

Introduction to the report *Understanding the Mechanisms of Corrosion and their Effects on Abandoned Pipelines* for the PTAC website

Pipeline abandonment refers to permanently taking a pipeline out of service. It is a subject that requires research to fully understand life cycle implications. Depending on a number of factors, sections of pipeline may be removed or abandoned in place. In the latter case, steel will corrode and the abandoned pipe will lose structural integrity. Ultimately, the corroded pipe will collapse and break into fragments under the load of soil and traffic over it.

This study by Det Norske Veritas (DNVGL) was commissioned by the PTAC Pipeline Abandonment Research Steering Committee (PARSC) to better understand the mechanisms that lead to corrosion and loss of structural integrity over time. Background information about PARSC is provided below. This DNVGL study included a literature review to identify relevant scientific and engineering models for corrosion and structural integrity. Soil data from the United States National Bureau of Standards was accessed. The study used analytical models to predict the time to collapse of abandoned pipelines and determined that time to collapse was dependant on a number of variables, including (i) pipeline diameter, wall thickness and yield strength, (ii) soil type and soil properties and (iii) pipeline depth of cover. Therefore, predictions need to be made on a case-specific basis. The study also estimated soil subsidence after the collapse of a corroded abandoned pipe. In summary, the study provided analytical models useful to estimate the time to collapse and resulting soil subsidence for abandoned pipelines. It is acknowledged that the models developed within this study need further development and refinement.

PARSC requested that DNVGL calculate time to collapse and resulting soil subsidence in circumstances typical for Canadian agricultural soils and the pipelines traversing them. The following tables report calculated results for 3 soil types, 6 pipeline diameters (3 thicknesses each) and 4 depths of cover when bearing the load of a Brent 1082 grain cart loaded with wheat (72,000 lbs or 32,659 kg per axle).

The study report was peer reviewed by Dr. Frank Cheng, Canada Research Chair in Pipeline Engineering, University of Calgary and Dr. Claudio Ruggieri, Professor of Structural Engineering, University of São Paulo, Brazil.

Pipeline Abandonment Research Steering Committee Background

The Canadian Energy Pipelines Association (CEPA), the National Energy Board (NEB), the Alberta Energy Regulator and the Canadian Association of Petroleum Producers have collaborated on technical and environmental issues associated with pipeline abandonment. In 1996, the NEB published a review document titled "[Pipeline Abandonment – A Discussion Paper on Technical and Environmental Issues](#)". In 2007, CEPA published a report titled "[Pipeline Abandonment Assumptions](#)" which discussed technical and environmental considerations for development of pipeline abandonment strategies. A comprehensive review was undertaken by the NEB as part of the Land Matters Consultation Initiative (LMCI) which involved four discussion papers on the different topic areas, 45 meetings and workshops in 25 communities across Canada, and written submissions from 13 parties. The [final LMCI report](#), published in 2009 recommended that knowledge gaps on the physical issues of pipeline abandonment be addressed. Thus, DNV was commissioned to conduct a literature review regarding the current understanding worldwide with respect to the physical and technical issues associated with onshore

pipeline abandonment and use the results of the literature review to critically analyze and identify gaps in current knowledge, and make recommendations as to potential future research projects that could help to fill those gaps. DNV published this [Scoping Study](#) in November 2010.

CEPA and PTAC have established the Pipeline Abandonment Research Steering Committee (PARSC) as a framework for collaboration to guide and direct innovation and applied research, technology development, demonstration, and deployment in order to address knowledge gaps summarized in the DNV Scoping Study. Research findings from the PARSC projects will be shared on a broad scale throughout the pipeline industry, the oil and gas industry, as well as with regulators, government agencies, and other stakeholders.