EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Corrosion Control of the Substation Ground Grid

- Identify degradation to increase substation reliability and personnel safety
- Provide knowledge necessary to improve maintenance actions

Background, Objectives, and New Learnings

Corrosion of substation grounding systems may impact the operation of a substation with respect to personnel safety, protective relaying and control operation. Copper and copper alloys are the typical material used in grounding systems construction. Degradation of grounding systems may occur due to variety of soil conditions and environmental factors that lead to various corrosion type affecting grounding system conductors above ground, at ground level and below ground.

The objective of this phase of research is to understand the cause of the substation grid degradation, to locate suspect areas of corrosion and to provide environmental data supporting asset management decisions.

Benefits

The identification of corrosion types common to copper and copper alloy ground grid degradation and new methods for location of suspect areas of degradation. Additional benefits include developing, piloting and validating a new methodology and approach for monitoring ground grid corrosion.

If successful, the resulting methodology and monitoring approach may:

- Enable visualization of present condition of the ground grid and location of specific areas where degradation may have caused ground grid deterioration.
- Provide knowledge necessary to develop triggers and alarms for maintenance actions.
- Track the condition of the ground grid, trend grid deterioration over time and compare the extent of deterioration to baseline such as design standards, thereby allowing for forecasting and budgeting for future remediation and/or ground grid enhancements.

Project Approach and Summary

1. Review available data:
   - Grounding plan and equipment foundation drawings, prior results of soil tests, soil condition etc.
2. Soil/conductor sample collection, testing and analysis:
   - As part of this task, soil and conductor samples from five (5) locations within the affected substation will be analyzed at the EPRI corrosion laboratory to determine the root cause and rate of ground grid degradation.
3. Field survey for vulnerability assessment:
   - The objective of this task is to physically survey the substation area, develop voltage gradient map and identify potentially vulnerable locations. Identified locations to be further reviewed for potential ground grid oxidation by harvesting additional soil samples and laboratory testing. Results from this assessment may provide input for identification of locations for installing a sensor array for continuous monitoring.

4. Develop, install and commission on-line monitoring approach:
   - Based on results of Task 3, develop, install and commission one (1) ground grid corrosion sensor array (GGCSA) for monitoring the most severe location on the system and one (1) weather station. Collect data and develop corrosion rates over time (to add monitoring period).
5. Analysis of online monitoring data:
   - As part of this task, data made available in Task 4 will be analyzed to understand amount of corrosion over time and to develop interpretation criteria that would guide engineers when to act.
   - Provide monitoring over the duration of the project

Individual funder information that is needed for the execution of this project:

Task 1:

- Maintenance History
- Ground Grid Design and Construction Standards
- Ground Grid Design Calculations
- Plan & Profile Drawings
- Previous Excavation and Soil Data (if available)

Task 2: Provide both new and degraded conductor samples.

Task 3: Provide site access and personnel to support this task.

Task 4: Provide site access and personnel for helping install, test and commission monitoring system. EPRI will provide onsite technical consultation, monitoring hardware and procedures.

Deliverables

- Quarterly teleconferences
- Two (2) Webcasts
- Final report to document the research approach, the methodology applied and results of the research

Price of Project

The total project costs are scope specific and vary due to the number of sensor arrays required. International project costs may vary due to travel and shipping cost increases. This project qualifies for Self-Directed Funding (SDF) or Tailored Collaboration (TC) funds.

Project Status and Schedule

The project length is 2 years from project kick-off.

Who Should Join?

Utilities who are looking to improving to locate and mitigate ground grid corrosion within substations.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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