

Equipment Reliability

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Overview

- INPO Top Priorities
- Continuous Monitoring
- Supplier Participant Advisory Committee
- Scram Initiative
- AC Power Reliability Initiative
- Nuclear Fuel Performance

INPO 2017 Top Priorities

- Identify and arrest plant declines quickly
- Recover and sustain performance of lower performing plants
- Improve INPO Organizational Resilience
- Strengthen WANO
- Advance safety and reliability while improving the efficiency of plant processes and programs



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Station Continuous Monitoring

Continuous Monitoring Update



- Evaluation report establishes performance baseline
- AMI Area monitoring insight (one for each assessment area)
- CRM collegial review meetings (internal challenge)
- IPSR INPO performance summary report (provided to site VP)
- SPM quarterly site performance report (provided to CNO & CEO)
- PID performance insight document (final monitoring summary prior to next evaluation)



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INPO Supplier Participant Advisory Committee (SPAC) Program

Benefits to Suppliers, Industry, & INPO

- SPAC members benefit by more targeted and collaborative engagement with INPO.
- Member utilities benefit by improved quality of goods and services, as well as improved safety and reliability.
- INPO benefits by improved supplier performance that supports reliability initiatives.

INPO Supplier Program

- Invitations to selected INPO webcasts, workshops, and open meetings, including the annual CEO Conference
- Opportunity to propose qualified staff for assignment to INPO
- Access to INPO member site
- Access to INPO Consolidated Events System (ICES)
- Access to INPO Leadership courses/seminars
- Access to two assistance visits per year
- Participation in bi-annual SPAC meeting

INPO Supplier Activities

- INPO 14-005
- IER L2-15-39
- Parts Quality Best Practice
- INPO Leadership Courses
- ICES Training, Reporting, and Analysis
- Supplier CAP Data
- Delivering the Nuclear Promise
- Supply Chain Industry Meeting
- Next Steps (2017)

Industry Continuous Improvement - Process Flow



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Where INPO Takes the Lead

Key INPO Inputs

- 1. Create Working Groups for the key SPAC areas (quarterly meetings)
- 2. INPO develops trend analytics
- 3. Provide candid input to solving problems, agree on resolution plans, check and adjust as process matures
- 4. INPO can assist suppliers who are unsure how to implement changes, or need help in certain areas
- 5. INPO is not assessing supplier performance, but measuring results against customer expectations
 - Helping to close the gap
 - INPO is the coordinator of the process; process will not work without their help

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Issues Impacting Industry Performance

- Increasing percentage of scrams caused by manufacturing issues
- Electrical subcomponent failures contributed to emergency AC power reliability challenges
- Most fuel failures are caused by maintenance-induced debris



Scram Trend



Equipment remains the major cause of scrams

Manufacturing-Related Scrams



Expected Outcome

- Increased awareness of supplier activities impacting scrams and critical equipment failures
 - Manufacturing and receipt inspections
 - Replacements (i.e., valves, pumps, turbines, etc.)
 - Developing, implementing, and testing modifications
- Increased vendor engagement in recognizing vulnerabilities during work activities

Consequential Equipment Failures caused by Manufacturer Defects or Refurbishment Services



Large Component One-Year Moving Totals - AP-913 Events



Main turbines Main feedwater pumps & motors Condensate pumps & motors Main generators Rx coolant/recirculation pumps, motors, & MG Sets Transformers Main condensers



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AC Power Reliability

INPO / Industry Actions

- INPO Actions to Address Trend:
 - Evaluation Team Focus Area
 - AFIs include Switchyard and EDG issues
- INPO IER L4, Insights AC Power Reviews
 - Contains ICES Records for Reference
- Improve industry use of EPRI and NATF documents that include:
 - Workscope and Risk Review
 - Indepth review of maintenance plan scope

Emergency AC Power

AC Power Review Visits

Important and common recurring findings include the following:

- Work package content and owner acceptance reviews
- Use of predictive monitoring tools to detect degraded component conditions
- Scope of components included in maintenance strategies
- Use of performance monitoring limits or triggers for trends of test data
- Life-cycle management of critical components and spares
- Work schedule coordination between site and transmission activities
- Procedure detail for local operation of equipment
- Interim actions in response to the Open Phase IER, L2-12-14 for switchyard rounds did not include all appropriate bus work
- Time-sensitive tasks associated with an SBO event response are not monitored or periodically validated to ensure assumed time limits can continue to be met.
- EDG PM program gaps (single component vulnerability review) and EDG system LCM plan

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Nuclear Fuel Performance

The Basics

- Fuel failures have significant adverse impacts
 - Release of fission products results in increased:
 - -Gaseous and liquid releases to the environment
 - -Radiation/potential for personnel contaminations
 - -Station and supplier costs
- Supplier activities during refueling outages can negatively impact fuel performance

-Maintenance activities can generate debris

-Activities over or near reactor fuel present challenges

U.S. Units with Failures

Nuclear Fuel Failure Trend

- Increasing number of fuel failures over the past 2 years
- Renewed INPO focus on improving industry fuel performance
- Eight cores with failures identified in 2016
 - Removed failed fuel from 6 cores
 - One station performed 2 mid-cycle outages to remove failed fuel
 - Another station core is operating with 4 failures

Fuel Failure Causes

- Most failures are caused by debris fretting
 - Debris generated during open system work
 Physical work creates the debris
 - Component degradation internal to systems

 Improperly installed or designed components
 - Debris dropped in the refueling cavity or SFP
 - -During refueling activities
 - -Dry Cask Storage campaigns

Expected Outcome

- Increased awareness of activities that can impact nuclear fuel performance
 - Equipment maintenance and inspections
 - Equipment replacements (i.e., valves, pumps, turbines, etc.)
 - Cutting, grinding, or drilling activities
 - Dry Cask Storage campaigns
 - Fuel Fabrication
- Suppliers and utilities partner to prevent fuel failures

