N238. Piping System Inspection and Testing: Managing the Massive Results, Records, and Reports

Maintenance of nuclear power plant piping systems has attained greater importance as the result of catastrophic failures experienced during the 1980s. Erosion in feedwater piping, corrosion in service water system piping, and thermal fatigue in pressurizer piping have brought forth comprehensive piping inspections and testing programs to detect cracks and deterioration before failures occur. These inspection programs require management of extensive activities to identify inspection locations, specify inspection procedures, quantify testing results, and justify corrective actions. Tens of thousands of records containing design specifications, as built details, nondestructive testing (NDT) instructions, material constituents, testing results, failure experiences, and corrective action descriptions are employed to properly manage a complete piping system inspection program.

Complex plant piping systems will include components such as pumps, fittings, reducers, valves, circumferential girth welds, hanger lug attachments, instrumentation taps, and drain/vent connections. Each component may require one or more of 13 NDT methods for a thorough assessment of its structural condition. Some components will require repeat inspections at periodic time intervals to identify deterioration trends and forecast when repair actions will be needed. Comprehensive inspection reports that are produced to document the findings can become overwhelming with pages of tabular NDT data amongst sections of procedural text pages. A plant manager often has difficulty in judging the significance of the NDT data since the relationship between the data the inspection location is not readily apparent.

Engineers work from drawings to develop an "engineering sense" or "intuitive judgment" about maintenance needs. A nuclear plant engineer must rely on drawings that portray damage data because actual inspection of a damage location is limited by radiation protection controls. New state-of-the-art computer-aided design (CAD) capability now allows the combination of inspection results and graphic display of a piping system. This linkage of component location graphics with inspection information enhances the analysis process and fosters comprehension of the data relevance.

In nuclear plants, comprehensive inspection reports must be produced and distributed to the U.S. Nuclear Regulatory Commission (NRC). These reports are available to the general public through the NRC's Public Document Room. Complex technical terminology and explanations must be sufficiently documented and appropriately described. Special inspection reports are a necessity and must be readily generated. A data management system that combines the inspection results with piping system displays is now available to produce understandable reports.

Requisites for Piping Inspection

Piping system inspection often requires application of several nondestructive testing (NDT) methods at each inspectable location. To manage the large number of inspection activities and tabulate the data and notes collected from all locations in the piping system, a computer-based NDT data management system has to be employed to record the pertinent data along with the detailed piping schematics. This NDT data management system incorporates the following attributes:

- Provide complete documentation of all inspection results.
- Analyze results based on system and component drawings.
- Enhance data interpretation and characterization.
- Formalize the NDT program for all plants.
- Search the database for the desired records.

- **Create specialized reports, and**
- **Record data sets by spreadsheet displays.**

Assurance that power plant piping systems are structurally acceptable is best accomplished through a formalized NDT program. A formalized program relies on the complete documentation of all inspection results so that future inspection activities can be justified and planned in an optimized manner. Results are analyzed to identify damaged locations so that repeat inspections can be performed before a failure or rupture is experienced. An innovative computerized NDT data management system has been created to directly tie the inspection results to system and component drawings. This visual presentation methodology fosters thorough data interpretation and characterization for achieving engineering judgments that are not achievable when only tabular data is viewed. This computer software system is being applied to complex plant piping systems to manage NDT data pertinent for damage assessments and for planning inspection activities. Cost savings are realized through reduced man-hours for recording inspection results and for reporting inspection actions.

For more, "Piping System Inspection and Testing: Managing the Massive Results, Records, and Reports," by G.P. Singh and D.A. Steinke, Nuclear Plant Journal, November-December 1992. For details contact G.P. Singh, Karta Technology, 1892 Grandstand, San Antonio, TX 78238, Phone (512) 681-9102, Fax (512) 681-9198