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## Pipeline Reliability Risk Assessment

*By Michael J. Humphries, Ph.D.*

Carmagen Engineering, Inc. recently conducted a study for an overseas client to identify the risk associated with a change in quality of gas fed to a natural gas pipeline. The corrosion impact of the change in gas composition was evaluated using published data and gas compositions and operating data supplied by the client. The resultant change in risk was assessed considering a range of damage scenarios according to the methodology defined in ASME B 31.8S. This standard covers managing integrity of onshore pipelines that handle nominally dry gas.

The method was based on evaluation by an experienced Subject Matter Expert, and considered damage scenarios covering the anticipated service life of the line. Our experience base includes reliability assessments on overseas pipelines ranging from 2 to 500 miles in length and 6 to 48 inches in diameter, on land and under water. The analysis identified cases where the damage scenario showed a potentially increased risk of an incident due to the change in operation. The various damage scenarios were plotted on a risk matrix to illustrate their criticality and the need for corrective action.

A range of mitigation measures were considered and evaluated to assess the level of risk reduction which each would accomplish. The effect of each mitigation measure in reducing the risk was then plotted on the risk matrices to clearly identify the benefit of each remedial measure. Using this approach, a mitigation measure was chosen that resulted in reducing the risk of damage to an acceptable level, similar to that of the current operation. The client was able to show to local authorities that the change in gas composition could be accomplished without an increased risk of damage to the pipeline.

### About the Author

*Mike Humphries has over 40 years experience as a Materials Engineer in the power generation and petroleum industries, including both the refining and pipeline sectors. His areas of specialty include corrosion, metallurgy, materials engineering, pipeline engineering, heavy wall vessel fabrication, water treating, inspection, and general fabrication.*

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### Work Highlights

#### Fired Equipment/Heat Exchangers

- In a multi-year activity, performed engineering design reviews of all fired equipment being provided for a major refinery clean fuels project being engineered in the US for a client in the Middle East. This work involved review of all contractor and equipment supplier design details and calculations with respect to their conformance to the owner's specifications. Recommendations were made to correct deviations that were identified.

#### Mechanical Engineering

- Reviewed design of existing FCCU regenerator air distribution grid that had experienced multiple failures and cracking of the support skirt and grid itself over the years. After performing Finite Element Analyses, design changes were recommended for a planned replacement grid that would improve its mechanical integrity. These included improved attachment details to minimize stress concentrations, welding electrode recommendations, installation of grid metal thermocouples, and a modified grid hole blanking pattern.

#### Process, Operations & Safety

- Provided troubleshooting support on an existing naphtha reformer located in North America that had major equipment and operational issues.