

# THE CROSS COUNTRY GAS TRANSMISSION RISK ANALYSIS AND MODELING CONSULTANCY SERVICES

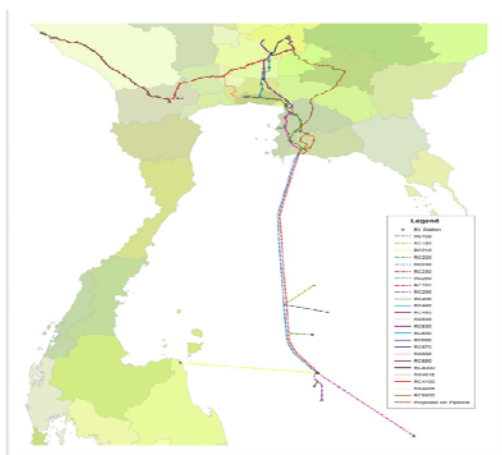


## REQUIREMENT

Risk Expert is a straightforward methodology that can be used by pipelines operators for modelling the qualitative threat assessment of their pipelines and to define their integrity policy regarding the prioritization of corrective actions and the planning of inspections.

Risk Expert enables the operators to create a model that identifies and semi-quantifies the threats of pipelines such as objects (crossings, defects etc.) and pipeline environment (soil type, population density etc.).

Risk Expert reflects the ASME B31.8S code and other standards such as API etc. It is applied to fulfil the most important requirements on Pipeline Integrity Management. It is based on the analysis of the current threat level of pipelines by means of brainstorm sessions, company expert's judgement, Bureau Veritas consultancy and international literature research.



## CONSULTANCY

The consultancy scope include:

- Brainstorm with a team of experts, from the pipeline operating company, to identify the threats to pipeline integrity.
- Classification of threats according to the codes used by the pipeline operator. Many categories and sub-categories are used (e.g. generic category such as corrosion, specific category such as SCC).
- Identification of factors inducing threats (e.g. MAOP for SCC).
- Ranking threats.
- Weighing inducing factors.
- Definition of algorithms to calculate each threat, together with data source.
- Definition of corrective measures for each inducing factor.
- Definition of the integrity company policy regarding the prioritization of corrective actions and the planning of inspections (the threat level of the pipeline will determine the inspection technique and / or frequency).

Each TAME process requires an important investment (in time and knowledge) from the pipeline operating company. Nobody can understand better the threat environment of the pipelines than company experts, therefore a TAME team must be set up at the beginning of each TAME process.

The basis of these calculations is from a system of groups – groups of reasons for failure or losses as a result of failure. By assigning weights and numbers against each group, the operator can define a system most suitable to each level of risk, based upon their opinion, against the entire pipeline.

Assessing the level of risk is done by establishing those influential factors (for example, a nearby built-up area, a reserve, a crossing with a highway, an underwater crossing) and identifying their level of risk

according to the chosen system of weight factors.

## RISK FACTOR

The risk model is made up of complex and elementary threats which each have individual scoring and weights. These can be seen in more details in the graphs below. Overall and Individual Risk Factors Scoring Graphs

### Risk Model Weights - Third Party Interference

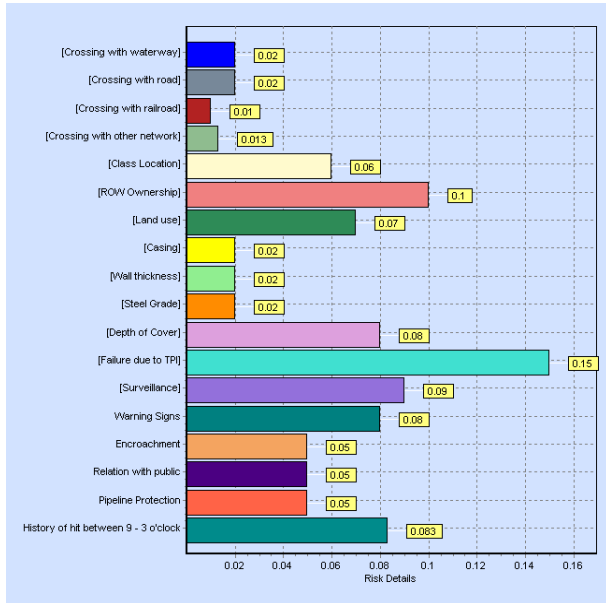


Figure Risk Factor

- Metallurgical analysis of coupons
- Metal fatigue analysis and pressure cycling operational data
- Root cause analysis and incident investigations
- Smart pig result analysis

Although Gasunie is familiar with the API approach to Risk base, recommendation to develop an embedded in-house methodology that enables Risk programs to be developed in a much shorter timeframe with a documentation process that is fully auditable and traceable in the same way as the API approach.

## RISK MODEL

Consultancy expertise, materials and corrosion team provides risk based assessment and inspection workshop for identify and conclusion on various stages of the threat by pursuing a systems engineering approach to the problem. This includes the development and oversight of risk-expert diagram and the detailed selection of appropriate condition monitoring points and surveillance locations.

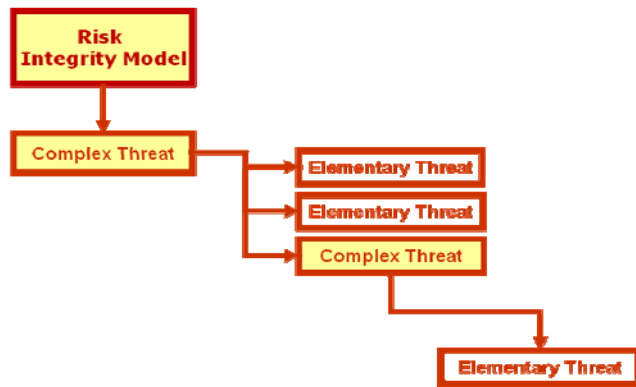


Figure Risk Model

- Depth of cover surveys
- Population density surveys
- Land use and activity surveys
- One-Call activity levels surrounding the pipeline right-of-way easements
- Aerial patrol records, encroachment sightings, corrosion monitoring and maintenance program
- Internal corrosion coupon monitoring program
- Right-of-way condition monitoring and maintenance leak history reports
- Excavation report and third party crossing line inspections
- Pipeline coating condition reports
- Third party pipeline crossing inspections and cathodic protection interference
- Metallurgical analysis of corrosion coupons and pipe cut outs

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