The essential elements of pipeline risk assessment

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As the need for better risk management continues, pipeline operators’ formal risk assessment methodologies must keep pace in order to remain relevant. This article revisits the essential elements of risk assessment introduced in 2012. This is the idea of developing efficient and appropriate risk management tools to help stakeholders and operators better understand and effectively manage risk.

The inaugurated article of this regular column—vintage 2012—questioned whether formal risk assessment performed on pipelines were truly helping all stakeholders to understand and manage risks. Much has been accomplished since then to help practitioners more efficiently and more accurately measure risk, but the newer ideas and methods have not yet reached all corners of our industry.

The essential elements proposed back in 2011 have now been tested and battle-hardened; they have proven to be a complete and helpful guide to help ensure efficient regulatory oversight. But has pipeline risk assessment been improving? Not according to some regulators, including in the UK, who—since 2011—have voiced scepticism regarding how pipeline operators are measuring risks.

This column seeks to address this situation by offering insights into risk concepts, especially efficient and appropriate ways to measure pipeline risk. Tackling the specifics of pipeline risk in that manner will hopefully make this challenging subject more approachable to those not yet well initiated.

We begin with the immediate concern of how to help ensure efficient regulatory oversight.

The Pipeline and Hazardous Materials Safety Administration’s recent criticisms are not unjustified. There is currently great disparity in approaches and level of rigor applied to risk assessment by pipeline operators.

This is largely due to the absence of complete standards or guidelines covering this complex topic. The disparity leads to inconsistent and problematic oversight by regulatory agencies. Without some standardisation, or at least consistency of understanding, auditors cannot readily determine where deficiencies may lie.

On the other hand, too much standardisation—a mandated, prescriptive approach—is inefficient and stifles innovation in this complex arena.

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Formal risk assessment is relatively immature in most industries, including pipelines. Many relative risk assessment techniques in current use by pipeline operators were developed before formalised and regular integrity management programs (IMP) were established.

As such, the assessments often do not meet the demanding-objections of the more recent regulatory initiatives. As the author of one of the most widely used indexing models, I can attest that such models were not designed for many of the applications now envisioned by regulatory IMP or other uses of risk assessment that are becoming commonplace today.

Due to the simplicity offered by relative or scoring type risk assessment models, their usage became widespread. However, most of the early models will indeed require modifications in order to keep up with the new demands.

A mandated risk assessment approach is not the best solution. That would introduce a prescriptive element with substantial ‘overhead’ related to the establishment and documentation of the approach’s specific requirements.

A better solution is to establish guidelines of essential ingredients necessary in any pipeline risk assessment. Critical elements would be identified and it would be left to the operator’s subject matter expert (SME) to detail these elements.

Properly crafted, a defined list of the essential ingredients in a risk assessment would introduce a minimum amount of standardisation without becoming prescriptive. Specifying that all risk assessments contain, at a minimum, a few essential ingredients ensures that both regulators and the regulated are on the same page.

For example, possible essential elements include the following:

1. A definition of ‘failure’ to accompany a measurement of ‘probability of failure’ (PoF).
2. A measure of consequence potential, separate from the PoF measurement and representation of the full range of possible consequences.
3. Production of a risk profile—all failure mechanisms and consequence potential must be measured at all points along a pipeline, showing changes in risk along the entire route. Summary values of risk—aggregating values from point to point—must be predictable without making true risks.
4. Sufficient resolution—the risk assessment must divide the pipeline into segments where risks are unchanged. While modern risk assessment routinely produces hundreds—of—segments per kilometre, a rule of thumb is that less than about 10—20 segments per kilometre is suspicious.
5. All inputs and results must be measurements (or estimates) expressed in commonly used and verifiable units.
6. The use of measurements (e.g., events/ km-year, mps, etc.) instead of points or scores reduces subjectivity and complexity (it’s actually simpler once the scoring system is discontinued), and allows validation.

A limited amount of standardisation in measuring risk is therefore appropriate and useful to all stakeholders. Expectations are managed, audits are smoother, information sharing is improved and risk management becomes more efficient.

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