

# Protecting underground pipelines from corrosion in sub-zero environments

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Northern Canada's permafrost and semi-permafrost environment is a huge challenge for designing and engineering underground pipelines, and a critical aspect of protecting both the pipeline and this sensitive environment involves the design of an effective corrosion protection system.

One of the most common methods to protect buried infrastructure—such as oil and gas transmission pipelines—from [corrosion](#) is the application of an external coating.

"Although great advances have been made within the past 30 years in terms of coatings reliability and longevity, it's still desirable to implement a back-up plan: cathodic protection," says Paul Duchesne, manager of media relations for Natural Resources Canada.

What is cathodic protection? It's a method used to protect buried pipelines from corrosion, which involves attaching sacrificial anodes to a [pipeline](#)'s coated steel. Sacrificial anodes are more electrically active than steel, so corrosive currents exit through the anodes rather than the steel.

Since the implications of partially frozen ground on a pipeline's cathodic protection system weren't entirely clear, Natural Resources Canada researchers decided to explore and evaluate the use of cathodic protection in permafrost regions.

In a paper published in *Corrosion* journal, the researchers explain how cathodic protection systems function at low temperature and describe the various aspects of cathodic protection application in sub-zero temperatures.

The researchers concluded that the application of cathodic protection systems may provide long-term protection of the infrastructure from corrosion when combined with high-performance coatings—as long as the system is designed and operated to overcome high electrical resistance frozen phases.

"Ultimately, we hope that our research will contribute to the safe and reliable operation of underground infrastructure such as oil and gas transmission pipelines, production facilities, and storage tanks," says Duchesne.

**More information:** The paper, "Applicability of Cathodic Protection for Underground Infrastructures Operating at Sub-Zero Temperatures," by Sankara Papavinasam, Tharani Pannerselvam, and Alex Doiron, appears in NACE International's journal, *Corrosion*, Sep. 2013, Vol. 69, No. 9, pp. 936-945. See: [dx.doi.org/10.5006/0881](https://doi.org/10.5006/0881)

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