

UTILITY WORKING CONFERENCE

INPO on maintenance and work management

This year's ANS Utility Working Conference, held August 9–12 at the Omni Amelia Island Plantation Resort in Florida (see page 77 for more on the event), included a number of maintenance-themed sessions organized and led by the Institute of Nuclear Power Operations' Bill Eckes and Pete Arthur. Among the topics discussed were current performance trends, the effective utilization of resources, and the minimization of rework.

In the session titled "Work Management and Maintenance 2014 Performance," Eckes, INPO's maintenance lead, offered attendees a look at trends in areas for improvement (AFI) and a review of INPO's current major areas of focus. According to Eckes, the leading AFIs in 2014 were in the categories of worker practices and rigging, lifting, and material handling. In 2015, he said, INPO broke down the worker practices category into a series of worker fundamentals, identifying the leading weaknesses in the areas of high-quality maintenance and knowledge and skills. Eckes also pointed out that supplemental workforce AFIs have shown a sharp increase in 2015, but added that there has been substantial improvement so far this year in the rigging, lifting, and material handling area.

Eckes discussed worker craftsmanship AFIs over the past few years as well, stating that the leading weaknesses were found in the areas of workmanship and professionalism. "Trends have been the same for the last four years in terms of causes for these AFIs," he said. "Too often, we're not reinforcing standards and expectations. The actions taken for improvement have been centered on revising existing standards and ex-

The Institute of Nuclear Power Operations returned to the UWC this year to share its insights into the most pressing issues facing nuclear plant maintenance.

pectation documents. But behavior-based AFIs cannot be fixed with process improvements. Actions need to be centered on how to change the worker behaviors."

Eckes further noted a downward trend in the number of AFIs related to maintenance fundamentals since 2013. This improvement, he said, is a result of an increased focus on this area throughout the industry. "Most stations have implemented and trained workers on maintenance fundamentals, and stations have implemented changes to the observation program to identify fundamental weaknesses," he said.

The first area of focus for INPO in 2015, Eckes said, is leadership and alignment, with particular attention being paid to understanding the barriers to high performance and to mid-level manager/superintendent fundamentals. "What we often see are supervisors acting more like foremen, superintendents acting more like first-line supervisors, and managers acting more like superintendents, doing jobs they shouldn't be doing," Eckes said.

To examine the degree to which workers are engaged in improvements and problem

solving and whether they are taking pride in and ownership of their work, INPO is also focusing on craftsmanship, Eckes said. "In plants that decline in maintenance, we normally see that workers are not engaged," he said. "When we ask these workers about their department's improvements and trends, they don't have an answer. They don't know what their own work group is doing to improve, nor do they know what their group's trends are. So have they been engaged? The answer is no."

On the topic of work ownership, Eckes was somewhat gloomy. "I will tell you, from my perspective, as an industry, I think we've declined over the last 10 years in workers taking ownership of their work," he said. "We've become so structured, we've taken away from the actual craftsmanship and the actual pride in the work. When you talk to workers, if a mistake happens, it's because something wasn't in the work instructions. I have to be honest, if you have pride in your work, and if you're not given sufficient detail for a task, you need to stop and address that problem."

A third area of INPO's focus this year is proficiency, which, Eckes stressed, is about more than simply worker training. "There are a lot of other things that go into proficiency, including the necessity for supervisor support when workers do not feel proficient at their tasks," he said.

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Eckes also mentioned the publication this year of a number of INPO documents, including a revision of *Guidelines for the Conduct of Maintenance at Nuclear Power Stations*, which includes aspects of cumulative impact, clarifies maintenance roles in the work management process, and provides examples of worker core specific fundamentals (published in January); *Nuclear Maintenance Fundamentals*, which defines those fundamentals for workers, first-line supervisors, superintendents, and managers (also published in January); an INPO Event Report on mechanical maintenance precursors that identifies an adverse trend in these sorts of events (published in March); and a new nuclear maintenance craftsmanship document (published in June).

INPO in this area, according to Arthur, are as follows:

- Department work coordinators and workweek senior reactor operators at times do not include or coordinate their department's activities in the site schedule, contributing to unnecessary safety system unavailability and work rescheduling at the point of execution. A contributing factor to this problem is that workweek managers do not consistently hold coordinators accountable for meeting their commitments.



Photo: David Burghardt/Island Photography

Arthur

workweek managers do not aggressively challenge the accuracy of safety system activity durations, logic, and coordination to ensure critical path schedule fidelity, resulting in extended

out-of-service time for important equipment and missed opportunities to minimize unavailability. Contributing to this are T+1 workweek critiques that do not critically

compare individual schedule performance to actual results in order to identify lessons learned.

- Work activities on risk-significant systems are ineffectively coordinated and reviewed to support online schedule implementation, resulting in increased unavailability, late identification of high-risk work, and delayed completion of risk-significant activities. Contributing to this are station leaders who have not demonstrated collective ownership for successful online work management.

The primary causes of these AFIs in work management, Arthur said, include the following:

- Workweek managers do not regularly hold department work coordinators accountable for meeting work-planning milestones and deliverable due dates.

- Workweek managers rely on department work coordinators to review and put together the work schedule.

- Workweek managers rely on their relationships with personnel in the shops rather than the work management process to facilitate work completion, because current successes were built on strong teamwork between different work groups to overcome shortfalls in approved schedules.

- Station leaders do not demonstrate collective ownership of successful online work management. Many key milestones, such as planning, tagging, and walkdowns, are not

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Eckes's INPO colleague Arthur centered much of his presentation on one specific AFI statistic from 2015, work management accountability. The issues identified by

out-of-service time for important equipment and missed opportunities to minimize unavailability. Contributing to this are T+1 workweek critiques that do not critically

consistently met for several months.

■ Department work coordinators and workweek senior reactor operators do not scrutinize the details of work activities along with current or projected plant conditions to fully understand the associated risk.

■ Maintenance supervisors and workers are not ensuring that walkdowns are conducted with the expected level of detail. Supervisors do not place a priority on completing walkdowns, often resulting in walkdowns being conducted after the milestone date.

■ Workweek managers and key work management stakeholders do not critically assess and question schedule information and logic provided by interface personnel to develop the schedule.

■ In many instances, personnel with specific knowledge of the physical work do not provide important details and insights during schedule preparation meetings.

Resource utilization

In the session titled “Resource Utilization Effectiveness and Proper Utilization of Fix it Now (FIN) Teams,” Arthur began with a review of some of the issues that INPO has identified concerning FIN team effectiveness, as well as some INPO recommendations.

FIN charters are not always well understood or followed, according to Arthur, and

they often fail to specify staffing needs. “Some charters state that the maintenance manager is responsible for FIN staffing and that the FIN team is staffed to meet the needs of the facility at the discretion of the maintenance manager,” Arthur said. “I have no idea what that means. Does that mean four electricians, three electricians? I don’t know.”

FIN teams also sometimes fail to track missed opportunities, Arthur noted. “If you don’t know what your problems are, you are probably not keeping track of them,” he said. “The strong FIN teams out there will keep track of the jobs they cannot take. They have a charter, they have goals and objectives, and every time they can’t meet a goal or objective, they will document it.”

“Another thing we’ve seen,” Arthur continued, “is that when a FIN team cannot take a high-priority job, the reason is not evaluated to determine if future staffing needs should be adjusted, or if qualification of the team should be modified.” In addition, he said, the interface among FIN teams, day-shift maintenance personnel,

and other maintenance personnel can be unclear regarding the roles and responsibilities for the management of emergent work, high-priority work, and scheduled work.

Among its recommendations, INPO suggests that plants develop metrics to track committed FIN staffing versus the actual resources supplied to the FIN team. “Identify the gaps and missed opportunities preventing the FIN team from being consistently

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staffed,” Arthur said. “Focus on key areas, such as radiation protection staffing, rotating craft individuals to meet staffing requirements and having only one supervisor to supervise all FIN craft disciplines. What you don’t want is to get into a situation where your manager says, ‘You’ve got your four mechanics,’ and you say, ‘Yeah, but there are four different ones every day.’ Fix your charter. Reach an agreement with the

maintenance manager, or whoever is running the FIN team.”

INPO also advocates the development of a FIN charter that describes the priorities for the team, staffing levels, qualification requirements, overtime rules, supervisor authorization capability, backlog goals, and performance goals, Arthur said. Further, INPO recommends that plants revisit and, if required, reestablish the expectation for the FIN team’s work-order level. “Over the years, we have seen FIN team work drift from the normal minor maintenance to full-blown, one-inch-thick work packages,” he said.

On the topic of resource utilization effectiveness, Eckes, like Arthur, reviewed

INPO-identified issues and recommendations for addressing them. INPO has discerned a number of troubling variations across the industry, he said, including the following:

- Resources are committed early in the process but are not retained or managed, so that at T-0 they do not look anything like they did at T-20 or T-16.
- Resources are not tracked throughout the process.
- Resources are not part of the equation when work selection takes place at T-20 or T-16.
- Resources are often referred to in “percent over- or under-loaded,” missing the ac-

countability to provide sufficient resources to perform the required work.

■ Resources are removed late in the process because of both routine and emergent training.

■ Peak demands for resources are not communicated from work management personnel to maintenance personnel.

■ Peak demands for resources are not communicated from work management and maintenance personnel to training personnel well in advance.

INPO’s recommended industry actions for adequately addressing these issues, Eckes said, include the following:

■ Establishing a consistent method of measurement for maintenance discipline resource requirements and availability to be used by both maintenance and work management personnel.

■ Establishing acceptance criteria for maintenance resource loading to be used when establishing workweek scoping.

■ Requiring the reporting of resource requirements and availability at each scheduling meeting to ensure that resource loading criteria are met and to identify causes for deviations.

■ Developing a plan and training schedule to rectify low numbers of critical qualifications.

■ Requiring training personnel to identify maintenance resource needs prior to the T-20 work-scope development.

Minimizing rework

A session on rework minimization and mechanical maintenance trends was presented by Eckes, who began the discussion by noting that mechanical maintenance has led all categories in the number of reported rework events over the past few years, and continues to do so. “The trend has improved somewhat over the last two years, but it still remains high,” he said. “Valves and mechanical connections are the leading components for rework, as well as the two leading areas for precursor events.”

Eckes emphasized, however, that a high number of rework events at a plant is not necessarily indicative of a failing rework program. “It depends on the threshold,” he said. “If you look at Hatch—the station that was dead last on the INPO key performance indicator for rework—we wrote that up as a beneficial practice. They have a very low threshold, and they use that data to actually improve performance. We think Hatch has the strongest rework program right now in the industry.”

Among the leading causes of mechanical rework, according to Eckes, are knowledge-based errors. These errors, he said, are often the result of skill-of-the-craft work being performed by new mechanics who have not been adequately trained, or by older, experienced mechanics who for a number of years have not exercised the skills required

to perform a particular task. Other causes of rework, Eckes said, include rule-based errors committed by mechanics who fail to adhere to written instructions, and errors resulting from instructions that contain inaccurate information or lack sufficient technical detail. "What we've found in looking at the rework from written-instruction errors is that it's about half-and-half," he said. "Half inaccurate information, and half insufficient detail."

Eckes said that the rework trend for the supplemental workforce has shown a decrease recently as well. He also pointed out that INPO has observed an increase in the amount and the risk significance of work performed by supplemental workers over the past three to five years.

"INPO sees a correlation between stations that have taken a turnkey approach to oversight and a trend in error by supplemental workers," Eckes said. Other causes of supplemental-worker error, he added, include the use of temporary or step-up supervisors who don't have the knowledge or skills to provide effective oversight of supplemental workers, and the use of supplemental workers who don't understand station standards and expectations or who are not adhering to them.

"From INPO's perspective," Eckes said, "stations that have a low threshold for identifying rework and have taken actions based on rework trends have improved in their maintenance fundamentals."

Eckes also touched on the Industry Maintenance Working Group's subcommittee on rework, established earlier this year to review current practices and identify clarifications necessary to ensure common implementation across the industry and to draft the second revision of INPO 12-007, *Guidelines for the Tracking and Classification of Rework*. "The subcommittee is addressing the problem of stations implementing INPO 12-007 Revision 1 guidance differently," he said. "These differences will impact the effectiveness of the Equipment Reliability Index once rework is incorporated in 2016." (At the time of this writing, 12-007 Revision 2 was being prepared for August distribution and comment.)

Significant changes proposed in this latest revision, Eckes said, include the elimination of the rework process category Unexpected Corrective Maintenance and the addition of maintenance-fundamentals codes to the list of Rework Cause Codes.

The Industry Maintenance Working Group's rework subcommittee charter was approved in April, Eckes said, with four objectives: (1) to clarify the intended rework program scope, (2) to identify changes to rework program coding, (3) to align the rework event level with INPO AP-913 (which describes an equipment reliability process to assist plants in maintaining high levels of safe and reliable operation in an efficient

manner), and (4) to clarify rework documentation/reporting requirements.

Eckes noted an upward trend in mechanical maintenance precursor errors from 2012 through the second quarter of 2014, but added that the trend so far this year is downward. The major causes of these events, he said, are supervisors who don't provide coaching and reinforcement of maintenance fundamentals and standards, supervisors or workers who don't understand the risk significance or the potential impact of an activity, and workers who don't have an opportunity or sufficient time to review the work task prior to execution, limiting their effectiveness to identify weaknesses in work-

instruction technical details or actual work-instruction errors. "Several events," Eckes added, "were the result of latent equipment failure caused by improper reassembly of critical and safety-related equipment that were not revealed during testing."

Eckes concluded the session with some optimism, noting that mechanical maintenance events have gone from approximately 25 to 30 events per quarter in early 2014 to less than 10 in the second quarter of 2015. The reduction, he said, is largely in procedure use and adherence, configuration control, and Occupational Safety and Health Administration recordable injuries.—*Michael McQueen* **IN**