communicate commitment to SMS to internal and external stakeholders.

Management

- ▶ Ensure effective processes, procedures and training related to day-to-day work are provided to meet SMS objectives;
- ▶ Assess, evaluate and adjust as needed to meet SMS objectives;
- ▶ Identify personnel responsible for SMS elements and oversight;
- ▶ Establish performance measures that effectively address each SMS element;
- ▶ Foster and ensure the goal of continuous improvement remains.

Employees/Workers

- ▶ Follow management's process and procedures to meet objectives;
- ▶ Identify areas of needed improvement and report them to management;
- ▶ Reveal threats/risks discovered on the job;
- ▶ Stop work if/when safety of employees, public and pipeline system is compromised.



2. STAKEHOLDER ENGAGEMENT

The contractor maintains a plan for communicating and engaging with internal and external stakeholders about safety issues related to pipeline construction. These plans and processes identify personnel responsible for receiving and sharing information.

Internal Focus: Ensure employee engagement and learning of policies, goals, objectives and procedures related to their work driven by the SMS.

External Focus: Move from safety awareness to continuous dialogue to reduce risk and enhance safety performance while striving for continuous improvement. This may require establishing a two- way communication venue with external stakeholders. Best practices should be shared across operating companies.

3. RISK MANAGEMENT

The pipeline contractor is generally aware of the operator's system as provided by the pipeline operator and is able to recognize potential threats as provided in their contract. Built on this premise, the contractor develops and maintains procedures for effective risk management.

Procedures may include:

- ▶ Ability to collect and analyze data;
- ▶ Risk Identification: "*What Can Go Wrong?*" (including compliance with training requirements, abnormal operating conditions, and other factors);
- ▶ Risk Assessment: Establish process of assessing risks during pipeline construction, including consideration of both likelihood and severity of potential accidents;
- ▶ Risk Prevention and Mitigation: Identify measures to address and reduce or mitigate both likelihood and severity of risks;
- ▶ Perform periodic analyses using data from risk identification, assessment, prevention and mitigation measures;
- ▶ Utilize risk register processes or Corrective Action Programs;
- ▶ Review results of risk management: "*Did We Achieve Our Intended Results?*"

These procedures are developed and maintained as provided in contractual language agreed to by the contractor and the pipeline operator.

4. VERIFICATION OF QUALIFICATIONS

Before or at the initial stages of a pipeline project, the pipeline contractor has a clear definition of required qualifications, and competencies for project personnel and verifies these qualifications, competencies and completion of other relevant training needed to perform the work safely.

Verification includes:

- ▶ An understanding of each worker's required qualifications, including those qualified to perform covered tasks without supervision and those required to perform covered tasks under direct observation by a qualified individual;



- ▶ Ability to re-verify qualifications when personnel changes within a construction crew;
- ▶ Ability to regularly confirm the qualification of workers performing covered tasks, including addressing changes to qualification status in the case of disqualifications, expired qualifications, and attainment of new qualifications.

Welding Qualification

- ▶ Identification of qualification method;
- ▶ Time period since individuals last performed welding process;
- ▶ Time since individual was weld-tested;
- ▶ Ensure that applicable welding procedures are available.

Plastic Pipe Joining Qualification

- ▶ Verification of documentation of fusion qualifications;
- ▶ Time period since individuals last performed fusion or mechanical joining process;
- ▶ Assurance that the individual's work has not resulted in joint failures above specified limits;
- ▶ Verification that fusion equipment is approved for use and in working order.

5. PROJECT INITIATION

Because there are several people involved in a pipeline construction project with multiple roles and responsibilities, discussion of expectations at a pre-construction meeting before the project commences is imperative. Roles and responsibilities to be addressed include:

Workers

- ▶ Responsible for performing work safely in accordance with procedures;
- ▶ Willingness to stop work for any safety or compliance issues without fear of reprisal;
- ▶ Qualification to perform "covered tasks" in accordance with Part 192, Subpart N – Qualification of Pipeline Personnel;
- ▶ Have and use applicable personal protective equipment (PPE).

Crew Leader / Foreman

- ▶ Verification that workers have and use applicable personal protective equipment (PPE);
- ▶ Verification that workers have appropriate OQ for tasks being performed;
- ▶ Responsible for compliance with pipeline safety regulations and ensuring that appropriate materials are used and proper techniques are employed;
- ▶ Ensure that all appropriate and applicable work area protection is in place.

Safety Representative

- ▶ Verification that standard operating practices are in place and appropriate;
- ▶ Verification that site safety plans are in place and are project-specific;
- ▶ Assurance that job-safety analysis and hazard recognition programs are followed;
- ▶ Investigation of pipeline incidents and recommendation of corrective actions;
- ▶ Participation in inspections and audits;
- ▶ Verification that compliance with training requirements is up to date;
- ▶ Facilitation of safety meetings.

Supervisor / Project Managers

- ▶ Ability to verify that all workers are following PPE rules consistent with applicable procedures;
- ▶ Responsible for compliance with pipeline safety regulations and ensuring that appropriate materials are available and proper techniques are employed;

Inspector

- ▶ Responsible to review and verify that work has been completed appropriately;
- ▶ Ability to read, comprehend and interpret project contracts, plans and specifications;
- ▶ Responsible for identifying and documenting non-conformances with plans and specifications;
- ▶ Ability to participate in the change management process by identifying problems and sharing all relevant information with the appropriate parties.

6. COMPLIANCE WITH SPECIFICATIONS & PROCEDURES

The contractor ensures that:

- ▶ The operating manual and construction specifications are available at the job site, including the appropriate weld procedure(s) and plastic pipe joining procedure(s);
- ▶ Workers are familiar with the operator's specifications and procedures;
- ▶ The operator's specifications and procedures are followed;
- ▶ Internal procedures are consistent with operator's specifications and procedures;
- ▶ The development of Inspection and Testing Plans are useful in ensuring compliance by providing a "step-by-step" description of their specifications.
- ▶ Specifications and instructions from component and equipment manufacturers are understood and followed.

7. REVIEW OF DESIGN DRAWINGS AND AS-BUILT DOCUMENTATION

Prior to construction, the contractor:

- ▶ Encourages meetings with the operator to review construction drawings, contract specifications and design criteria to ensure that the contractors have the most current information about the location of pipeline infrastructure;
- ▶ Submits a revised set of as-built drawings at the conclusion of the project. This data can provide important information related to shop drawing changes, design changes, field changes, changes during construction, and any minor or major modification to the pipeline system.

These reviews are conducted as provided in contractual language agreed to by the contractor and the pipeline operator.

8. TRACEABILITY

The contractor follows all material documentation required and provided by the operator. If pre-tested pipe will be installed, the contractor verifies that there is traceability from the pipe to be installed to the documentation of its pressure test.



9. EXCAVATION DAMAGE PREVENTION

The contractor ensures for compliance with all state requirements related to excavation damage prevention, including “811” notification and other safe digging requirements.

10. PIPE LOWERING/INSTALLATION

During pipeline installation, the contractor takes action to ensure for safe lowering and installation of the pipe. Such actions may include:

- ▶ Using appropriate equipment and spacing of equipment for lowering pipe, including heavy equipment for moving the pipe, temporary supports while preparing to lower the pipe and equipment used to lift the pipe;
- ▶ Setting proper permanent supports in place, if necessary, for pipe or appurtenances in a trench;
- ▶ Removing all non-desired objects (rocks, etc.) from trench and spoil that may damage coating during and after pipe installation;
- ▶ Visually inspecting applicable pipeline coating as pipe is lowered into ditch;
- ▶ Visually inspecting the inserted end of a pipe to determine if any damage occurred during pipe insertion;
- ▶ Ensuring all documentation required prior to completion of backfill.

11. SAFE WORK PRACTICES AND MONITORING PERFORMANCE

The pipeline contractor is aware of the site safety plan provided by the operator and encourages regular job briefings on safety issues and/or concerns. The contractor develops and maintains procedures to ensure safe work practices at the jobsite and monitors safety performance. As part of these procedures, the contractor:

- ▶ Is generally familiar with operator’s Operating Procedures as provided to the contractor;
- ▶ Provides resources for reporting damages and the product releases, including contact information for emergency responders through the 911 system and communications with the operator;
- ▶ Ensures for excavation safety and that all appropriate equipment is available;
- ▶ Provides for reporting personnel injuries or property damage;
- ▶ Reviews internal safe work procedures annually for lessons learned and improvement opportunities;
- ▶ Is generally aware of operator’s Management of Change (MOC) procedures and related risks associated with pipeline construction. MOC is an area that requires an extensive amount of work and collaboration between contractors and operating companies;
- ▶ Communicates to all project workers the operator’s documented processes for:
 - Requirements of operator’s SMS applicable to scope of work;
 - Training and orientation on safety policies;
 - Risks/hazards at the work site;
 - MOC procedures.



12. PIPE HANDLING AND PROTECTION OF MATERIALS

The contractor takes action to ensure for safe pipe handling and protection of materials. Examples may include the following practices:

- ▶ Coated Pipe is delivered from trucks, trailers or railcars with padded cradles and fasteners. The contractor ensures that coated pipe is unloaded, supported and racked to prevent damage to the coating. Pipe is inspected at the point of change of custody to confirm there are no defects or damage to pipe coating.
- ▶ Plastic Pipe is handled according to manufacturer recommendations. This may include requirements to store the pipe in smooth, flat locations free of debris that could damage the pipe, and limits on stacking heights for various sizes of pipe.

Pipe is stored in a manner that prevents anything from entering or contaminating the pipe. The contractor adheres to all stacking/storing policies and/or specifications.

Once materials are unloaded at the job site, the contractor takes precautions to prevent damage to the materials prior to use. This may include proper stacking of pipe, use of dunnage or other material to raise pipe above surface level, spacers at end of pipe joints, and prevention of debris, water, animals, and other contaminants from entering materials and pipe.

13. DIRECTIONAL DRILLING

If the pipeline is installed using directional drilling, the contractor ensures that:

- ▶ The bore/HDD entry/exit targets are consistent with construction drawings;
- ▶ Known or identified crossings or obstructions in the drill path have been test-holed and the elevations verified;
- ▶ Proper matting/support for drill rigs and receiving equipment;
- ▶ Drill mud has proper consistency;
- ▶ Lubricating head functions properly for pullback;
- ▶ Pipe coating is appropriate for bore/drill construction as specified by the pipeline operator;
- ▶ Visual inspection of exposed pipe is made to ensure no damage was made during pullback;
- ▶ Continuity test is conducted on tracer wire following pullback;
- ▶ Post-pullback testing is conducted (hydro, inline inspection, etc.)

14. SAFETY ASSURANCE

The contractor evaluates its SMS to determine if expected progress toward effective risk management and improved safety performance is being achieved. Sub-elements may include:

- ▶ Audits/Inspections/Evaluations;
- ▶ Employee Reporting and Feedback;
- ▶ Analysis of Data (Leading and Lagging indicators);
- ▶ Overall Performance Evaluation;
- ▶ Evaluation of Safety Culture;
- ▶ Evaluation of Maturity: determine strengths/weaknesses of efforts to support SMS elements.

15. INCIDENT INVESTIGATION, EVALUATION, AND LESSONS LEARNED



In the event of a pipeline incident, the pipeline contractor develops and maintains a detailed procedure for investigating incidents or near misses that led, or could have led, to a loss of life or serious injury while building or performing construction work on a pipeline system. Investigations may include:

- ▶ Detailed description of events leading up to the incident;
- ▶ Identification of the root cause and any potential contributing factors;
- ▶ Confirmation of compliance with all plans and specifications as provided by the operator;
- ▶ Additional investigation findings and/or lessons learned;
- ▶ Review and evaluation of emergency response procedures.

16. MANAGEMENT REVIEW AND CONTINUOUS IMPROVEMENT



The contractor's SMS and performance related to SMS elements, is reviewed to evaluate the extent to which SMS goals are being met. The review is conducted to ensure:

- ▶ Involvement, accountability and participation by top management;
- ▶ Regular reviews by top management are being completed;
- ▶ Consideration of stakeholder feedback;
- ▶ Evaluation of SMS maturity;
- ▶ Consideration and use of technology to improve SMS.

17. EMERGENCY PREPAREDNESS AND RESPONSE



The pipeline contractor develops and maintains procedures to effectively respond to incidents/accidents occurring during construction work on pipeline infrastructure, consistent with applicable laws and regulations. The emergency preparedness and response plan may include:

- ▶ Identification and recognition of all possible types of emergencies;
- ▶ Internal and external notification/communication requirements;
- ▶ Identification of emergency resources, including those held by first responders;
- ▶ Preparation for events outside of damages to the pipeline system, including:
 - Weather events
 - Threats to security
 - Civil disturbances
- ▶ Provisions to review emergency procedures when new threats are identified or following an incident where emergency protocols were initiated.

18. COMPETENCE, AWARENESS AND TRAINING

The contractor assures that workers whose responsibilities fall within the scope of the SMS have the education, documented training, and experience they need to safely and proficiently perform those job duties.

This training is provided to:

- ▶ Management
- ▶ Employees
- ▶ Subcontractors

Responsibilities and authorities are communicated to all levels of employment in the company. Training is conducted so that all applicable personnel is aware of:

- ▶ Elements of SMS that impact their job requirements;
- ▶ Newly emerging or changing risks associated with pipeline construction;
- ▶ Problems in executing the SMS or opportunities to improve it.

Training and education is conducted with intent to create confidence and a proactive, positive safety culture.

19. DOCUMENTATION AND RECORDKEEPING

Data and communication drive SMS. High quality and current data is used as the basis for decision making and is made readily available to all employees throughout the company. Quality documentation provides the dual-purpose of setting expectations and recording results related to objectives, policy, methods, etc.

The contractor maintains a procedure with regard to the identification, distribution and control of all documents required by the SMS. The procedure may include specifics on responsibilities for document approval and any controls needed to effectively maintain these documents, including:

- ▶ Any changes and status of revision;
- ▶ Assurance documents are clear and legible;
- ▶ Assurance documents are readily available



THE “PLAN-DO-CHECK -ACT” CYCLE

Plan-Do-Check-Act (PDCA) is a cyclical, four-step model to help address the ten elements described above. PDCA requires the determination of steps needing to be taken, periodically reviewed, and make necessary changes if necessary. This ultimately drives the pipeline construction industry towards the goal of zero incidents by ensuring that the many components of safety management are regularly reviewed and continually evolving/improving.

This can be applied to SMS as a whole as well as to each individual element and process within the SMS. PDCA aims to encourage the establishment of strategies and plans, executing those strategies and plans in line with guidelines, checking those actions for quality, and using those results to adjust the next generation of plans. This cycle is maintained to achieve continuous improvement.

PDCA should be useful when beginning a new pipeline project, or when defining a repetitive work process. PDCA supports efforts toward the goal of continuous improvement, when prioritizing threats or causes, and when implementing any changes.



Plan – Establishing the objectives and processes necessary to deliver results in accordance with the organization’s policies and the expected goals;

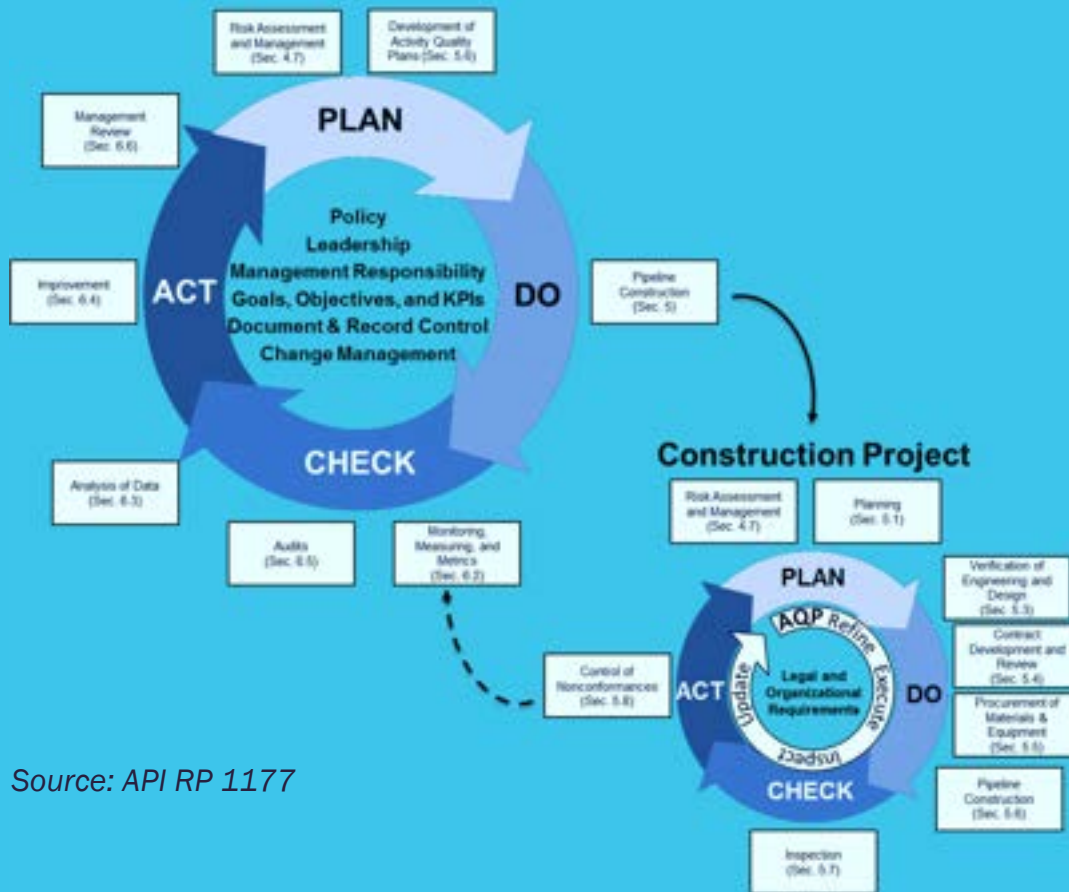
Do: Executing the plan as designed;

Check: Reviewing the results compared with original objectives; and

Act: Taking action to continually improve process performance, including corrective actions

Source: API RP 1173

Quality Management System



Source: API RP 1177

CONCLUSION

Clearly, QMS elements and front and center in contractor operations and are appropriate for inclusion in a contract SMS program. Pipeline contractors build and maintain elaborate safety programs but may not approach safety in a systematic way that provides opportunities for continuous improvement and requires “top to bottom” engagement, including buy-in from senior management. Therefore, while some contractors may have all the elements required for effective SMS, they may need to adjust their operations to ensure they approach safety management in a cyclical fashion.

Contractors working on gas distribution and transmission pipelines instill a culture of safety in their companies because they have to. Pipeline construction is challenging work that presents a range of hazards every day, and prudent contractors do everything they can to perform their work as effectively as possible and make sure all workers go home safely every night.

As contractors adjust their safety programs to better align with the SMS model participants may find value in conducting gap analyses of this template compared with their SMS and/or safety programs. A gap analysis will enable contractors to compare the effectiveness of its current safety programs to the potential effectiveness under the elements provided in this template.

This template was developed to assist contractors interested in developing an SMS program or improving their current program. The pipeline construction industry supports the concepts of SMS and looks forward to collaborating with industry partners to improve SMS approaches in the future.

For more information about pipeline SMS and ways to manage and continuously improve your company’s safety efforts, visit <https://pipelinesms.org/>. While this website is intended for pipeline operators, contractors can use this material to help implement SMS into their safety programs or improve their current SMS approaches.