Onshore Pipeline Regulations Review – Discussion Paper

Commentary

Provided by: [redacted]
Olitech, Consulting Inc.

Contact Info: ***Olitech@rogers.com***
416-294-0217

June, 2022

Olitech

The following commentary and advice is provided by [redacted] P.Eng. who is a Principal Engineer and President of Olitech Consulting Inc. Olitech is a boutique consulting firm providing process safety and risk management services in the hazardous industries to clients in Canada and internationally.

[redacted] has circa 35 years experience related to process safety and risk management in multiple industries including pipelines, oil & gas, nuclear, transportation, utilities and propane. Mr. [redacted] recently retired from Enbridge after seven years as a process safety technical expert. He is recognized across Canada as a subject matter expert in these areas.

[redacted] has deep technical knowledge in the safety-related areas CER is requesting advice on. In addition, he has been involved in similar exercises in Ontario for the provincial propane and operating engineers' regulations. Some of his pertinent current and past activities include:

- Lead author preparing a process safety risk assessment guideline for the CSChE's PSM Division. This will be a national guideline expected to be used by both regulators and companies across Canada;
- Guideline and standard development for process safety / risk management topic areas for clients in the Canada and the USA;
- Guideline development support and regulation advice to the TSSA in Ontario – propane and operating engineer;
- University instructor, Department of Chemical Engineering, University of Toronto – process safety management course and risk assessment course.

Note that [redacted] is a contributor to a separate submission to CER on the OPR review provided by the Canadian Society for Chemical Engineering's (CSChE) PSM Division. Whereas this submission was a collective effort, additional commentary is provided herein, reflecting more of the his views, primarily focused on process safety and risk management.

CER

The Canadian Energy Regulator, through the Onshore Pipelines Regulations (OPR), provides the requirements / rules that pipeline companies must follow. The CER is now conducting a comprehensive review of the OPR to update the regulations. The CER is seeking input, which will assist with the review and update of the OPR.

The input that is sought is framed around topic areas with each area having a number of sections. Each section has questions that describes the advice CER is seeking. The commentary provided below is aligned with these questions.

Commentary

The commentary provided is focused on process safety and risk management. Thus, not all questions are addressed.

Question 1:

What's working well in relation to the OPR, and its implementation, and what could be improved?

The commentary for this question is at a high level. More detailed commentary is provided for other questions.

The OPR has a good holistic approach but is believed to lack the following:

- Detail in certain areas that would contribute to improved safety performance by pipeline companies. For example, the current OPR does not specifically require a robust / best practice risk assessment process to analyze and evaluate risk to public or environmental receptors to demonstrate pipelines are safe to operate. Another example is the requirement for a safety management system. Current OPR requirements lacks the comprehensive approaches provided in management system frameworks such as CSA Z767, API 1173, CCPS Risk Based Process Safety.
- Adequate guidance documentation. CER relies CSA standards, principally Z662, which are lacking in a number of ways. Guidance documents will help regulated companies understand requirements details and what they must to meet them.

A stepwise approach to would be for CER to:

1. Develop a model / framework identifying requirements that meet CER's goals and objectives, and how it should be implemented;
2. Undertake a gap assessment to identify gaps between the current OPR and its implementation and the desired model;
3. Assess the gaps and develop plans / methods / approaches to close them;
4. Develop guidance documents so that pipeline companies can understand the model and its requirements;
5. Build the technical expertise within the CER to support the model;
6. Promote the requirements through technical meetings, safety and information advisories and workshops;
7. Establish "compliance mechanisms"/audits so the CER can interrogate companies to ensure they have implemented the model and that it is working well.

Olitech recommends the formation of a team to address steps 1 to 3 and to support steps 4 to 6. The team should have the following makeup.

- process safety / risk management expertise
- management system expertise
- human and organizational factors
- pipelines design and operations, but who also understand process safety
- CER staff
- environment

Note that this approach has been proven to be effective in Ontario (e.g., TSSA Operating Engineer's Task Force; [redacted] participated on this task force)

The above is focused on process safety / risk management. However, other management areas need to be addressed – e.g. quality management, security, environmental management. A popular approach is to consolidate requirements into an integrated management system.

Questions 2 to 5

No comments. Refer to the CSChE PSM Division submission.

Question 6:

How can the OPR address the participation of Indigenous peoples in pipeline oversight?

Indigenous peoples are stakeholders. ISO 31000, an international risk management standard, and CSA Z767, a Canadian process safety management standard, both call for stakeholder engagement in the development of new pipelines.

The onus is on proponents of new pipelines and owners of existing pipelines to develop and implement a process for stakeholder engagement. The OPR can provide the (minimum) requirements. For example, the OPR can address the following:

- Clearly stipulate the requirement for engagement and the engagement model/approach;
- Project lifecycle stage when engagement begins;
- Information communicated;
- Buy-in and dispute resolution process;
- Timelines; and
- Funding support.

Information communicated would likely include environmental impact assessments, risk assessments and cost-benefit analyses.

CER can refer to CAN UL-2984 (Standard for Safety Management of Public Risks – Principles and Guidelines) for guidance. Also refer to CSA Z663 (Land use planning in the vicinity of pipeline systems).

Question 7:

How can the OPR support collaborative interaction between companies and those who live and work near pipelines?

Indigenous peoples are not the only stakeholders. The stakeholder engagement process applies to all stakeholders. Please refer to the Question 6 commentary.

Questions 8 to 11

No comments. Refer to the CSChE PSM Division submission.

Question 12:

How can the OPR support innovation, and the development and use of new technologies or best practices?

The OPR's management system requirements provide companies the flexibility to continually improve and innovate to meet regulatory requirements in ways that align with company-specific risks and the systems/controls needed to address them. The CER supports innovative approaches and the use of equipment, processes, and procedures that are based on new technologies.

New technologies and best practices emerge on a continual basis. The OPR can support pipeline companies by avoiding prescriptive requirements and promote performance-based requirements. A clear example of this is pertains to meeting tolerable risk. The OPR should identify the risk criteria that must be met, but then allow pipeline companies the flexibility with respect to ways to meet the risk criteria.

However, the OPR should include some type of requirement stipulating that any technology or practice credited, for example, in a risk assessment, actually meets the credit assumed/taken. An example of this in the process safety world is certification of safety instrumented functions (commonly referred to SIFs). The certification testing of the SIF would confirm the SIL (safety integrity level) credited in a risk assessment.

In short summary, the OPR can provide companies the flexibility to innovate and use new technologies and practices, but companies must demonstrate the reliability of the technologies and practices proposed.

Questions 13 to 15

No comments. Refer to the CSChE PSM Division submission.

Question 16:

How can the OPR be improved to address changing pipeline use and pipeline status?

The existing OPR does describe an overall management system which incorporates many of the elements of recognized best management system elements. Pipeline companies do have management systems in place in compliance with the OPR. Improvements to the OPR can be made by aligning the regulations with widely accepted/used management systems such as ISO 9001 (Quality), ISO14001 (Environment), ISO 45001 (Occupational Safety), ISO 31000 (Risk Management), CSA Z767 (Process Safety), and API 1173 (Pipelines Process Safety). Specifically, the revision to the OPR should incorporate the necessary management system elements that pertain to the specific subjects that support the overall safety of the pipeline

systems - e.g., Quality, Process Safety, Occupational Safety, Environment, Security, Emergency Management and Integrity. It is recommended that the requirement be for one integrated management system (IMS) that addresses all these program areas.

The recommended approach for the IMS is to define program areas and then develop requirements for each program – e.g., program elements. For example, process safety could be a program and risk management and human and organizational factors would be elements within the process safety program. It is expected that this will take considerable development and discussions because of the overlap between program areas.

To achieve consistency and improved regulatory oversight, the CER should define the structure of the IMS in the OPR and then issue a guidance document to describe the details. For example, it is recommended that

- the process safety requirements to be included within the IMS be aligned with the requirements described in Process safety standards such as CSA Z767 and API 1173.
- the risk management requirement be updated to align with risk management as described in CSA Z767 and CSA Z662:19 Appendix B, CAN/UL 2984 and CSA/ISO 31000, and it needs to be made clear that risk management applies to all subject areas (i.e OPR programs).

Process safety management is of particular importance to pipeline safety (elaborated under Question 21). Risk assessment is fundamental to process safety and should be a legislated requirement on the OPR. In particular, the OPR should make CSA Z662 Annex B, currently an informative annex in the standard, a mandatory requirement in the OPR. This should not overly burden pipeline companies as the leading ones are already doing risk assessments – just that they may not be done effectively and in the public's best interest.

The requirements for the identification, evaluation, mitigation and control of hazards/ risks and communication about these hazards, risks and their controls, needs to be clarified to ensure there is understanding that this applies to all hazards/risks arising from the complete lifecycle of a pipeline from concept through design, construction, operations, and eventual abandonment/decommissioning.

Furthermore, the CER should review and update their oversight process, and in particular clarify audit requirements. It is recommended audit requirements cover three types: (i) requirements pertaining to ensuring the management system is implemented and meets requirements, (ii) requirements pertaining to demonstrating the organization is meeting specific technical requirements, and (iii) requirements to confirm an organization is meeting legislated requirements.

Auditing technical requirements is a highly important regulatory function. There is some evidence that CER is not undertaking this effectively.

Question 17:

How should information about human and organizational factors, including how they can be integrated into a company's management system, for both employees and contractors, be provided in the OPR, and/or described in related guidance?

Refer to the CSChE PSM Division submission where a detailed commentary is provided. Additional comments provided by [redacted] are as follows. Note that Mr. [redacted] s expertise is not in human factors per se. The commentary is limited to pipeline operations. Furthermore, Mr. [redacted] fully endorses the use of guidelines and standards identified in the above submission – principally CSA EXP 16, Z767 and Z662.

Human factors pertain mostly to the execution of tasks that support the operation of the pipeline. Incorrect execution of tasks could lead to an unwanted incident, potentially affecting human and/or environmental safety. The role of risk management is to identify critical human tasks and understand the risk associated with them such that tolerable risk is maintained throughout the lifecycle of a pipeline. Identification of critical human tasks should be done through the risk assessment Hazard Identification task. Pipeline companies generally do not do this well.

Pipeline companies venturing into process safety and risk management occurred after it was established in other industries – notably oil & gas, chemical and nuclear. Pipeline companies looked at and adopted methods used in the oil & gas and chemical sectors. Most notably the Hazop technique. The Hazop method is well suited to more complex technologies with a high degree of process control, which pipelines are not.

Some of the methods used in the nuclear industry are better suited to pipeline operations than Hazop – e.g., fault tree analysis, event tree analysis, critical task analysis, and human error analysis. Pipeline companies have not yet figured this out. It is recommended that CER, in a HOF guidance document, identify and describe the range of techniques available that are suitable to pipeline operations and provide examples of when to use them.

Organizational factors pertain to things that are generally not quantifiable, but contribute to safety performance and must be managed. CSA EXP 16 and Z767 address these well.

Questions 18 to 20

No comments. Refer to the CSChE PSM Division submission.

Question 21

How should the OPR include more explicit requirements for process safety?

Process safety, and risk management are the areas where [redacted] has the greatest expertise. Mr. [redacted] is the principal author of the CSChE's PSM Division submission for Question 21. Process safety management, along with Quality, is arguably one of the most important components to pipeline safety.

Process safety is a discipline that focuses on the prevention of releases of hazardous material or energy, with an emphasis on low frequency, high consequence events. Incidents include toxic or flammable material releases (loss events), resulting in toxic effects, fires, or explosions, and liquid spills having environmental impacts.

Process is a broad term that includes, for pipeline systems, the equipment and technology needed for transport of fluids, including buried pipelines, compressor stations, pump stations, valve stations, storage facilities, etc. Prevention is framed around managing risk – i.e., the consequences and likelihood of releases. Risk management requires the identification of hazards, evaluation of risk, and risk reduction to ensure risk is considered tolerable and lifecycle management of residual risk to ensure risk is maintained tolerable. This requires a disciplined framework for managing the integrity of operating systems and processes handling hazardous substances by applying good design principles, engineering, and operating practices. This also requires a robust analysis of risk and defendable risk tolerance criteria to evaluate the risk. Thus, the cornerstone of process safety is a reliable risk assessment that does a good/reasonable job of assessing risk to the public, workers and the environment. In particular, the risk assessment should not underestimate risk leading to poor risk-informed decision making that undermines safety.

The CER has found that hazard identification often focuses on worker safety. Process safety hazards – i.e., hazardous material systems that can experience high consequence / low frequency incidents, must also be identified, and their risks evaluated and managed, in order to prevent such incidents. This is affected by a number of process safety elements. The elements are organized under four foundational pillars:

a) process safety leadership;

b) understanding hazards and risks;

c) risk management; and

d) review and improvement.

Process safety management is the application of management principles and systems for the identification, understanding, avoidance, and control of hazards to prevent, mitigate, prepare for, respond to, and recover from process-related incidents. All process safety elements contribute to this.

A process safety objective is to "consider a hazard to be safe". Being safe is related to risk by the following: "*A system can be considered safe if its risk is considered tolerable*". Thus, understanding and managing of risk is central to process safety - and this requires a reliable risk assessment.

There is a well-established practice in Canada and worldwide that hazardous materials should pose a tolerable risk to receptors that can be impacted by them and that tolerable risk be maintained throughout the lifecycle of the hazard (pipeline system). Thus, the concept "process safety" fundamentally means declaring a process to be safe through demonstrating its risk is tolerable. Process Safety Management is the suite of disparate efforts that work in unison to achieve and maintain tolerable risk.

Pipeline companies can achieve safe facilities by implementing a four-step approach. The first step is the identification of hazards (process hazards) and developing a Hazard Register to track them. A hazard could be an existing system / facility / pipeline / section of pipeline, or one that is proposed / not yet built.

> *Note: CSA Z767 definition of (process) hazard is: " a physical or process situation that can cause human injury, damage to property, or damage to the environment through the release of a hazardous material or hazardous energy." CER uses a term "potential hazard". This term is not used anywhere else. It could be argued that potential hazards do not exist.*

The second step should focus on design, siting and construction. In particular, inherently safer design principles, whose aim is to avoid/minimize hazards instead of controlling them. These are typically applied at the design stage.

The third step is to determine the safety of hazards and their designs via establishing whether absolute risks are tolerable, through risk assessments. This means first analyzing risk for an existing or proposed hazard design and operation, followed by risk reduction if the analyzed risk is found to be intolerable. Risk reduction feeds back to design, siting, construction as well as operation. The end of this step is:

1. A well documented risk assessment that demonstrates risk is tolerable and that has undergone quality assurance (more on this in Question 26) and approval. The risk assessment would include assessed recommendations to reduce risk to tolerable levels, if required;
2. Process safety information (PSI) supporting the risk assessment – e.g., design basis documents, drawings, procedures, process control information, etc.;

Note: Complete and up to date / accurate PSI should be available prior to initiating a risk assessment.

3. Any documented analyses supporting the risk assessment – e.g. Process Hazard Analyses such as HAZOPs, Cost Benefit Analyses;
4. Implementation (to completion and documented) of all recommendations / risk controls from the risk assessment.

5. Entering of risk scenarios and their controls into a Risk Register.

The fourth step is lifecycle risk management to ensure risk remains tolerable throughout the life of the hazard presented by pipeline systems. This would include:

1. Ensuring the competency of people managing the hazard;
2. Managing the mechanical integrity and process control of equipment from which the hazard is comprised;
3. Managing proposed changes to the hazard – i.e., changes to equipment, technology and people. Proposed changes may require assessment of risk and the risk assessment and PSI may need to be updated accordingly.

   Note: This would be under a Management of Change (MOC) program, which would include steps for planning, analysis, assessment, review and approvals. Also, the risk assessment is a "living" document/assessment that should be updated to account for any approved changes. PSI should also be updated accordingly.

4. Incorporating new information – e.g., changes to equipment failure rates, changes to adjacent population/receptors, incident investigation learnings, information from incidents elsewhere, etc. New information should be incorporated in the risk assessment as required.

   Note: the "living" risk assessment should be periodically reviewed and updated to incorporate any new information or revalidated. CER should establish a review/ update frequency not to exceed 5 years (e.g. per CSA Z767) or sooner if a significant uncontrolled release event occurs.

5. Continual improvement with respect to process safety to include the following:

   i. Incident investigation and incorporation of findings;
   ii. Monitoring and auditing of the process safety system and its components;
   iii. Development of process safety performance metrics and their tracking over time; and
   iv. Acquisition and use of knowledge through, for example, participation in forums and committees, review of historical information – e.g., past incidents, identification of emerging trends / technologies, etc.

6. Emergency management to ensure that the company and external emergency organizations are prepared to deal with emergencies should they occur.

Furthermore, quality is closely linked to process safety. Companies should be encouraged to develop / implement quality management programs. Note that this is addressed in Question 16 and Question 26.

Additional background on risk assessment and risk tolerance criteria:

Traditionally, regulators specify the risk assessment methodology and the risk criteria to be used to evaluate risk. The current OPR does not address this. There are three risk assessment approaches commonly used in Canada:

1. Aggregate risk, commonly referred to as Quantitative Risk Assessment (QRA). The risk analysis results consider total risk from all potential scenarios to risk receptors. In addition, QRAs also included detailed modelling. This is the best practice risk assessment method. For people, risk evaluation is done using individual risk (IR) criteria and societal risk (SR) criteria.

   The latest Annex B of CSA Z662 identifies these criteria, which CER can adopt. These criteria implicitly require QRAs be completed for pipeline systems to demonstrate they are safe.

2. Single scenario risk assessment embedded in PHAs and LOPAs. PHA risk analyses tend to be more qualitative; LOPAs are more quantitative, but often lack the detailed analysis of QRAs. Risk evaluation is done using risk matrices. The latest CSA Z662 Annex B puts this type of risk assessment as an option, but does not specifically describe it.

   If single scenario risk assessment using risk matrices is permitted, CER should stipulate when and how it should be used and develop a common risk matrix for companies to use – not available in Z662. The current practice is that companies have their own, internally developed, risk matrices. There is no risk matrix consistency company-to-company and risk matrices often lack a foundational basis linking them to IR / SR criteria, which are defendable. Also, they may underestimate risk. This is undesirable from a regulatory risk management perspective. Pipeline companies should not be in a position to decide risk tolerability, especially for risk their facilities impose on the public.

3. Land Use Planning Guidelines, originally developed by MIACC (Major Industrial Accident Council of Canada) - Location Specific Individual Risk method. This methodology has been used in Canada for over two decades and has wide acceptance. It was developed for, and is most useful for land use planning

applications specifically pertaining to public risk. CER can consider this approach, but only for public encroachment to gas transmission pipelines. These guidelines do not require consideration of risk reduction in the equivalent-ALARP region and thus are fundamentally flawed from a continual improvement perspective.

In a risk management guideline to support the OPR, CER should carefully describe risk assessment methods and how and when to use them.

Update of the OPR

The OPR does not specifically include process safety requirement details, rather it references other CSA Standards (e.g. Z276, Z341, Z662 and Z246.1), which contain some process management requirements, but may or may not be consistent with 'process safety benchmark practices' (e.g. CSA Z767, API 1173, CCPS Risk Based Process Safety, OSHA 1910) causing confusion for regulated companies.

Recommendation: To update the OPR to identify process safety management requirements for CER regulated companies. In addition to Z662, these should also be based on Z767 and API 1173.

> These would be program requirements – i.e. the management system, often referred to PSM elements. The OPR does not differentiate Process Safety and Process Safety Management System. In order to achieve and maintain a successful implementation of process safety, it requires a management system. This will allow decision makers access to critical information so that they can provide oversight.
>
> *Note: Process safety management can be a subset of an integrated management system (see Question 16 response).*

Current OPR observations:

- Process safety requirements are scattered throughout the OPR regulation and CSA standards such as Z662. The requirements do not appear to address all the elements identified in widely used PSM frameworks
- Within the OPR Regulation, Clauses 6.5 (1) (c), (d), (e), and (f) address process safety elements. The Guidance Notes do not provide substantive interpretation material.
- Z662 identifies process safety requirements in Clause 3. In bullet form, many of the PSM requirements of recognized PSM frameworks are identified, but not all, and they are not explained in sufficient detail to advise pipeline operators what a best practice would be.

Recommendation: To update the OPR to provide minimum process safety (technical) requirements and develop a technical guidance for these specific requirements.

This would provide an explanation of what is required to meet a PSM element. For example, Management of Change (MOC) is a PSM element. The OPR could identify that (i) MOC covers changes to equipment, technology and personnel, and (ii) the MOC process requires a structured process covering approval to consider, planning, assessment and approval to implement. MOC guidance document would provide details – e.g., what is a change versus replacement-in-kind.

Recommendation: To update the OPR to (i) specifically require risk assessments for pipeline systems, and (ii) provide the risk tolerance criteria for pipeline companies to use. This can be achieved by making Z662 Annex B mandatory.

Z662 Annex B – latest draft version, provides an informative guideline for risk assessment of pipeline systems. It is quite detailed and up to date. However, there are some gaps and some clarifications are still required. These clarifications would best be included in a guideline document and not the regulation itself.

Note: a reliable risk assessment that meets tolerable risk is a demonstration the pipeline system is safe to operate. There is no other way to reliably demonstrate safety. Some might argue that past safety performance can demonstrate a pipeline system is safe. This is a dangerous argument to make. A risk assessment not only accounts for past performance, but also ferrets out what potentially could happen, but hasn't happened yet.

A reliable risk assessment could have prevented the Lac Megantic disaster.

If PHA single scenario risk assessment is permitted then CER should develop a common risk matrix that is aligned with societal risk criteria in Z662 Annex B.

Olitech is providing below example clauses and supporting information which are recommended to be included in the OPR update. Some of these may already be in place or covered by CSA Z662.

- A company shall implement and ensure an effective process safety management system aligned with recognized industry practices or standards.
- A company shall identify hazards and develop a Hazard Register to track them.
- A company shall identify, develop and implement process safety methods during design and construction of new projects and upgrades/replacement of existing facilities.
    - For proposed new hazards (new projects), companies should consider (i) inherently safe design principles and (ii) risk-based land use planning.
    - To ensure that the design of a pipeline, or any modification to it, takes into account the operating regime, the conditions under which the fluid is to be

conveyed as well as the environment to which the pipeline will be subjected to, should be considered.

- Safety systems to include (i) devices which prevent the safe operating limits being exceeded - for example pressure relief valves, safety instrumented functions (SIFs), etc., and (ii) programs to counter other threats – e.g., corrosion, 3rd party damage.

- A company shall identify and develop the appropriate process safety information required to analyze risk and keep it current and easily accessible to those who need it.
- A company shall develop a risk management framework. The framework shall include a risk assessment process, and consist of the following:
  - Hazard identification;
  - Risk analysis, including
    - Consequence analysis and facility siting
    - Frequency analysis
    - Human factors
    - Equipment integrity
    - External environment
  - Risk evaluation, including identification of risk receptors and appropriate risk tolerance criteria for each receptor;
  - Risk reduction to ensure risk is reduced to tolerable levels; and

    Note: The combined process of risk evaluation and risk reduction will confirm the adequacy of materials and safeguards.
  - Residual risk management program to ensure risk is managed and maintained at tolerable levels over the lifecycle of the hazard (pipeline system).

    Note: Pipeline companies will struggle with the concept of "reducing risk to tolerable levels". Left to their own means, potentially, every company will have a different approach with different results. [There is evidence of this with process safety risk matrices – "every company has a different one", they don't align, and many do not have a defendable basis.] This is not desirable from a consistency standpoint, nor from a public, worker or environmental standpoint, nor from a regulatory approval standpoint. CER should develop a risk tolerance framework based on the ALARP Principle, which includes risk criteria and a process for justifying ALARP. This should be explained in a guideline. Without this, justifying ALARP

can be highly variable / inconsistent which is not desirable from a regulatory standpoint.

- A company shall complete risk assessments that demonstrate pipeline systems are safe to operate – i.e., risk assessment demonstrates tolerable risk. A risk assessment will be maintained and updated as needed throughout the lifecycle of the pipeline system. Additional information to be maintained includes:
    - Management of change notifications
    - Updates to the risk assessment, including process hazard analysis as per MOC
    - Revalidations of the baseline risk assessment
- Through commissioning, including testing, a company shall ensure that the constructed system adheres to the design.
- A company shall utilize the risk management framework, to ensure the integrity of operating systems, that it applies industry recognized design principles, engineering, and operating practices. More specifically, the risk analysis shall consider mechanical integrity of components, human factors, process control, and external threats.
- Hazards that have potential to produce major consequences from failure incidents shall undergo detailed QRA.

    Note: QRA provides the most comprehensive and reliable analysis of risk and is considered the best practice. Major consequences would need to be defined, but typically include multiple fatalities, widespread environmental damage, and widespread damage to property.

- A company shall include a quality assurance process for the risk management framework requirements, including risk assessments, to ensure:
    - Analyses and assessments are technically correct;
    - Verification and validation of supporting PSI;
    - Decision processes are developed with approvals and close outs;
    - Competency requirements for process safety and risk engineers (internal and external), who complete the analyses and assessments.
- A company shall develop implementation requirements for risk reduction and lifecycle risk management, including:
    - Using the risk assessment to analyze risk reduction options;
    - Using Cost Benefit Analysis, good practice considerations and the ALARP principle to justify risk reduction decisions.

- Risk reduction implementation planning, timelines, accountabilities, controls and closeout

- A company shall implement life cycle operational process safety practices to achieve residual risk management through
  - Monitoring to ensure the pipeline is operating and controlled within the limits identified in the design, construction and installation process.
  - Human and organizational factors
  - Management of Change (MOC) for changes to equipment, technology and personnel. MOC shall consider impacts on risk.
  - Management oversight, including ongoing monitoring and formal audits
  - Emergency planning, response and recovery
  - Training and competency requirements for those undertaking critical process safety functions and for process safety knowledge
  - Program for process and equipment integrity, including process control
  - Incident investigation with a process for implementing learnings
  - Process for continual improvement including development and monitoring of performance indicators for process safety
  - Cyclical process hazard analyses / risk assessments to be conducted or revalidated at a frequency. Consequence analysis and facility siting analysis to be reviewed and updated at each cycle to accommodate changes made to process safety information, other new data, or the surrounding community.
    - Revalidations must be conducted by the revalidation team and incorporated into the risk assessment / process hazard analysis documentation.

- A company shall document "the above" in a Process Safety Report (known elsewhere as Safety Case or Risk and Safety Management Plan) and submit to CER.
  - The Process Safety Report will be the repository for risk and safety information associated with a hazard. It is the "proof"/demonstration that the hazard is safe (i.e., risk is tolerable) and that it is being well managed. It is recommended that the CER require summary reports for submission to stakeholders, including the CER, and detailed reports containing the (i) summary reports and (ii) all supporting documents to be retained by the company. Detailed Process Safety Reports should be made available for regulatory audits.

Note: Risk and Safety Management Plans were introduced in Ontario for propane in 2010 and proved to be successful. They are very similar to Safe Cases

required in Europe and elsewhere. [redacted] *was a major contributor to the RSMP process in Ontario, working with the TSSA.*

- A company shall identify stakeholders and develop strategies for their engagement / communicating with them.
    - Ensure the results of the process safety activities, including knowledge on hazards and risks, and training is provided to affected stakeholders – in particular operating personnel.

  Note: Stakeholder engagement is a key aspect of ISO 31000 and CSA Z767. An example approach would be to make publicly available Process Safety Report summary documents.

The benefits of the above approach are:

- A defendable risk-based process that demonstrates pipeline systems are safe to operate;
- Companies will use comparable methods, standards and criteria, establish basic expectations, and foster continual improvement;
- A structured, consistent process for PSM, identifying requirements in accordance with the lifecycle stages of a pipeline;
- The OPR will provide more explicit and clear requirements pertaining to process safety, and in particular risk assessment;
- Improved communication to stakeholders;
- Improved regulation, including the ability to compare and contrast industry safety performance company-to-company;
- An approach that supports continual improvement
- An approach for process safety that is considered a best practice, and that aligns with safety standards nationally and internationally – e.g.,
    - CSA Z767
    - CSA Z662
    - API 1173
    - CAN/UL 2984
    - CCPS Risk Based Process Safety
    - ISO 31000
    - COMAH safety cases (Europe)
    - RSMPs (Ontario)

Technical Guidance

Development of technical guidance documents will be crucial to understanding of requirements. The following guidance documents are proposed:

Technical Guidance: Integrated Management System (IMS)

An integrated management system guidance document will be crucial for pipeline companies to help them understand the broad OPR requirements, which extend beyond process safety and risk management. The IMS will have a framework structure that needs to be described. There will be programs, elements, etc

The guidance document will not be technical in nature, but rather describe a desired management system model. A different team with more pipeline company participation will be needed to develop it.

Technical Guidance: Risk Assessment for Risk to People

Technical Guidance: Environmental Risk Assessment

Both risk assessment guidance documents should address the following:

- Technical requirements, including:
  - Pipeline system design and operating descriptions;
  - PSI requirements;
  - Methods for risk assessment of pipeline systems, including
    - Methods for hazard identification
    - Methods for frequency analysis
    - Methods for consequence analysis
    - Methods for estimating risk, including individual risk and societal risk
  - Risk evaluation
    - Risk evaluation using the ALARP principle
    - Land use planning risk evaluation
    - Approaches for justifying ALARP
  - Risk reduction, including re-assessment of risk to demonstrate tolerable risk

- Risk assessment approach for (i) existing pipelines, (ii) new pipelines and (iii) new public developments proposed near existing pipelines. These can be different types risk assessments.

- Competency requirements for individuals completing risk assessments

- Quality assurance requirements

- Hazard identification and risk assessment updates – under MOC and revalidations

Technical Guidance: Process Safety Report:

As indicated above, the Process Safety Report is the repository of all the information for a specific pipeline system, that demonstrates that the pipeline system is safety to operate. It is indicated above, that a summary report be developed for stakeholders and a comprehensive report be retained by the company and be available for to CER for audits. The technical guidance should describe what the documentation requirements are for each report.

Furthermore, the technical guidance should describe:

- System design and operating descriptions, including
    - codes, standards, recommended practices used
    - critical safety systems
    - industry best practices for safety in design, including inherently safe design principles and what these could be for pipeline systems.
    - design and construction methods and standards.
    - PSI requirements, including keeping such information up to date
- Methods for risk assessment – refer to risk assessment guidance documents
- Competency requirements for process safety / risk management practitioners and key company staff
- Quality assurance requirements for process safety elements
- High level requirements for stakeholder engagement
- Land use planning for pipeline systems
- Lifecycle requirements, including
    - Management of change (MOC)
    - Management oversight, including formal audits
    - Process and equipment integrity
    - Operations, including critical operating procedures, maintenance, inspection and testing
    - Historical incidents with the pipeline system and elsewhere within the company
    - Human and organizational factors
    - Continual improvement
    - Land use planning.
- Emergency management, including emergency response plans and emergency exercises.
- Requirements for pipeline system decommissioning and abandonment

Development of Guidance Documents

Guidance documents should be developed by a multi-disciplinary team including process safety and risk management experts, pipeline engineers knowledgeable on design and operation, and CER staff. It is recommended, based on Olitech's experience elsewhere, that such teams comprise 6 to 8 individuals.

The documents should then undergo validation and review before being published.

References

The following references are provided to assist the CER.

- PSM management frameworks
  - CSA Z767 – Process Safety Management
  - CSA Z662 - Oil and gas pipeline systems
  - API 1173 - Pipeline Safety Management Systems
  - US OSHA 1910
  - CCPS Risk Based Process Safety (handbook published)

- Risk Management
  - ISO 31000 – Risk Management
  - CAN/UL 2984 - Safety Management of Public Risks – Principles and Guidelines

- Land use planning
  - *UK HSE does have a process a process for risk-based land use planning – see https://www.hse.gov.uk/landuseplanning/methodology.htm*
  - *MIACC Risk Based Land Use Planning Guidelines:* Risk-Based20Land20Use20Planning20Guidelines-1.pdf (cheminst.ca)
  - CSA Z663 - Land use planning in the vicinity of pipeline systems

- Safety Cases
  - *Gas Safety Case Guidelines for Natural Gas & LPG Licensed Undertakings, Commission for Regulation of Utilities (Ireland). CRU19155 (2019)*
  - *Safety Case Guideline, Third Edition. Engineers Australia*
  - *UK Health and Safety Executive: Major Hazard Regulatory Model, Safety management in major hazard sectors*

- Risk and Safety Management Plans (RSMP)
  - Ontario TSSA (propane): *Guidelines for the Implementation of the Level 2 Risk and Safety Management Plan.* Guidelines-for-Level-2-FINAL.pdf (tssa.org)
  - Ontario TSSA: *Operating Engineers Safety Program Path 2 Risk & Safety Management Plan (RSMP) – Implementation Guideline*. Path-2-Guideline-V0.97-Nov-2-.pdf (tssa.org)

Questions 22 to 26

Refer to the CSChE PSM Division submission.

Questions 27

How can the OPR incorporate the key issues identified in the Safety Advisory regarding the strength of steel and the relative strength of the weld area?

No comments.

Questions 28

What are your recommendations for compliance promotion at the CER?

Olitech's recommendations with respect to compliance promotion are as follows.

First and foremost, CER must ensure that its staff have a fundamental understanding of the technical requirements and communication requirements in order to both promote requirements and enforce them. This should not be a superficial understanding, nor does it need to be at the level of a subject matter expert (SME). This may require CER staff to gain knowledge.

> *Note: technical requirements are the things pipeline companies must do to comply with the OPR. Communication requirements pertain to engagement of stakeholders by both pipeline companies and the CER in order to gain and build public support and trust.*

Secondly, as indicated above, it is recommended that CER develop technical guidance documents ("guidelines") that describe technical and management system requirements in sufficient detail so that compliance would be unambiguous. These would primarily be for the benefit of pipeline companies but also for other stakeholders. Management system requirements must include communication and engagement with stakeholders.

Thirdly, comes the compliance promotion. This could be through compliance meetings, safety and information advisories, and technical workshops.

The fourth and final aspect is CER compliance oversight – i.e., enforcement (post approval). This is principally done through CER audits of pipeline companies. It is recommended that CER audit teams develop sufficient technical knowledge or include external SMEs to be able to ask the right questions and digest / interpret the information provided by pipeline companies being audited.

In addition, it is recommended that CER engages beyond the organization to stay abreast of how standards are better implemented and what promotion activities have been successful. This could include:

- Participation in technical forums such as the Canadian Society for Chemical Engineering's Process Safety Management Division;
- Liaising with organizations with similar interests – e.g., Environment Canada, Transport Canada, Ontario Technical Standards and Safety Authority, BC Oil and Gas Commission.
- Actively acquiring process safety knowledge through:
  - Attending and presenting at safety conferences;
  - Reviewing related safety publications and professional journals.

Questions 29

How do you want to be engaged by the CER in the development of technical guidance?

The commentary provided herein has been provided by [redacted] P.Eng.

Mr. [redacted] has circa 35 years experience in process safety and risk management across multiple sectors, including pipelines, utilities, nuclear, oil & gas, chemical, propane and transportation. He recently retired from Enbridge after seven years as a process safety technical expert.

[redacted] is uniquely qualified to support the CER and is interested in doing so. He is also quite flexible in how support can be provided. He can be reached at:

[redacted] *P. Eng.*
Principal Engineer and President
Olitech Consulting Inc
olitech@rogers.com
416-294-0217

His qualifications and credentials described above are reiterated below:

- Expert knowledge of most and knowledge of virtually all process safety and risk management technical methods and tools. He thus has full technical knowledge on matters of process safety and risk to support the OPR update in these areas;
- Is seen as a process safety / risk management subject matter expert by peers across Canada;
- He is currently writing a national QRA guideline for the CSChE PSM Division. He has recently written technical guidance documents for (i) risk assessment and (ii) process hazard analysis, for a large pipeline company out of Houston, Texas. While at Enbridge, Mr. [redacted] was a key contributor to the development of the company's process safety management system and risk management framework. With his pipelines experience from Enbridge, he is uniquely qualified to contribute to the development of technical guidance documents.
    - He has provided technical support to the Ontario technical regulator (TSSA) pertaining to methodology development for Risk and Safety Management Plans (propane) and technical guidance documents (Operating Engineers regulation) on and off over a ~ 10-year period.
    - He has already done much of what CER is about to do.
- Mr. [redacted] can provide training and participate in workshops and technical promotion meetings.
    - He is currently developing risk management training for a Canadian multinational energy company.

  - Current instructor of process safety risk assessment course – University of Toronto, Department of Chemical Engineering
  - Past instructor of process safety management course – University of Toronto, Department of Chemical Engineering

  He has training material available and can provide technical training to CER staff and other stakeholders.

- Other career highlights include:
  - 2019 recipient of the Canadian Society for Chemical Engineering national PSM award;
  - Member of the CSA Z767 (Process Safety Management) technical committee