

Laying the Foundation for an Engineered and Integrated Approach to Pipeline External Corrosion Protection

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ABSTRACT

With a growing and aging liquids asset base covering over 17,000 pipeline miles throughout the U.S. and Canada, as well as Enbridge's move to a High-Reliability Organization (HRO), the Enbridge External Corrosion Prevention (ECP) team is working on a shift from a compliance and time-driven routine maintenance program to a predictive forecasting strategy. Coupled with advanced diagnostics and modeling, such an approach can provide useful information for Long-Range Forecasting (LRF). Utilizing a comprehensive in-line inspection (ILI) and direct examination (DE) program with state-of-the-art predictive technologies, sound engineering, and risk management practices, the Enbridge Pipeline Integrity ECP team is developing a unification of corrosion monitoring and mitigation strategies that will minimize and effectively manage external corrosion risks. The expected outcomes of such an approach are increased safety and reliability of the pipeline system along with improvements in operating efficiency.

The efforts are consistent with general industry trends to capitalize more on extensive historical data and increased use of analytical tools including advanced diagnostics and modeling to help manage the relevant threats including DC interference, AC interference, and coating degradation among others. This paper will review the activities of this evolving initiative thus far and planned steps moving forward.

Key words: pipeline integrity, pipeline safety, cathodic protection, interference, external corrosion, in-line inspection, corrosion growth rate, modeling, risk, management program, proactive integrity management

INTRODUCTION

Enbridge is proposing to develop a program that utilizes state-of-the-art technologies and proven inspection methods to prescribe interventions related to external corrosion mitigation using a predictive, integrated approach. This new program embraces complex problems by collecting, analyzing, and integrating environmental, pipeline integrity, and corrosion control data to predict external corrosion risk with sound engineering models (mechanistic, reliability and risk) to anticipate, prevent, and contain unexpected events. The program emphasizes continuous improvement within the HRO culture that effectively manages the risk of failure, avoids unfounded oversimplification of the data and interpretation, is committed to resilience, sensitive to operations, and capitalizes on expertise.^[1]

OBJECTIVE

The objective of this paper is to describe the foundation of an integrated approach to external corrosion management (IECM). When finalized, the program will allow Enbridge to realize improvements in efficiency and safety of pipeline system operation, personnel, and the public at large.

INTEGRATED EXTERNAL CORROSION MANAGEMENT (IECM)

The following sections describe the steps involved in an integrated approach to external corrosion management for the Enbridge pipeline system. This approach utilizes a continuous improvement cycle as shown in figure 1 below.

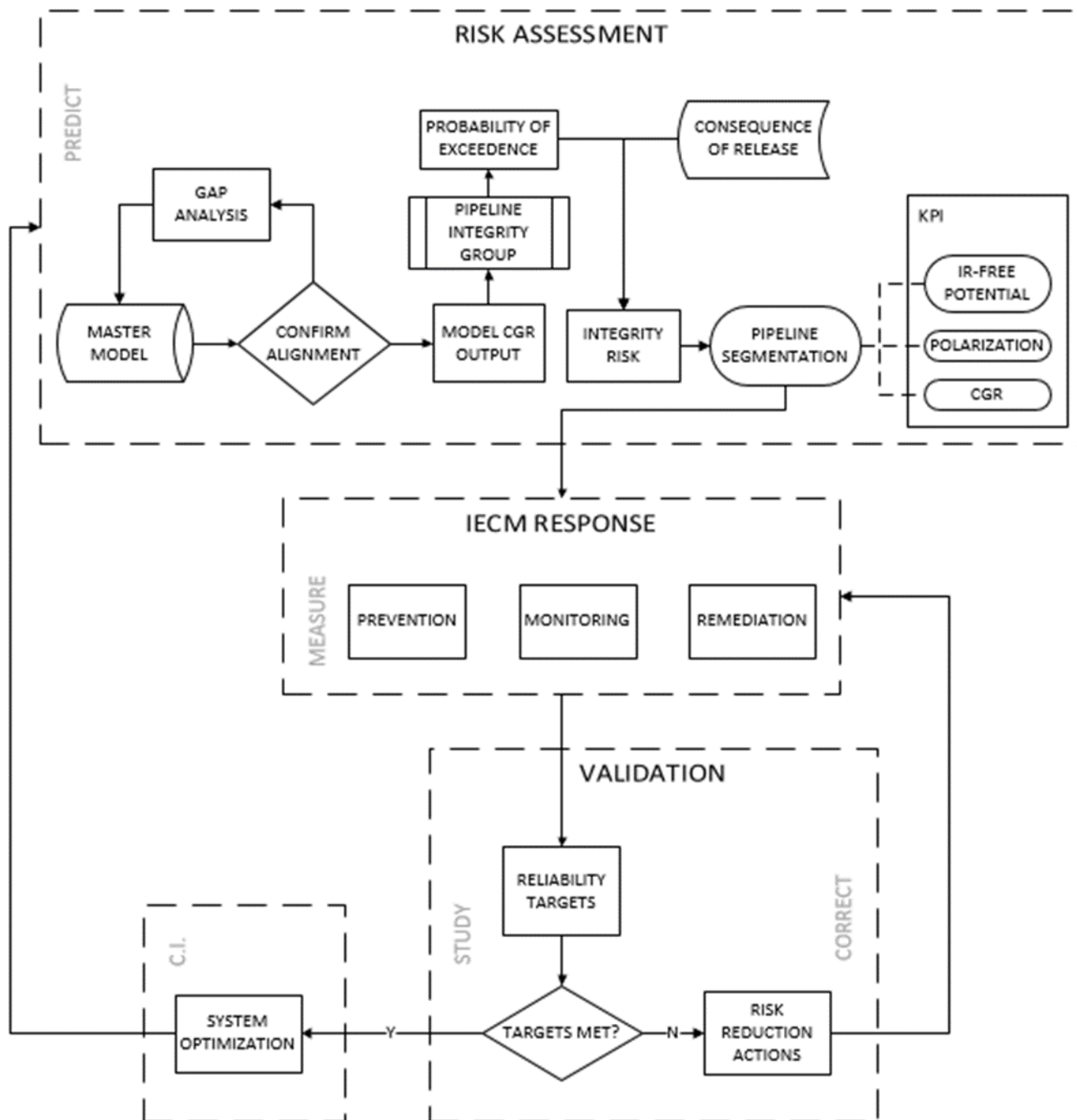


Figure 1 - Program Framework

Risk Assessment (*Predict*) Phase

The IECM continuous improvement cycle begins with a robust prediction phase aimed at quantifying relative risk across the Enbridge pipeline network as shown in Figure 1 below. The prediction phase begins by reviewing the mechanistic model to determine suitability for an integrated approach.