

## **N237. Advanced Imaging Tools for Nuclear Power Plant Operation and Maintenance**

This paper presents the results of a follow-up EPRI research project to examine how advanced imaging tools are being used to improve plant operation and maintenance. The following technologies are being used at U.S. PWRs and BWRs:

- videodisc-based image storage and retrieval systems,
- still video and digital photography,
- photogrammetry,
- multimedia,
- image transmission technologies, and
- virtual reality.

### **Videodisc-Based Image Storage & Retrieval Systems.**

Of all the advanced imaging systems addressed in the study, videodisc-based image storage and retrieval systems are the most widely used in nuclear power plants. They are a way to store and navigate through vast quantities of plant data, including photographs, drawings, computer graphics, text, motion video, and even audio. A typical videodisc-based plant photographic database is 75,000 to 100,000 images. Using keyword searches, location descriptions, equipment names, etc., it is possible to move instantly through the database and videodisc (less than one second) to the photograph of any plant area or component. In the surrogate travel mode, a keyboard, joystick, or mouse is used to move through the facility in a sequential manner, as if walking. In this most common mode, one can adjust the speed of the walk and can pause to look ahead, behind, left, right, and overhead. site maps or building diagrams (such as elevation and plan views) displayed in a window on the screen, or on a separate monitor, allow the user to orient himself in the plant.

Engineers and others use these systems to see components, identify obstructions and interferences, make approximate measurements, identify access routes, and do the many other planning tasks that usually require personnel entries into restricted areas. Most systems are now sold with video printers so that hard copy is available for planning meetings and for appending to job packages, maintenance records, etc.

### **Still Video And Digital Photography**

This method captures images electronically and stores them on magnetic media or in semiconductor memory rather than film. The photographs can then be displayed on a television monitor or--using additional equipment--printed, stored, and manipulated in a computer or transmitted over phone lines. Still video and digital cameras use a CCD (charge-coupled device) to capture an image. The CCD produces an analog video signal and stores it on a 2" microdiskette. up to 50 images can be captured on one diskette. Using a built-in microphone, some also record up to 10 seconds of audio with each image, thus plant photos can be voice annotated with explanatory information. The diskettes can be erased or reused or can be used to store the photos. Digital cameras store the CCD image in digital form in the camera's internal memory. Much more information is stored, so the result, compared to still video, is much sharper image with less noise.

Here is one example of how electronic photography is being used in nuclear power plants. Millstone Unit 3 used still video extensively during their 1991 outage. They ran two shifts in their still video imaging facility to collect and catalog images, create survey forms and other documents, and to process

requests for prints. Still video photos were used throughout the plant during the outage to plan work and document changes. The Health Physics, Maintenance, Operations, Instrumentation & Controls, and Engineering Departments all used the equipment in their work.

*Taken from, "Advanced Imaging Tools for Nuclear Power Plant Operation and Maintenance," by Dennis E. Owen, James Ketchel, and John F. O'Brien, Nuclear Plant Journal, November-December 1992, p. 48.*