



Training Optimizes Nuclear Outage

HAVING THE RIGHT equipment ready at the right time is just the start of planning for a safe and well executed nuclear power plant outage. Before work can begin, supervisors, crafts and temporary people must re-learn, or learn for the first time, the optimum use of the equipment used in an outage.

Given the critical nature of an outage, and the stress involved, nuclear power companies have never been willing to assume that operating personnel have memorized the manual. Pre-outage training is considered of critical importance at every nuclear facility. Southern California Edison is involved in many industry groups to address performance improvement both during outages and routine operations.

The company's San Onofre's Nuclear Training Division provides instructional design and development services for Web and computer based training. They also contract with other training suppliers for specific content, including specialized refueling equipment. Edison's qualified instructors and training procedures and content for the nuclear environment are recognized throughout the industry as meeting or exceeding INPO guidelines. San Onofre Nuclear Generating Station (SONGS), part of the Edison grid, has been in operation for more than 33 years and the plant's management is committed to improving procedures.

SONGS is located approximately three miles south of San Clemente, California. Unit 1, a 425 MW first generation Westinghouse commercial unit, was shut down in 1992. However, Units 2 and 3 are still operating. These units have Combustion Engineering two loop pressurized water reactors. Unit 2 started up in 1983 and Unit 3 in 1984. Each is rated at 1,100 MW. Pre-outage training, conducted by the core refueling group supervision and management, involves five to seven days of intensive training on all aspects of the outage work.

Preparing for 2002 Outage

With the 2002 outage coming up, management considered many types of outage-critical equipment for intensive review. Among them was a number of highly sophisticated, outage-specific tooling systems from Biach Industries, Cranford, NJ.

The four equipment models involved are all associated with detensioning and tensioning the reactor pressure vessel head. They are:

1. A single-operator electric stud drive tool
2. A hydraulic quick disconnect (QDH) tensioner
3. An EPN series electric/hydraulic pumping system
4. A stud elongation measurement system (SEMS).

While definitely user-friendly, this equipment can hardly be considered operations intuitive. Management felt that online self-study and classroom training materials should be prepared to

supplement the comprehensive operating and maintenance manuals supplied when the equipment was originally purchased.

The equipment training package included computer-based training (CBT) applications, with self-quizzes to reinforce the learning; classroom instructor and student materials; ancillary materials like PowerPoint presentations, posters and lesson plans; and a laminated booklet of key points for use on the job. The CBT applications were developed by Biach Information Arts (BIA), the training development arm of Biach Industries. The job aids are intended to be attached to the equipment so that the operator has a brief, concise step by step operating procedure at the tool.

Learning and Refreshing

Outage specific equipment is only used when the outage occurs, usually every 20 months. No matter how thorough and intensive the original equipment training was, after so much time has elapsed, a refresher course is essential. Pre-outage training is focused on operations: what the equipment does and how to use it safely and quickly.

Tony Watt, BIA's expert in the development of training materials, states that consistency of presentation is a prime goal in developing task oriented training for operators. "It's part of information ergonomics: how people assimilate and process information. We work to frame the pictures the same way the operator/learner will see the equipment in operation. The training moves from basic to a higher level and in developing self-study tools, we work to catch the students' eyes and keep their attention so they don't get click-happy," Watt says.

In all, about 55 people were to be trained in a variety of disciplines prior to the 2002 outage. This was a highly variable workforce, including the facility's regular staff of supervisors and crafts, full-time employees from other Edison Departments loaned to San Onofre for the outage work, and 30-40 traveling building trades people. The latter included boilermakers and pipe fitters brought in specifically for the outage.



It's hard to predict who will do best with the sophisticated equipment under the pressure of the actual outage environment. Station management is using the classroom instruction and hands-on training to make an educated assessment before going out to the field.

Tensioning reactor pressure vessel at SONGS

Successful RPV Head Operation

During the actual outage, each shift work crew for detensioning and tensioning the reactor pressure vessel (RPV) head consists of an Edison supervisor who runs the EPN pump (backed up by a Biach service representative), and seven people in the refueling cavity—three two-man teams assigned to each of the three tensioners and an overall circulating supervisor.

The Edison people available for the crews include supervisors, who could be degreed engineers, ex-navy nuclear personnel or managers in an IT department plus craft personnel. Everyone who took part in the tensioning for the 2002 outage, about 20 people, went through

pre-outage training on the Biach tooling systems. The training modules helped compress training time into a shorter period of time.

Using the modules for initial and continuing training for the crafts resulted in a successful operation in the reactor cavity. The crafts understood the equipment and were prepared to operate it even before they moved to the hands-on portion of the pre-outage training, which is conducted with actual equipment.

The modules operate very well for knowledge-based training and also transitions easily to skill-based training. Posters, flip charts and summary books help the crafts learn in the classroom what they will see down on the floor. The modules include both generic information and custom material specially prepared, in conjunction with San Onofre's training people and experienced supervisors, to suit the station's specific needs and circumstances.

San Onofre refueling management is extremely happy with the four modules, feeling that the quality and depth of knowledge in the representations fit well with the station's training goals. With the carefully thought-out training sequence and the new modules, training dose radiation is minimized because the crews hit the floor ready to begin the actual work. There are fewer people in the cavity for a shorter amount of time. This has made a difference in outage time and, even more important, in radiation dose. San Onofre management has been told that its RPV head stud removal and reinstallation is done as fast as anywhere in the industry.

Polar Crane Training

A polar crane-training module has also been prepared for use at San Onofre's next outage. However, actual operation of the equipment was not part of the 2002 program. The program is specifically designed for the refuel supervisors and not the crane operators. Although Biach Industries has nothing to do with the cranes they did prepare the training package.

Most potential polar crane incidents occur during the on-load stage where space in the containment building is extremely tight and everyone is under great time pressure. While the RPV is open, or being opened, and fuel moved around, safe load paths are essential. The goal is to ensure that the crane will never be in a position where a load could be dropped on any of the safe shutdown equipment.

Naturally this is not left entirely to human judgment. Limit control systems in the crane automatically stop the equipment before it can reach a restricted zone. Although this would avoid endangering the critical equipment, it could shear off crane drive pins and damage drive motors. It could also extend outage time.

It is up to the refuel supervisors to observe operations and make sure a crane is not moving into load-path violation. The training program is a refresher course for the supervisors with an overview of the key points they need to be aware of. It is aimed at helping the supervisors understand enough about the crane operators' job so they can work together in an intelligent way.

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