Troubles with weightings

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There is currently a great disparity in approaches and level of rigour applied to risk assessment by pipeline operators largely due to the absence of complete standards or guidelines covering this complex topic. The disparity leads to inconsistent and problematic risk management, as was discussed in a previous column.

Most operators desire sound and useful risk assessment to support their decision-making. Weaknesses in an operator’s risk-assessment practice are almost entirely due to insufficient guidance. This column strives to improve this situation by challenging past practice as well as discussing proper methods for pipeline risk assessment.

Focusing this time on our past missteps, the use of ‘weightings’ should be a target of critical review in any risk-assessment practice. Weightings have been used in some older risk assessments to give more importance to certain factors. They were usually based on a factor’s perceived importance in the majority of historical pipeline-failure scenarios. For instance, the potential for AC-induced corrosion is usually very low for many kilometres of pipeline, so assigning a low numerical weighting appeared appropriate for that phenomenon. This was intended to show that AC-induced corrosion is a rare threat.

In this way, weightings steer decision-making. Weaknesses in an assessment and result in a very high probability of failure rather than only some percentage of the total. of pipeline incidents are caused by corrosion and a per cent by geohazards, weightings might have been used to make corrosion point totals 15 times higher than geohazard point totals (assuming more points means higher risk) in an older scoring methodology. But a geohazard phenomenon is a much localised and very significant threat for some pipelines, and may dominate all other threats in some segments. Assigning a per cent weighting might mask the reality that, perhaps, 90 per cent of the failure probability on this segment is due to geohazards. So, while the assumed distribution may be valid on average, there will be locations along some pipelines where the pre-set distribution is very wrong. It would not at all be representative of the dominant failure mechanism at work there.

The weightings will often completely mask the real threat at such locations. This is a classic difficulty in moving between the behaviour of statistical populations and individual behaviour. The former is often a reliable predictor – hence the success of insurance actuarial analyses – but the latter is not.

In addition to masking location-specific failure potential, use of weightings can force the higher-weighted threats to be perceived ‘drivers’ of risk, at all points along all pipelines. This is rarely realistic. Risk management can become driven solely by the pre-set weightings rather than actual data and conditions along the pipelines. Forcing risk-assessment results to resemble a predetermined incident history will almost certainly create errors.

Since weightings can obscure the real risks and interfere with risk management, their use should be discontinued. Using actual measurements of risk factors avoids the incentive to apply artificial weightings (see the previous column on the need for weightings). Therefore, migration away from older scoring or indexing approaches to a modern risk-assessment methodology will automatically avoid the misstep of weightings.

One can easily envisage numerous scenarios where, in some segments, a single failure mode should dominate the risk assessment and result in a very high probability of failure rather than only some percentage of the total.