

Case Study – Sharing an AC Mitigation System

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ABSTRACT

An alternating current (AC) interference study was conducted in 2019 following a utility development project that included constructing a new substation and upgrading approximately 24 km of new AC transmission powerline sections in Alberta, Canada. The study comprised six transmission powerlines owned by one utility and eight pipelines owned by two different operators.

The modelling results showed touch voltage hazards under steady-state and fault conditions and susceptibility to AC corrosion and coating stress above the established limits in the unmitigated state.

A shared AC mitigation system was designed to eliminate the hazards caused by AC interference on all eight pipelines. This approach reduced overall mitigation requirements, number of site visits, construction footprint, environmental impact, and project costs.

This paper describes the mitigation system's design, installation, and commissioning and discusses the benefits of a shared AC mitigation system approach.

Keywords: AC corrosion, AC interference, AC mitigation, pipeline integrity.

INTRODUCTION

AC interference analysis between high voltage AC (HVAC) powerlines and buried pipelines is a matter of current interest due to the growing number of right-of-ways shared between powerline and pipeline infrastructure. This is only expected to increase as the worldwide energy demand grows considerably over the next 30 years,¹ and stricter environmental regulations and policies are applied. Therefore, AC interference will continue to be an issue of concern for powerline and pipeline operators to protect the public, environment, and maintain asset integrity.

AC interference hazards on pipelines resulting from nearby powerlines can occur under steady-state (normal operation) and fault conditions. Under steady-state conditions, the pipeline is subject to AC voltages induced by electromagnetic coupling between the pipeline and nearby HVAC powerline. These induced voltages can result in electrical shock to any person who touches an appurtenance that is electrically continuous with the pipeline. Induced voltages can also result in accelerated corrosion at pipeline coating defects, i.e., AC corrosion, as the AC current is discharged through any coating defects.

Under fault conditions, e.g., line-to-ground faults, the pipeline is subject to induced voltages due to electromagnetic coupling and currents flowing in the ground from the powerline structures, known as conductive coupling. Under these conditions, the AC interference can result in safety hazards for personnel, damage to the pipeline coating, and damage to the pipeline itself.²⁻⁴

This paper describes the AC interference analysis conducted as part of a power utility development project and the shared mitigation designed to prevent AC interference hazards under both steady-state and fault conditions, following industry standards in Canada.⁵⁻⁸

STUDY BACKGROUND

In 2019, a power utility development project proposed constructing a new substation and approximately 24 km of new transmission line sections. The project comprises six 240 kV high voltage AC transmission lines owned by the same power utility. Short segments of the existing transmission lines were to be removed or altered.

The six powerlines included in the project run in parallel, i.e., are co-located, with eight existing pipelines owned by two different operators. The total length of powerline/pipeline co-location covered in the project is approximately 120 km. The separation distances between the powerlines and pipelines along the co-locations on average vary between 30-70 m. Figure 1 shows a simplified configuration of the area of study. Each pipeline is identified by two digits as follows: #-#. The first digit represents an Operator #, i.e., 1 and 2, and the second digit represents the pipeline #, i.e., 1 to 2 for Operator #1, and 1 to 6 for Operator #2.

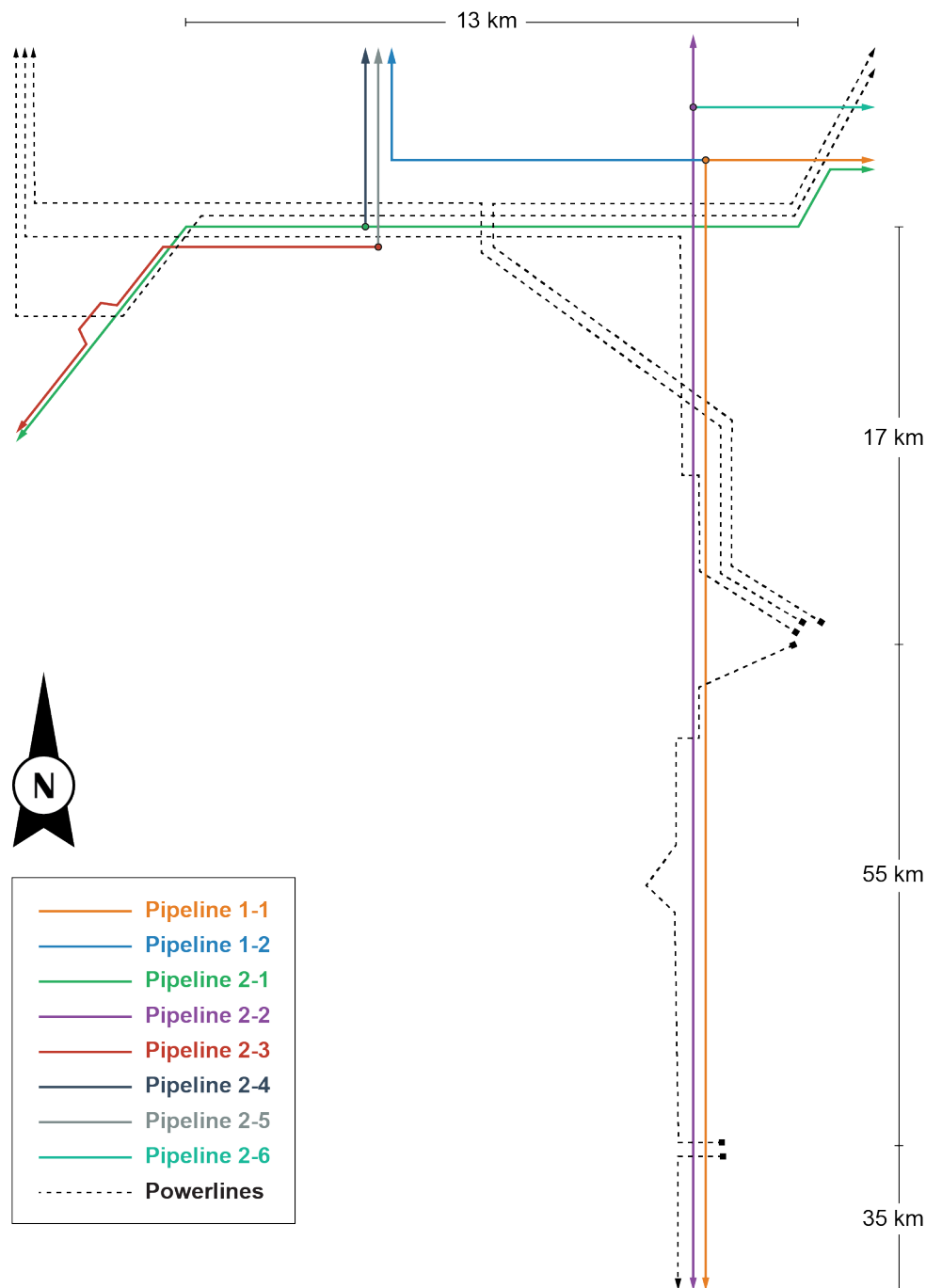


Figure 1: Simplified Pipeline and Powerline Co-location Configuration

Table 1 summarizes the pipeline data provided by the two operators involved in the project.