

Prioritizing Risk for Pipelines Using Geographic Information Systems

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Abstract

Risk for liquid pipelines includes the possibility of failures resulting in environmental damage that can also significantly affect corporate value and reputation. Risk is generally quantified by evaluation of a pipeline's physical integrity; however, this process overlooks the potential magnitude of environmental consequences and therefore does not address the actual risk to the pipeline operator.

In contrast, Stantec's pipeline risk assessment methodology combines probability-of-failure engineering analyses with risk analytics to assess environmental impacts, allowing for prioritization of those pipeline segments where overall risk is the greatest. Coupling the environmental consequence evaluation with engineering integrity analyses provides companies a more fulsome risk assessment, and assists with identifying the most appropriate risk reduction measures. Stantec assessments systematically evaluate the pipeline in a joint by joint risk analysis covering several threat variables: identified overland flow, subsurface transport, and downstream flow paths; and quantified environmental consequences to onshore and offshore environmental receptors.

Stantec integrates Geographic Information Systems (GIS) into the risk assessment work flow to efficiently manage and analyze big data, and serve as the framework to host fate and transport modeling of the spilled product from potential breach points. GIS is capable of identifying potential overland spill pathways along pipelines and simplifying the complex spatial relationships of pipeline infrastructure, hydrologic flow, and other critical variables such as land cover and slope that contribute to a product's ability to travel overland and downstream towards High Consequence Areas.

Stantec's GIS analysis precisely identifies Contributing Pipeline Segments, or those specific pipeline segments potentially capable of impacting nearby High Consequence Areas. Contributing Pipeline Segments are assigned a hazard score according to a number of factors using proprietary software. Prioritization based on hazard scoring helps pipeline companies properly allocate limited operational budgets to those locations where overall risk is the greatest, thereby protecting human health and the environment. Pipeline hazard categorization is used during design and routing to proactively minimize risk as well as during operations for existing pipelines.

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Heidi Tillquist is Stantec's Director of Oil and Gas Risk Management. She has over 26 years of experience in environmental consulting, including environmental permitting, environmental toxicology, pipeline and environmental risk assessment, National Environmental Policy Act (NEPA) analysis, fisheries and wildlife biology. She and her team have evaluated over 30,000 miles of pipelines and worked in 32 states of the U.S. and 6 provinces in Canada. Ms. Tillquist has conducted numerous risk assessments for regulatory agencies and the oil and gas industry and provides technical expertise in all life cycle phases. Ms. Tillquist routinely provides expert witness support for oil and gas clients regarding the probability of a release of petroleum hydrocarbons from oil and gas projects and the potential for subsequent impacts to the environment.