



Gas Distribution Systems

Safety and Loss Management System Guidelines

Prepared by: Brad Wyatt, Provincial Safety Manager - Gas

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1. Introduction

Gas installations owned or operated by a gas utility, must be designed, installed, operated and maintained in accordance with CSA Z662-15 Oil and Gas Pipeline Systems adopted in Section 30 of the Gas Safety Regulation. CSA Z662-15 Clauses 3.1 and 12.2 require companies operating distribution systems to develop and implement safety and loss management systems for the management of safety and loss control associated with activities throughout the life cycle of a distribution system.

The owner of a gas utility holding an operating permit issued under section 28 subsection (1) (h) of the Gas Safety Regulation, shall develop and implement a safety and loss management system that includes policies, processes and procedures for the operation and maintenance of the facility which:

- Comply with the *Safety Standards Act*, Safety Standards General Regulation, Gas Safety Regulation and CSA Z662,
- Set relevant company policies and performance objectives,
- Proactively identify hazards, evaluate risks, identify and implement risk mitigations measures, and conduct inspection, maintenance, and monitoring activities,
- Establish clear responsibilities and accountabilities,
- Provide sufficient trained and competent persons and other resources to manage the program,
- Administer documentation, records reporting, evaluation and continual improvement.

2. Purpose

The purpose of this manual is to provide gas utilities guidance and basic information to conform to Technical Safety BC's requirements for the development, implementation and documentation of a safety and loss management system which meets the intent and requirements of CSA Z662.

3. Scope

The requirements for safety and loss management systems apply to the following gas equipment within the jurisdiction of the Gas Safety Regulation:

- Distribution mains conveying gas at a pressure of 700 kPa or less between a city gate and a service pipe,
- Service pipes conveying gas at a pressure of 700 kPa or less between a distribution main and to the gas purchaser's service meter,

4. Definitions

Competency - the demonstrated ability to apply training, experience and knowledge in the execution of duties

City gate - the plant or premises where gas received from a pipeline is metered, reduced in pressure and prepared for distribution to individual users of the gas

Distribution main - a pipe used for the transmission and distribution of gas at a pressure of 700 kPa gauge or less for any distance between a city gate and a service pipe

Gas - means any of the following:

- (a) natural gas, manufactured gas, liquefied petroleum gas, digester gas, landfill gas, biogas or a mixture or dilution of any of them;
- (b) hydrogen

Gas company - a person or organization engaged in the sale or distribution of gas

Gas distribution system - a system of distribution mains and service pipes, and the associated control devices and service meters through which gas is conveyed

Gas installation - a facility or system, including fittings, that is owned or operated by a gas company and is used to store, convey, measure or regulate gas

Gas utility - a gas company that owns or operates a gas installation for conveying gas from a city gate or bulk storage facility to the outlet of an individual user's meter set

Service meter - a meter that is installed by or on behalf of a gas company

Service pipe - a pipe installed by or on behalf of a gas company for the transmission of gas from a distribution main to a meter on the land or premises of the purchaser of the gas

5. Owners and Operators Responsibility

Gas utilities installing, operating and maintaining gas distribution systems shall develop and implement a safety and loss management system that conforms to CSA Z662-15 Clause 3. The safety and loss management system shall address the entire life cycle of the distribution system including planning, design, construction, operation, maintenance, and abandonment. The gas utility shall identify and ensure conformance with regulatory and legal requirements, external standards and codes.

6. Management Program Requirements

The safety and loss management system shall incorporate the elements detailed in this section and document the program's policies, processes and procedures in a system management manual. Gas utilities shall explain their intent, capability and applicability for each element outlined in this section. Work may be subcontracted provided controls are clearly defined for maintaining full responsibility for compliance to the *Safety Standards Act*, Gas Safety Regulation and CSA Z662-15 by the gas utility.

Gas utilities in British Columbia, cover a broad range of installations from large natural gas distribution systems supplied through a city gate from a pipeline to small facilities consisting of a single propane tank supplying propane to a few buildings through a distribution system. The extent of a program needed to achieve an effective and practical safety and loss management program will therefore vary considerably and will also depend on the gas equipment that the distribution system serves.

The level of documentation detailed in should be appropriate for the size, scope, complexity, and level of risk for an operation and may range from a few paragraphs for small operations consisting of a small amount of equipment with a low level of risk through to several pages for large, complex operations with numerous types and large numbers of equipment with a much higher level of risk.

The management program manual shall incorporate the following general requirements:

- bound in a manner that allows for easy revisions and updating;
- company logo or letterhead on each page;
- typed name and date after a signature;
- handwriting not permitted; and
- each page must be identified with a page number, total number of pages in the manual and manual revision number and date.

The manual should provide clear and simple instructions on the gas utilities policies and procedures for the management program. The manual may be brief or detailed depending on the program requirements based on the size and complicity of the gas distribution system. The following elements are to be included in the manual:

- a) Title Page - The name and complete address of the gas utility, the number assigned to each “controlled” copy, the name of the person or group a controlled copy is issued and the date of issue shall be included on the title page of the manual.
- b) Contents Page - The manual should contain a page listing the contents of the manual by subject, reference number (if applicable), page number, and revision number of each document.
- c) Scope - The manual shall clearly identify the distribution systems, facilities and gas equipment managed the safety and loss management system. The manual shall specify if it applies to third-party operated assets and have controls to ensure that third parties are fulfilling any contractual agreements with respect to facility operation or maintenance. Any gas distribution systems or equipment covered by other operation or maintenance programs shall be identified. Existing operating or maintenance programs can be referenced by the manual and do not have to be included in the manual provided they are documented. The scope should state the operations, inspection, maintenance, repairs or alterations the manual includes.
- d) Statement of Authority and Responsibility - A dated *Statement of Authority*, signed by an authorized representative of the gas utility shall be included in the manual. Further, the *Statement of Authority* shall include:
 - i) The gas utility’s commitment to provide resources for implementing and continually improving the safety and loss management system;
 - ii) A statement that all regulated work carried out by the gas utility shall meet the requirements of the *Safety Standards Act*, *Safety Standards General Regulation*, *Gas Safety Regulation*, *CSA Z662* and applicable codes or standards;
 - iii) A statement that if there is a disagreement in the implementation of the program, the matter is to be referred for resolution to a designated position in the gas utility with the authority to resolve the matter; and

- iv) The title of the individual who is responsible for the management of the safety and loss management system and that the position has the authority to carry out the responsibility. The individual assigned responsibility and accountability for the safety and loss management system shall ensure that:
- processes and procedures are developed, documented and implemented to support the execution of all the key components of the safety and loss management system.
 - a process is defined to identify and ensure conformance with changes to regulatory requirements and new editions of standards and codes.
 - resources (personnel and technical) are planned and provided to develop, implement, and continually improve the safety and loss management system.
 - executive management receives reports on the performance of the safety and loss management system and any need for improvement.
 - awareness of the requirements of the safety and loss management system are promoted throughout the gas utility.
- e) Manual Control - The manual shall include the necessary provisions for revising and issuing documents to keep the manual current. The title of the individual authorized to approve revisions shall be included in the manual. There shall be provisions for signatures of the authorized individuals responsible for making changes and approving changes or revisions. Any manual changes shall be approved prior to issuance of any revisions to the manual and implementation of the safety and loss management system changes.
- f) Organization - An organizational chart shall be included in the manual. It shall include the title of the positions in all departments or divisions that perform functions that can affect the execution of the safety and loss management system such as a maintenance, operations or engineering departments and it shall show the relationship between each department or division.

The manual shall identify the title of those individuals responsible for preparation, implementation, or verification of the safety and loss management system. The responsibilities shall be clearly defined and the individuals shall have the organizational freedom and authority to fulfill those responsibilities.

- g) Training and Competency - The safety and loss management system shall establish, implement and maintain a process for developing competency requirements for critical job functions and training of employees or contractors responsible for administrating and executing program activities, including safety and loss management system implementation, operation, inspection, maintenance and repair of the gas distribution system. Training requirements shall be provided for new employees, employees assuming new responsibilities or positions. Ongoing and periodic refresher training must be addressed for all identified critical tasks. The procedures for the administration and maintenance of training records shall be documented in the manual.

The management program shall have a process for verifying that employees and contractors working with or on behalf of the gas utility are trained and competent to perform their duties in a safe manner.

Where contractors are utilized for the maintenance of a facility, there must be a process to evaluate and select contractors on the basis of ability and qualifications to perform contracted duties. The evaluation process should include a review of safety and environmental policies, procedures, past performance, ability and qualification check through audits, work-site inspections, and observations of performance as appropriate. There must also be a process in place to ensure that performance requirements and expectations are defined and communicated to the contractor. A process to monitor and assess a contractors' performance and ensure that identified deficiencies are resolved shall be developed.

There shall be a process for evaluating the effectiveness of the training.

- h) Document and Records Administration - The safety and loss management system shall establish, implement and maintain a process for administering documents and records needed for the effective implementation of management system activities including but not limited to design, construction, operation, maintenance, engineering changes and decommissioning. The document and record administration process shall encompass creation, security, updating, retention, retrieval and deletion of all information and records. Records may be in electronic or paper-based format.

Responsibilities for document approval shall be specified and shall identify appropriate controls to ensure that revisions and updates to procedural, process or other record documents are reviewed and approved.

The management processes for records shall address:

- responsibilities and procedures for creating, gathering, updating, retaining, and deleting documents;
- records and other documents that must be retained;
- records of past activities, events, changes, analyses and decisions;
- an index describing the types, forms and locations of records; and
- retention policy as required by regulations or codes and the owner's/operator's requirements.

As a minimum the following records shall be maintained:

- a) Design, Construction and Commissioning
- i) Survey and route, including location of the distribution system with respect to crossings, land use and structures
 - ii) Design basis and calculation of the distribution system including limits on pressure, temperature, loading, and other operating conditions
 - iii) Design changes and approvals including:
 - Material specifications and certification for the pipe, components, bolting and coating materials (material test reports)
 - Inspection and test certifications and reports (joining and inspection records, coating and inspection records, inspection of terrain, soil type, backfill material, and depth of cover)
 - Pressure test records and summary

- nonconformance during design, construction and commissioning
- b) Operational and maintenance details
- i) Changes (operating conditions, procedures, maps, drawings, plans)
 - ii) Cathodic protection system design and performance
 - iii) Inspection, testing and monitoring records (corrosion control record, device control, leak detection)
 - iv) Evaluation of testing and inspection
 - v) Repair and modification
 - vi) Incidents and failure records and investigation
 - vii) Records of deactivation
- c) Safety and loss management program records
- i) Management review
 - ii) Training and competency records
 - iii) Approved contractors
 - iv) Nonconformance reports
 - v) Internal and external audits

Where records are incomplete due to change of ownership, asset transfers or other reasons, the management program shall have a process for ensuring safe operation and maintenance in the absence of these records and how the missing information is to be recovered.

- i) Project Management - The safety and loss management system shall establish procedures to ensure that all projects for the design, construction, alteration or additions to a gas distribution system are managed in order for the project to achieve the stated objectives safely. Aspects to be addressed are:
- planning and scheduling to assign responsibilities and ensure adequate resources review, verification and validation of project changes;
 - systematic reviews to identify problems and corrective actions;
 - risk management process that identifies, assesses, and manages the hazards;
 - establishment of documented design control procedures;
 - procedures for the evaluation of suppliers and contractors and the verification of purchased products including documentation and records;
 - design control procedures to achieve conformity to applicable gas utility specifications, standards and project and regulatory requirements; and
- j) Integrity Management Program - The gas utility shall develop and implement an integrity management program that specifies the practices used by the utility to ensure the safe, environmentally responsible, and reliable service of a gas distribution system. The integrity management program shall incorporate operational controls for:

- i) risk management;
- ii) design, material selection, and procurement;
- iii) construction;
- iv) operations and maintenance;
- v) inspection, testing, patrols and monitoring;
- vi) cathodic protection;
- vii) hazard identification and control;
- viii) engineering assessments;
- ix) emergency preparedness, response, and recovery;
- x) security management; and
- xi) deactivation and abandonment;

The operational controls should be developed in accordance with the guidelines of CSA Z662 Annex N or other applicable standards.

k) Operations - The safety and loss management system shall include procedures for the safe operation of a gas distribution system. These procedures shall be appropriate to the size and complexity of the facility and eliminate, mitigate or control the identified hazards. As a minimum, operational procedures shall address:

- i) normal operations including shutdown, start-up;
- ii) operating limits;
- iii) alarm management;
- iv) maintenance of facilities and critical equipment;
- v) right-of-way inspection and maintenance;
- vi) excavation procedures;
- vii) underground pipe location procedures;
- viii) emergency preparedness, response, and recovery;
- ix) security management; and
- x) operation and control systems.

l) Emergency Procedures - The safety and loss management system shall develop and maintain an emergency response and preparedness plan which outlines the responses and procedures for when an incident, identified by a hazard analysis, that could cause an unintentional or uncontrolled release of gas or a potential safety or health hazard, such as a fire, explosion or chemical exposure, occurs. This plan shall be designed to stop or mitigate the incidents such that the consequences are minimized.

It should address both emergency actions of the distribution system operator and those of emergency responders from the municipality, township, or region as well as communications with the general public. The emergency plans for external responders are developed by the local emergency response providers, in consultation with the owner/operator.

The procedures in the emergency response plan shall be appropriate to the size and complexity of the distribution facility and as a minimum, address:

- i) evacuation from the danger area to a designated safe location when an emergency occurs;

- ii) emergency escape routes, assembly points and shelter areas;
 - iii) responsibilities such as emergency response command, first aid, firefighting, evacuation wardens;
 - iv) emergency procedures to manage incidents including the use of emergency shut off devices, electrical isolation and fire suppression;
 - v) emergency response training for employees;
 - vi) contact information for emergency responders and other individuals who must be notified of an emergency situation;
 - vii) contact information for external emergency responders;
 - viii) contact information for external emergency responders and support agencies such as ambulance and police;
 - ix) information about chemical hazards and material data sheets;
 - x) location and description of repair equipment;
 - xi) procedures for the safe control or shutdown of the distribution system or parts of the system, in the event of an emergency;
 - xii) safety procedures for personnel at emergency sites; and
 - xiii) repair procedures and acceptance tests.
- m) Inspection and Monitoring - The safety and loss management system shall document and maintain inspection and monitoring procedures that are appropriate for the gas systems, equipment and storage containers in the facility. The procedures should be designed to ensure safe operation and to mitigate risks identified by the hazard analysis. Inspection and monitoring activities should follow relevant regulations, standards, codes and equipment manufacturer's instructions. Planning, scheduling, and frequency of inspection and monitoring should consider parameters such as effectiveness of inspection method and technology, previous inspection results, incident history, insufficient documentation, evaluation of anomalies, time dependent consideration, current state of facility/equipment, and industry data such as standard damage mechanisms. The program shall document schedules and have controls to ensure that the planned activities are carried out.

If any irregularities, anomalies, damage or other unsafe conditions are identified, further inspections and investigations such as an engineering assessment, fitness for service evaluation, code guidelines for evaluation imperfections or anomalies or other means shall be used to evaluate if the equipment or facility can continue to be operated safely. The outcome of the evaluation could be to monitor the irregularity by increasing the inspection frequency, altering operational procedures, rerating or repairing equipment.

As a minimum the inspection and monitoring program shall include methods to inspect, test and monitor:

- i) cathodic protection systems
- ii) corrosion monitoring systems
- iii) leak detection methods and devices
- iv) shutdown devices and systems
- v) pressure control, pressure limiting and pressure relieving systems
- vi) distribution system control valves
- vii) system patrolling
- viii) inspection of exposed piping for corrosion or other damage

- n) Incident and Near-miss Investigation - The safety and loss management system shall document and implement a process to report and investigate any hazards, potential hazards, incidents or near misses affecting or having the potential to affect the safe operation of the distribution system. A process for reviewing incidents and near-misses for the system and reports from across industry shall be developed. Lessons learned shall be incorporated into facility procedures and processes to improve the effectiveness of the operation and maintenance program.

Records of investigations shall be maintained for the life of the distribution system until it is removed from service and decommissioned.

- o) Maintenance - Maintenance procedures shall be developed for distribution systems and equipment based on codes, standards and manufacturer's instructions. Maintenance procedures shall be documented and reviewed whenever a change, including operational changes, in gas systems or equipment occurs. Written maintenance procedures provided by equipment manufacturers may be used as maintenance manuals. Maintenance work shall be carried out by individuals who have been trained in the maintenance and testing procedures applicable to the systems or equipment on which they are working. Maintenance procedures shall be developed for all distribution systems and equipment including:

- i) gauges, valves, pressure relief valves, emergency shut offs;
- ii) piping, pipe fittings, supports, hydrostatic relief valves, and shut off valves,
- iii) protective coverings;
- iv) calibration of gauges, instruments and other monitoring equipment;
- v) pressure control, pressure limiting and pressure relieving devices in meter sets;
and
- vi) maintenance of right of ways and marking signage.

- p) Installation, Repair and Alteration Methods - The safety and loss management system shall include processes for installations, repairs and alterations, including mechanical assembly procedures, materials and nondestructive examination methods, as applicable. Where modifications or repairs are required, there shall be a process to identify and document relevant corrective actions that are acceptable and appropriate for the facility. Repair methodology must be documented to execute the repair.

Reference shall be made in the manual for inspections, examinations and tests required by the equipment manufacturer, codes or standards upon completion of the installation, repair or alteration including the pressure testing of pressure components upon completion of the work. A detailed description of the method for conducting the pressure test and acceptable test results will be included in this reference.

- q) Materials - The safety and loss management system shall describe the method used to ensure that only certified components and acceptable materials are used for installations, repairs and alterations. The manual shall include a description of how new material, equipment or components are ordered, verified, and marked. The manual shall identify the title of the individual(s) responsible for each function and a brief description of how the function is to be performed.

- r) Exhibits - Any forms referenced in the manual shall be included. The form may be a part of the referencing document or included as an appendix. For clarity, the forms may be completed and identified as examples. The name and accepted abbreviations of the owner/operator shall be included in the manual.
- s) Change Management - The safety and loss management system shall have a systematic process for identifying, evaluating, controlling and documenting any change to distribution system design, specification, operations, standard, organization or activities and legal requirements to ensure that no unforeseen new hazards are introduced and that the risk of existing hazards to employees, public, or the environment are not unknowingly increased. This process should cover changes such as:
- i) ownership or management of a distribution system;
 - ii) the organization and personnel who operate and maintain the distribution system;
 - iii) equipment, process, process technology and control systems;
 - iv) operating status, such as shutdown, or decommissioning which can introduce “temporary” hazards not expected during normal operations;
 - v) operating conditions;
 - vi) methods, practices, and procedures related to operation or maintenance of the distribution system;
 - vii) standards and regulations related to the distribution system’s operation or maintenance;
 - viii) other installations (e.g. power lines, roads) that cross piping and other equipment or facilities;
 - ix) changes to the distribution system made to account for environmental factors, such as flood, fire, ground movement; and
 - x) adjacent land use and development.

The management of change process should address:

- i) identification of anticipated and actual changes;
 - ii) what constitutes a change (temporary or permanent) and what falls under replacement in kind, which is not subject to the management of change process;
 - iii) responsibilities and authorities for approving and implementing changes;
 - iv) analysis of implications of the changes;
 - v) impact and risk of the changes;
 - vi) training required as a result of changes;
 - vii) communication of the changes, their impact and required documentation; and
 - viii) timing of changes (approval and implementation)
- t) Internal Audits and Control of Program Non-conformances - The safety and loss management system shall develop and implement a process for conducting internal audits to verify the implementation of the safety and loss management system. This process must define the responsibilities, scope, objectives, frequency, and schedule for internal audits. The process for completing corrective actions for non-conformances identified through internal audits shall be outlined. The process must also ensure auditor competency and independence.

The management program processes shall be regularly monitored to measure conformance to the requirements of the management program. A process to investigate identified non-conformances, initiating and completing corrective actions shall be implemented.

- u) Management Review - The facility owner or management shall review the adequacy, implementation and effectiveness of the facility's operation and maintenance program on a regular basis. The review shall evaluate if the program's goals have been met, compliance to facility and regulatory requirements and identification of actions for continual improvement of the operation and maintenance management program.