Operations Management & Technology - Program 108

Program Overview

Program Description
Operations performance in today's fossil generation plants is the key to achieving highly reliable, safe, economic, and environmentally compliant plant performance. The operations staff and management provide the human performance that controls the operation, directs and performs equipment condition monitoring, and performs predictive and corrective maintenance activities. Also playing a significant role in the overall plant performance are work processes, clear goals and objectives, personnel development, communication, support facilities, and plant design. Effective integration of wide-ranging skills and knowledge, work processes, and design — along with strong leadership by the management team — are critical to plant success.

The Electric Power Research Institute's (EPRI's) Operations Management & Technology program (Program 108) provides a forum for the development and evaluation of new and improved fossil plant operations technologies, work policies, and practices that raise standards of operational performance.

Research Value
EPRI's Operations Management & Technology program develops advanced processes and related technologies that support improved plant reliability and reduced costs. The program addresses the key tactical challenges facing fossil plant owners relating to management, conduct of operations, workforce performance, equipment monitoring, and risk. This program is highly collaborative in nature, providing forums for EPRI members to jointly resolve issues, improve processes, and identify research gaps. Members of the program receive:

- Guidelines that provide tools for excellence in plant operations
- Forum for industry information exchange
- Improved plant operations through support from EPRI technical staff
- Opportunities for enhanced plant operations through understanding of new technology applications

Approach
This program helps operating crews apply industry best practices and new technologies, and understand the ways that both can be applied to plant operations to identify vulnerabilities, manage risk, and exchange information with peers.

- R&D of plant operations fundamentals and new developments provide guidance to plant operators and their managers on best practices in fossil plants through exchanges of ideas and shared lessons on improved operational performance and new technologies.

Accomplishments
EPRI's Operations Management and Technology program has helped members through implementation of products to assess operations performance, improve operations processes, learn from industry experiences, and exchange ideas with industry peers. Products have included:

- Updated Operations Assessment Guideline, which helps members understand their strengths and areas for improvement in operations. The guideline is updated based on members’ experiences.
- Annual operations conferences, which allow industry peers from shift operations to share experiences, problems, and solutions
- Lessons learned from industry events, which provide information about prevention of similar events at other facilities
- Guideline on managing emergency events
- Guideline on clearance and tagging
Current Year Activities

The program R&D for 2013 will continue to develop guidelines that support excellence in fossil operations, sharing of lessons learned from industry case histories, reviewing technology applications, and fostering information exchange among the membership. Specific efforts will include:

- Annual operations and future operations perspectives conference
- Case history database maintained to summarize events shared by members
- Technical support of members
- Conduct-of-operations guideline on topic selected by advisors
- Distributed control system (DCS) specifications to assist in operating logs and routine data requirements
- Understanding of new North American Electric Reliability Corporation (NERC) requirements' impact on plant operations
- Results from operations assessment activities

Estimated 2013 Program Funding

$1.0M

Program Manager

Wayne Crawford, 704-595-2727, wcrawford@epri.com

Summary of Projects

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<tr>
<th>Project Number</th>
<th>Project Title</th>
<th>Description</th>
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<tr>
<td>P108.001</td>
<td>Plant Operations Fundamentals and New Developments</td>
<td>This project provides guidance on industry best practices for plant operations, evaluates technology applications, and supports information exchange among members to foster continuous improvement of fossil plant operations.</td>
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P108.001 Plant Operations Fundamentals and New Developments (067361)

Key Research Question
Clear descriptions of best-practice performance and benefits of new technologies for operations are needed to support industrywide improvement efforts. Plant operations staffs need effective information sharing to learn from the experiences of others.

Approach
This project provides the ability to exchange information among members and develops guidance to improve plant operations activities. Information exchange is facilitated through an annual conference. EPRI staff provides technical support, which often includes input from other members. A full set of Conduct of Operations Guidance is being developed to capture the best operational performance practices and provide detailed information on the conduct of operations, based on member rankings of importance. Reports on new technology developments offer insight into application successes and problems. Supplemental projects assist members with product applications when required.

Impact
- Improved plant operations result in lower cost and increased generation.
- Plants can avoid negative events by studying industry experiences and taking preemptive corrective action.
- Savings and performance improvements are gained by learning from others’ experiences to effectively implement new technologies.
- Fewer operator errors and improved response to events reduce impact on plant equipment, prevent outages, and result in increased production.

How to Apply Results
Plant operations staffs compare their existing practices with those reported in guidelines to determine areas that can be improved through new or revised procedures, instructions, training, and management coaching. Lessons learned through event reviews or operations conferences are evaluated in the plant to determine if changes to operational practices are required. New technologies applied using ideas from EPRI guidance or industry experience can achieve maximum value with minimum impact on plant staff.

2013 Products

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<tr>
<th>Product Title &amp; Description</th>
<th>Planned Completion Date</th>
<th>Product Type</th>
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<tr>
<td>Control Operator Performance: Control Operator Performance is a continuation of the series on Conduct of Operations. This guideline will focus on the best practices used by control room operators as they oversee and control the generating units within the plant. The guideline is expected to address topics such as equipment monitoring, providing direction of field activities, maintaining overviews of all site activities, effective control actions, and interfaces with other site organizations and off-site entities. The guideline recognizes that the control operator has direct oversight and control of multiple millions of dollars of equipment, and is responsible for protection of staff, public, and equipment while operating extremely high concentrations of energy and chemicals, and directing staff actions. The control operator also is the central overseer of the station's impact on the environment and the public. Best practices for conduct of these critical functions will be explored and documented.</td>
<td>12/31/13</td>
<td>Technical Update</td>
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**Future Perspectives in Operations:** This report will investigate the leading indicators that will affect the future for plant operators, including drivers and trends understood today. New trends and technologies affect how plants will be operated in the future. Some of the topics of interest include:

- New plants and major modifications to existing plants are changing the landscape for operators
- Unique operational requirements brought on with new equipment installations on existing plants
- New operational regimes, such as cycling, extended low-load conditions, and other challenges
- Advances in control systems will change the way operators interface with the plant
- Remote and contracted operations should be investigated
- Industry trends and operations-related developments reviews
- Member needs and interests in new technology, operational concepts, and objectives
- Input from related industries, such as refineries and chemical processing plants, can provide valuable insights
- Industry operational trends and future perspectives
- Interfaces with off-site monitoring entities

**DCS/Operating Procedure Integration Specification:** Describes the concepts of integrating procedures into DCS systems. Key procedures such as unit or major component startups and shutdowns can be included into the DCS, with links to data and plant conditions that aid the operator in the effective implementation of the procedure. Some ideas to be considered are:

- Specifications for procedures to guide significant operations actions included in the DCS
- Specifications to include prerequisite/condition status per procedure
- DCS to document operator actions per procedure, and operator sign-off of checklist
- DCS to confirm equipment response per procedure, and independent instrumentation to confirm response.

**Future Year Products**

**Operations Outage Management:** Operations performance is key to effective outage accomplishment. EPRI intends to document best practices to achieve better operations support of outage work. Some of the topics that could be addressed are:

- Tag-out organization and implementation for optimum outage performance
- Use of overtime and additional resources for critical work demands
- Post-maintenance and post-modification acceptance testing
- On-line versus outage determinations
- Shutdown and startup scheduling and optimization.
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<td><strong>Methodology for Investigation of Events for DCS Improvements</strong>: Current event investigations do not include evaluation of DCS operator graphics displays as a source for preventing or mitigating future events. Guidance on performing these type reviews could include&lt;br&gt;• Links to CAP guidelines as appropriate&lt;br&gt;• Consideration of both alarms and DCS graphics as areas for improvements&lt;br&gt;• Examples from actual industry events&lt;br&gt;• Investigation of combinations or other precursors as “smart alarms”</td>
<td>12/31/14</td>
<td>Technical Update</td>
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<td><strong>Conduct of Operations Topic</strong>: Advisors are expected to select a Conduct of Operations topic as a continuation of a series of reports that provide best-practice guidelines for plant operators. Some topics that have been addressed include log keeping, shift turnover, management of operator aids, and operator rounds. Topics for consideration include: Housekeeping for plant and control areas; managing complex, multi-disciplined functions; conservative decision-making; and other topics identified by advisors.</td>
<td>12/31/14</td>
<td>Technical Update</td>
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<td><strong>Electronic Equipment Labeling, RFID and Other Technologies</strong>: Accurate labeling of plant equipment is key to reducing human error by operations and maintenance personnel. Several technologies currently are being used to help ensure the correct component is being operated or maintained by plant staff. To assist members who are considering making improvements in plant labeling, the report should include:&lt;br&gt;• Overview of technologies&lt;br&gt;• Application to fossil plants&lt;br&gt;• Member experiences in new labeling technologies&lt;br&gt;• Labeling electronic links to other work processes, clearance and tagging, and rounds data</td>
<td>12/31/15</td>
<td>Technical Update</td>
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<td><strong>Operations Metrics</strong>: A compilation of operations metrics, definitions, and perspective on what is being measured, including:&lt;br&gt;• Limitations of key metrics&lt;br&gt;• Broad base for member selection, enabling users to pick metrics that link to business plans and corporate goals</td>
<td>12/31/15</td>
<td>Technical Update</td>
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This report is not expected to drive industry standardization, but offer individual member insights.

**Operations Fuel Management**: As gas prices drop relative to other fuel sources, the pressure is increasing to reduce fuel cost increases for solid-fueled plants. Managing the impacts, understanding the total costs of lower-grade fuels, and creating techniques that allow lower-priced solid fuels to be effectively burned can help keep plants viable sources of generation into the future. Some topics for consideration include:<br>• Impacts of changing coal characteristics on operations, O&M processes, plant management, and equipment operators<br>• Best practices for handling changing fuel conditions<br>• Low-cost and statistically accurate sampling and weighing methods for contract verification and plant performance measurements<br>• Fuel blending techniques<br>• Plant relationships with fuel buyers -- how to communicate and influence fuel decisions at your plant<br>• Linking fuel quality and fuel characteristics with long-term plant performance | 12/31/16               | Technical Report |
**Product Title & Description**

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<th>Configuration Management: Understanding the fundamentals of an effective Configuration Management Program are important for implementation. Plants being operated with undocumented changes, outdated drawings, and unanalyzed design changes create unnecessary hazards to the equipment and staff. A report should include:</th>
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<td>• Member experiences in Configuration Management</td>
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<td>• Building the case for a comprehensive program</td>
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<td>• Transition from existing disperse information to integrated, user-friendly data</td>
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<td>• Design basis</td>
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<td>• Major modifications, taking advantage of these additions and data management.</td>
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**Planned Completion Date** 12/31/16

**Product Type** Technical Report

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**Supplemental Projects**

**Fossil Plant Operators Situational Awareness Enhancements (071259)**

**Background, Objectives, and New Learnings**

Like other complex operations, power plants depend on human oversight to keep physical processes performing according to design and prevent equipment and systems from failing. A key element of operators' control of power stations can be summed up by the term “situational awareness.” Operators have been trained to respond to routine and off-normal situations; however, to correctly respond, they must fully understand the numerous variable conditions so that appropriate, effective actions can be taken. Full understanding of conditions — i.e., situational awareness — is paramount to guide operator decisions and actions during routine equipment malfunctions and natural events such as tornados, hurricanes, or floods.

For a variety of reasons, current alarm systems — those that warn the operator of off-normal conditions — are not effective in providing plant operators with clear, actionable warnings, challenging their ability to retain overall situational awareness. Operators often are flooded with unimportant alarms, leaving them unable to identify the few valuable alarm conditions. In other cases, alarms are generated unnecessarily, creating similar distractions to operators.

Industry studies have shown that operators can effectively manage 150 alarms per day, and likely cannot effectively manage systems that generate more than 300 alarms per day. Many of the alarm systems in power plants today create more than 1,000 alarms per day and are distracting operators, reducing their situational awareness, and increasing the likelihood of equipment damage (as has been experienced at some plants) and accidents.

Implementation of Distributed Control Systems (DCS) has resulted in displays of information to plant operators on computer monitors rather than the more dated analogue devices such as electrical or pneumatic gauges, paper chart recorders of various types and sizes alongside of pistol grip control switches coupled with individual lights denoting equipment status, such as running, open, or closed. With limited experience, and virtually no standard guidance, many of these systems have been developed and implemented with poor human machine interface (HMI). Techniques have now been developed to take advantage of greater computer power and knowledge of HMI concepts to enhance the HMI for generating plant operators. Improving HMI, along with resolving alarm problems as noted above, can create significant enhancements in the situational awareness of generating plant operators, and ultimately their ability to monitor and control plant equipment.
The objective of this project is to demonstrate the practical implementation of research work conducted by EPRI, which is intended to improve operator situational awareness and the overall control of equipment and the electrical generating process. Insights gained by implementing the EPRI-developed guidelines at multiple units and multiple companies' generating plants will validate concepts that could be applied widely across generating units. These key insights include both the challenges associated with guideline implementation as well as the benefits. Under differing operating and design conditions experienced by members, evaluation of alarm system improvements can be accomplished with direct correlation to operator situational awareness improvements.

**Project Approach and Summary**

This project uses specifically designed software and technical guidance to support members in reducing distracting alarms, which affect unit operators’ abilities to manage normal, abnormal, and emergency situations. Plant operators, control technicians, engineering staff, and component experts from the site form a team, led by a facilitator, to review each alarm against an alarm philosophy reference document to eliminate unnecessary alarms, establish correct priority, confirm set-points, and guide operator responses to off-normal conditions.

Host sites evaluate plant alarms for those that effectively support operational needs. Correct alarm priorities are established, and actions identified to resolve nuisance or troublesome alarms. A data base for each plant alarm is developed for reference by plant operators.

**Benefits**

Host sites can gain much greater understanding of their alarm system conditions and can conduct a structured review of all alarms to understand the distributed control systems (DCS) changes needed to achieve a manageable, nondistracting level of alarm activity. Operators can achieve a higher degree of situational awareness that will support more effective operation.

**Self Assessment and a Culture of Continuous Improvement in Fossil Generating Stations (066048)**

**Background, Objectives, and New Learnings**

Generating facilities today are seeking to improve O&M performance and create lower cost, more reliable, and safe electricity with minimal impact on the environment. To achieve these goals, it is necessary to understand where improvements can be achieved and what barriers must be overcome to sustain continuous improvement.

These improvements, collectively, could result in more reliable generating facilities, fewer environmental emissions, and fewer events that challenge health and safety. EPRI is fostering the concept of self-assessment, along with a culture of continuous improvement, within the industry to achieve improved performance. To that end, EPRI has updated industry guidance as reported in *Updated Operations Assessment Guideline* (EPRI report number 1014200).

The objective of this project is to obtain knowledge of barriers that affect continuous improvement in O&M practices at generating stations. Through application of the EPRI Guideline at host sites, EPRI staff, along with member host sites and peers from other members plants, are validating the guidance and gaining insights into barriers that affect continuous improvement.

**Project Approach and Summary**

Performance-based assessments are performed at host sites, using site peers and staff from other host companies' sites. Team members and plant staff are trained in assessment methods. Peers learn from the EPRI team and assessment performance steps and techniques.

**Benefits**

Host site staffs benefit from participation on assessment teams and by learning assessment concepts. Sites receive assessment results, identifying areas for improvement and strengths in performance. The industry gains assessment experience through peer participation in assessment activities.