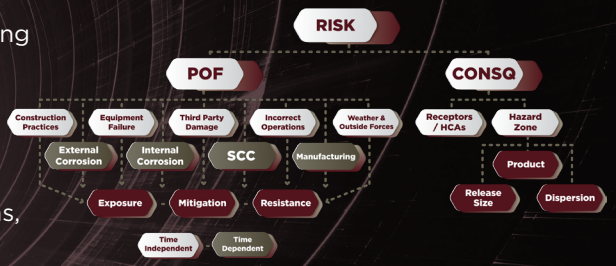
INTEGRITY SOLUTIONS

PIPELINE & FACILITY QUANTITATIVE RISK ANALYSIS (QRA)

As PHMSA pushes for operators to migrate from relative risk to quantitative risk modeling, Integrity Solutions® Ltd can lead the way. Our Pipeline & Facility Integrity Manager™ (PFIM™) risk-modeling software has been a PHMSA-accepted industry leader in risk-modeling for years, and PFIM is fully programmed to perform QRA modeling.

Our risk management experts can help transition you to PHMSA-preferred quantitative risk using PFIM QRA, just as we provide traditional relative-risk modeling using 11 different algorithms, for a wide-range of your pipeline facilities. Our QRA results provide you with an absolute risk value, allowing optimal allocation of your preventive and mitigative (P&M) measures budget.



500+
Years of Risk Analysis Experience

20+
Satisfactory PHMSA/State Audits

100,000+
Miles of Pipeline Analyzed

QUANTITATIVE RISK ANALYSIS PROCESS

1 ENHANCED ALGORITHM CUSTOMIZATION

Facilitated, operator SME Evaluation of the QRA Algorithm's *threat attack rate* and consequence exposure, mitigation, and resistance variables and attributes.

2 ENHANCED INFORMATION INTEGRATION

Gathering and Integration of asset design, performance, and geography; nearby population, environment, and business factors; and other required QRA algorithm data.

3 ENHANCED RISK ASSESSMENT

Consequence of Failure (CONSQ) in relation to hazard receptors – people, the ecology, and infrastructure.

Probability of Failure (POF) – QRA's evolution of an asset's likelihood of failure, taken to the absolute level via enhanced data and mathematics.

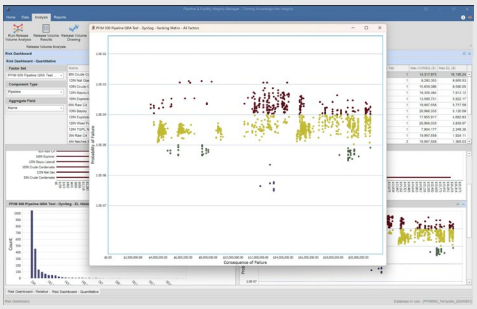
4 ENHANCED RESULTS DOCUMENTATION

Expected Loss (EL) – the ultimate result of the PFIM QRA process, providing operators with an absolute risk value that is a much more comprehensive result than traditional *risk of failure* scoring.

EL = POF x CONSQ

RISK ANALYSIS PROCESS

DETAILED LOOK



The ISItd® PFIM QRA algorithm incorporates all the original core enhancements of PFIM and adds the ability to calculate ***time-to-failure*** rates — allowing the final result sets to be probabilistic in nature and providing operators with an absolute risk value.

1 THREAT ATTACK RATE

Three possible types of exposure rate – the rate determined using ISItd's Anomaly Data Manager™ (ADM™) software, the SME rate, or the estimated rate.

- The ADM rate is based on performance records over time, including data from ILI results and other integrity assessment data.
- The SME rate is supplied by the operator's SMEs and is based on operational knowledge of the asset.
- The estimated rate is based on the product of the available rate and the exposure index, where "available" means the potential maximum rate that could be achieved.

Failure attack rates, along with resistance *indices* to quantify the effective wall thickness of piping (or applicable attributes for other assets), enable the QRA algorithm to fully establish a *time-to-failure* or an *event-per-mile-year* value for each threat.

2 EXPOSURE VALUE & RESISTANCE VALUE

PFIM QRA uses an enhanced process to better distinguish the attack rates and resistance factors between time-dependent and time-independent threats.

For time-dependent threats, the traditional exposure index becomes only one of two factors in determining the *exposure value* and the traditional resistance index becomes only one of two factors in determining the *resistance value*.

3 HAZARD RECEPTORS

Hazard receptors are measured as the cumulative *impact on population*, *impact on environment*, and *impact on business* due to a potential release.

- Each of these three impact types are determined by multiplying its consequence impact with the applicable rate of influence.
- The rate of influence is based on SME opinion of hazard receptors in proximity to the asset or is based on an industry-provided statistic, such as PHMSA's value of a statistical life.

4 EXPECTED LOSS (EL)

EL is the ultimate result of the PFIM QRA process, derived from probability of failure (POF) and consequence of failure (CONSQ): **EL = POF x CONSQ**

- The EL for each identified segment is used to risk-rank the segments, allowing you to better understand the pipeline system, establish priorities for the P&M measures, and take appropriate action.
- EL is expressed in U.S. dollars per mile, per year for each dynamically segmented pipeline section or facility asset component, providing you with a real-world value instead of just a relative score.

QRA math is complex!

But never fear! An Integrity Solutions professional will guide you through data acquisition and integration, operator-customized algorithm setup, and will expertly run the resulting customized PFIM QRA program to provide you with absolute, probabilistic risk results.

TURNING KNOWLEDGE INTO INTEGRITY®

WE ARE ANALYSTS. WE ARE PROBLEM SOLVERS. WE ARE PIPELINE EXPERTS.

We are a devoted group of uniquely qualified and knowledgeable professionals who deliver specialized integrity management services and software solutions to the U.S. oil and gas pipeline industry. Our customers rely on us to guide them through the complicated, and always changing, integrity management process from the initial jurisdictional reviews to ongoing risk analysis and integrity management.

INTEGRITY SOLUTIONS

integritysolutionsltd.com

Denver, Colorado
(303) 652-5628

Houston, Texas
(281) 962-6104