



EROSION PROGRAM SERVICES

As FAC programs continue to mature and mitigate the risk of piping failure, the nuclear industry has turned its attention to degradation that occurs due to various mechanical erosion mechanisms. These mechanisms: Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particles Erosion, have resulted in leaks, ruptures, unplanned shutdowns, and the ongoing expense of inspection, repair and replacement. Significant industry operating experience has shown that a programmatic approach must also be taken to combat erosion degradation and reduce the risk of piping failure.

Recent industry guidance has suggested the development of a separate program to mitigate piping degradation to erosion mechanisms. True North's Erosion Program service offerings include the development of each of the key Erosion Program elements:

- Program Implementation Procedures
- Basis Document
 - Erosion Susceptibility Analysis
- CHECWORKS SFA Erosion Modeling
- Risk Ranking/Prioritization
 - Susceptible Non-Modeled Analysis
- Inspection Planning & Management
 - Inspection Scope Development
 - Data Evaluation & Trending
- Long-Term Strategy
- Program Assessment
- Training

Program Implementation Procedures

True North will update existing or develop from-scratch program implementation procedures for a comprehensive Erosion Program. Procedures can be tailored to site-specific requirements or broad corporate objectives based on client need.

Basis Document

Similar to the FAC Program, the basis document of an Erosion Program should be developed through a systematic evaluation of all station piping and components. True North's *Erosion Susceptibility Analysis* is prepared using a 'drill down' approach to determine which systems, lines and components are susceptible to each type of erosion mechanism or non-susceptible. This methodology effectively bounds the scope of the Erosion Program.

The ESA basis document will be developed using plant configuration and operating data (P&ID's, isometrics, system descriptions, valve line-ups, plant and industry operating experience, etc.) and categorize plant piping into three distinct categories:

- Susceptible to Erosion & Modeled in SFA
- Susceptible to Erosion & Non-Modeled
- Non-Susceptible to Erosion

True North's ESA basis document consists of a Engineering Report documenting the susceptibility evaluation, a database reflecting the susceptibility status of each plant line or component, and a set of corresponding color-coded flow diagrams or P&IDs.

CHECWORKS SFA Erosion Modeling

EPRI CHECWORKS SFA v4.0 includes a module to predict the potential for various erosion mechanisms in plant piping. The scope of piping suitable for erosion-prediction modeling in SFA will be determined in the ESA basis document. The modeling effort required to predict erosion potential will be substantial, requiring significant time and knowledge of SFA modeling best practices, especially in Network Flow Analysis. True North offers the expertise necessary to maximize the effectiveness of erosion modeling output in SFA.

Risk Ranking

For plant piping that is susceptible to erosion but not suitable for modeling in CHECWORKS SFA v4.0, True North offers a qualitative, engineering judgment-based approach to systematically prioritize the inspection of both large and small-bore erosion susceptible (but not modeled) plant piping.

Inspection Scope Development

True North offers inspection scope development services that optimize inspection value and resource usage while reducing risk, increasing plant safety, and ensuring asset reliability.

Data Evaluation & Trending

The non-linear nature of erosion degradation calls for a different approach to inspection data evaluation and trending. True North applies industry best practices and significant operating experience to evaluate inspection results and make erosion mitigation decisions on a case-by-case basis.

Long-Term Strategy

The ultimate goal of minimizing erosion damage requires significant effort in planning design mods, inspections, and piping replacements. True North can assist in developing a sound long-term strategy.

Program Assessment

This service involves performing an assessment of the key program elements: basis docs, models, etc.

Training

True North offers hand-on training on erosion fundamentals and erosion program management.

Industry Guidance on Erosion Mechanisms

EPRI NSAC 202L - Recommends the development of an Erosion Program (separate from FAC program)

NRC LR Guidance - Identifies erosion as different from FAC and the need for an Erosion Program to maintain consistency with the plant licensing basis.

INPO FAC How-To Guide - Erosion mechanisms are a "sub-set" of the FAC program and should be addressed during the planning of inspections.

COMPANY PROFILE

True North Consulting is an Engineering Services company specializing in support for the electric power industry. Founded in 1999, True North has provided engineering based consulting services to the majority of US utilities and to several abroad. Our services cover a wide spectrum within the power generation sector ranging from Engineering Programs related services in the nuclear power industry to plant Thermal Performance issues across the entire generation continuum. Additional areas of expertise include a complete array of Power Services associated with secondary plant equipment and a highly experienced Information Technology staff supporting our line of customized software products.

It is our goal and ongoing commitment to optimize these services with respect to cost, technical adequacy, and overall value to our clients. Towards this goal we continue to refine and update our staff and services through incorporation of technology and experience-based advancements.

Presented in this brochure is an overview of Erosion Program Services offered by True North Consulting along with general information concerning our office locations and contact information.

We sincerely hope this provides a clear representation of our company and how True North Consulting might benefit performance at your facility.

CONTACT INFORMATION

True North Consulting is headquartered in Montrose, Colorado. Contact information for our corporate and satellite offices for Engineering Programs is listed below.

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