

JANA Executive Brief: Lessons for Risk Based Integrity Management of Gas Storage Systems from Gas Transmission and Distribution Applications

“Doing nothing is not as bad as things can get for risk management. The worst thing to do is to adopt a soft scoring method or an unproven but seemingly sophisticated method (what some have called “crackpot rigor”) and act on it with confidence.”

-Douglas W. Hubbard, The Failure of Risk Management¹

Implementation of a risk-based approach to Integrity Management for gas Storage Systems is being considered by many operators. JANA has developed Fully Quantitative risk approaches to Transmission and Distribution Pipeline Integrity Management programs over the past decade. The learnings from these applications can be leveraged as a similar approach is brought to bear on Storage Systems. This Executive Brief outlines key elements to the successful application of Fully Quantitative risk approaches to gas reservoirs and associated wells.

The Evolution to Risk-Based Integrity Management

The issuance of the gas Transmission and Distribution Integrity Management Program regulations (DIMP / TIMP) drove a transition from a prescriptive, activity-based approach to Integrity Management to a more risk-based approach. A similar risk-based approach is now being considered for gas storage systems.

While the risk-based approach to storage facilities is still evolving, there are many lessons from the implementation of risk-based Integrity Management to gas transmission and distribution pipelines that can be applied to gas storage systems. In applying these lessons, an operator can ensure that an effective and functional approach is developed for storage facilities.

The Objective of Risk-Based Integrity Management

Gas pipelines and storage systems have an excellent safety history when compared to alternative means of transporting and storing gas. This is because the integrity of gas systems has always been actively managed. Historically, however, this has been through a prescriptive, activity-based approach with Subject Matter Expert (SME) input. The intent of a risk-based approach is to optimize the Integrity Management process by clearly identifying potential integrity risks and optimally directing integrity efforts to eliminate or minimize these risks. In essence, moving from an activity-based approach to a risk-based approach will provide even higher levels of integrity through greater risk awareness.

The Key Foundations for Effective Risk-Based Integrity Management

Some approaches to risk-based Integrity Management in gas transmission and distribution systems have worked better than others (and, arguably, some have not worked at all). There are a few key

¹ Douglas W. Hubbard, *The Failure of Risk Management: Why It's Broken and How to Fix It*, Hoboken, NJ: John Wiley & Sons, Inc., 2009.

considerations for ensuring the implementation of an effective risk-based Integrity Management program.

- **The right tool for the job must be selected**
 - The key to risk-based Integrity Management is the risk assessment methodology – the specific method used to assess risk. If the right approach to risk assessment is not selected, then the effort of implementing a risk-based Integrity Management approach is likely to provide little or no return. This is analogous to building a house on a sand foundation.
- **Selecting the right tool requires a clear definition of objectives and needs**
 - There are specific requirements for the underlying risk assessment methodology that are defined by the specific nature of gas systems and the objectives of risk-based Integrity Management. A key lesson that can be drawn from some of the missteps observed in gas transmission and distribution efforts to develop risk-based Integrity Management is that these requirements need to be clearly defined and the right risk modeling approach must be selected to meet these requirements. If this is not done properly then the effort is likely to provide limited value.
 - For example (a very short list):
 - Long range planning requires a risk assessment method that projects risk into the future (and not just current risk)
 - Budget optimization requires quantification of risk (i.e. an absolute, as opposed to relative, measure of risk) to set required spending levels to keep risk at acceptable levels, quantification of the risk reduction versus cost (risk value) of potential mitigations and the ability to compare these values across and within asset classes and types
 - Low Probability – High Consequence (LP-HC) events dominate the risk picture for gas systems, including Storage Systems. A functional risk assessment methodology needs to provide decision makers insight into these specific type of risks
- **Some tools have been shown to be inherently flawed**
 - Another key lesson is that there is scientific research in the broader risk assessment field that clearly shows that some approaches are better than others for assessing risk and, further, that some just do not work
 - A common approach that was originally used to develop a Risk Assessment approach for Transmission and Distribution pipelines was that of relative risk measures based on semi-quantitative or purely SME Scoring or Index type models. These models have an inherent simplicity and, at first, they appear to have many advantages. Further, they appear to address the ever-present concern of not having “enough data”. However, the scientific research in the broader field of risk management has concluded that these approaches simply do not work. Dr. Tony Cox, a PhD in Risk Analysis from MIT and a lead researcher in the field, has concluded that scoring type approaches are often “worse than useless.”¹
 - A short list of some of the identified issues with relative Scoring or Index type approaches:
 - Range Compression (i.e. limited risk differentiation, no insight into LP-HC events)

- Risk Masking (common math errors, as identified in the San Bruno investigation)
- Presumption of regular intervals
- Presumption of independence (i.e. issues with addressing interacting threats)
- Relative measure of risk do not provide the necessary inputs needed to optimally direct Integrity Management
- Inability to perform Scenario (What If) Analyses on Mitigations

The Right Tool for the Job

As the transition to risk-based Integrity Management continues to evolve in gas transmission and distribution pipelines, there is increasing discussion around quantitative and probabilistic approaches to risk and increasing awareness of the limitations of Relative Risk Scoring and Index model approaches.

The right tool for the job – the right approach to Risk Assessment for effective risk-based Integrity Management of Storage Systems – is a quantitative approach for risk, driven by the mechanisms driving failure. While challenging to develop, quantitative risk assessment approaches can be (and are being) successfully applied to gas storage systems. The basic tools needed to develop these models have been established by JANA and proven in transmission and distribution pipelines. In addition, these methods are specifically designed to address data issues. Ultimately, a fully quantitative risk approach to storage systems will result in excellent Integrity Management and improved business results.