Recommended Changes to the Oil Pipeline Application Process

A presentation to the NEB Expert Panel on Modernization

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Good morning. My name is Dr. Alan Hepburn, and today I represent the Ontario Rivers Alliance. I am a retired engineer from the Canadian nuclear industry, with specific experience in the instrumentation and control of nuclear power reactors. For example, in the 1980s, I led the team that designed the world's first fully computerized shutdown systems for the reactors at Darlington. In the course of this work, I became familiar with the probabilistic analysis of safety risks.

What follows is an engineer's perspective of the application approval process. I tried to get pipeline experts to confirm my points, but while they were verbally supportive, none of them would put their support in writing. Their incomes, after all, are almost exclusively derived from the pipeline industry.

Given the 7 minute time constraint, what follows is a very condensed subset of some of our concerns. A later written submission will provide more comprehensive coverage. You will have to read the recommendation while I provide the background information verbally.

These concerns are based on a review of the EE Conversion Application, that is the 2,000 km converted segment in Ontario. The recommendations are presumably applicable to similar projects.

Now to my list of recommendations...

1. The “industry best practice” bar needs to be raised.
2. The Applicant should not be permitted to make deliberately misleading statements to the public.
3. Environmentally significant release frequencies and volumes must be defined for the entire length of the pipeline, taking route topography, drainage, population density, and water use into account.
4. The regulations should require that the project design include analysis to demonstrate that the release frequencies and volumes meet the required limits.

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1.The Applicant frequently claims that the project meets or exceeds best industry practice. In what follows, I will show reasons why current best practice may not be “good enough”. Even with allowances for recent improvements, the release frequencies and volumes predicted in the EE Application are arguably unacceptable.

2. In the public information sessions, the Applicant claims that zero spills are realizable. Yet the Application shows that this is not expected to be achieved on the project.

3.This one is key to a lot of the recommendations that follow. Without a definition of environmentally significant spill frequencies and volumes, neither the Applicant nor the Regulator has a basis for deciding whether the project is safe and in the public interest.

4.Once these limits have been defined, the Applicant should be required to show that his design will meet them.

5. The values of the modification factors used in the Application to claim improved leak frequency performance need to be justified, and a number of project-specific factors which can only degrade the performance also need to be considered.
6. The data set used for spill frequency and volume prediction must be limited to comparable pipelines.
7. Predicted release volumes should be adjusted to account for pipeline diameter.
8. Requirements must be introduced to define the scope of the required Engineering Assessment when the operating fluid is changed.

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5.The Applicant calculates spill frequencies based on industry historic data. This data is not available for review. The closest I was able to come was an Alberta Government database for spills in that province over a 22 year timeframe. Modification factors are then applied to account for technological improvements. Collectively, these factors add up to a times 3 improvement over historical performance, but no justification is provided for the magnitude of these factors.

For the converted pipeline in Ontario, a spill frequency of once every 13 months is predicted, with volumes in the 100 – 1,000 barrel range. A number of project-specific differences that can only raise the spill frequency are not taken into account.

6.The database used by the Applicant appears to contain data for a wide range of pipelines. The conclusions based on this data pertain predominantly to the large number of small pipelines covered by the database, and are of limited relevance to pipelines intended for the long-haul transportation of crude oil.

7.At 42” in diameter, the converted line would be one of the biggest in North America. Spill volumes calculated for average pipelines need to be adjusted accordingly.

When these factors are taken account, the spill frequency drops to once every 6.6 years, but the volumes go up to an average of 24,000 barrels, not allowing for the increase due to project-specific risks mentioned under point 5. Is this good enough?

8.The relevant design standard is CSA Z662-15. This Standard requires an Engineering Assessment when the operating fluid in a pipeline is changed. The Applicant is left to decide the scope of this Assessment. A number of factors which could render the converted pipeline unsuitable for the purpose intended have not been considered. For example, oil is 14.7 times heavier than compressed natural gas.

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9. If the protection technology of the pipeline material is not good enough for new pipeline, the inferior material should be required to be replaced.
10. A requirement to detect small leaks in the line prior to conversion should be introduced
11. Mandatory standards for horizontal separation of adjacent pipelines should be introduced.
12. An updated version of the CSA standard's Annex E, including release frequency and volume targets, should become mandatory.
13. An appropriate software engineering standard, such as IEC 61511 be required for the design of safety-related software functions.

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9. A key factor in ensuring the integrity of modern pipelines is the use of FBE protection to minimize corrosion. The implication in the Application is that the converted line will be fabricated largely from FBE coated pipe. Yet, digging into the Application, 40% of the length in Ontario is either tape wrapped or "unknown".

10.New pipelines are required to undergo a hydrostatic test. The Applicant has elected not to repeat this test on conversion. Since the converted line would have been in the ground for decades, it may have developed numerous small, undetectable leaks. When the fluid changes from gas to oil, the environmental impact of these small leaks will be much more significant.

11.In the Emergency Response Plan for the Keystone pipeline, failure of the adjacent gas pipeline, and the consequent fire/explosion, is recognized as a threat. Yet the design of the EE line considers the oil line in isolation. The lack of horizontal separation standards was noted as a concern in the incident report on the Marten River gas line fire.

12. The ability to detect leaks will obviously be key in meeting the spill volume targets I mentioned earlier. The requirements for the performance of the Leak Detection System currently included in the CSA Standard are advisory only. The proponent is left to determine its sensitivity and speed of response.

13.The detection of leaks is a safety-related function. The quality of the software development process should reflect this.

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14. The performance of both the Leak Detection System and the operator should be tested periodically. Failure of this test should require the line to be taken out of service until appropriate corrections are made
15. Unless leaks below the detection threshold of the real-time LDS can be shown to be extremely improbable, requirements for the detection of small leaks once the line is in service should be introduced.
16. The IMP and the ERP must be included in the Application before it is considered complete.
17. Technologies are available to dramatically reduce the volume of releases to the environment. Incentives (such as a $10,000 penalty per barrel spilled) should be introduced to encourage the pipeline owners to incorporate effective spill reduction features in their design.

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14.Rather than rely on a rather complex analysis to predict the effectiveness response to spills, means of physically simulating a spill could be introduced at minimal expense.

15.Persistent leaks well below the limits detectable by the on-line LDS can grow over time to volumes of hundreds of thousands of barrels, since they are typically not detected for up to a month. The detection of these leaks needs to be improved.

16.Without the Integrity Management Plan and the Emergency Response Plan, the Application is incomplete, since it does not describe how the integrity of the pipeline will be maintained throughout its operational life, and there is no basis for determining the effectiveness of the emergency response procedures.

17.So, what is to be done? The 2,000 km segment in Ontario is going to leak several thousand barrels every few years. Cleanup is typically 30 – 40% effective, and the more aggressive cleanup techniques may do more harm than good. Clearly, we need to stop the spilled material reaching the environment in the first place. There is an obvious way to reduce releases to the environment by orders of magnitude. A secondary containment should collect spilled material. The cost-benefit analysis of such measures should not be left to the Applicant. Applicants should be given an incentive to adopt such measures.