UNITED STATES
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September 5, 2007

MEMORANDUM TO: Terence L. Chan, Chief
Piping & Nondestructive Examination Branch
Division of Component Integrity
Office of Nuclear Reactor Regulation

FROM: Donald G. Naujock, Materials Engineer
Piping & Nondestructive Examination Branch
Division of Component Integrity
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SUBJECT: SUMMARY OF PUBLIC MEETING HELD MAY 2 THROUGH 4, 2007 WITH THE ELECTRIC POWER RESEARCH INSTITUTE PERFORMANCE DEMONSTRATION INITIATIVE REPRESENTATIVES (TAC NO. MD4240)

On May 2 through 4, 2007, the staff participated in a public meeting with representatives from the Electric Power Research Institute (EPRI) - Performance Demonstration Initiative (PDI) program at the EPRI Office, 942 Corridor Boulevard, Knoxville, Tennessee. EPRI provides PDI's business operations and technical support. PDI is a nuclear power industry initiative established to develop and administer the qualification requirements of Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," Section XI of the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code) and to develop and administer the demonstrations and qualifications of ultrasonic examinations of butt welds that are associated with other EPRI programs.

The purpose of the meeting was to discuss PDI's approach for implementing selected aspects of Appendix VIII and associated items. The subjects discussed were the status of reactor pressure vessel and piping performance demonstrations, the variables in the performance demonstration data base, the proposed ASME Code actions affecting ultrasonic examinations, the inspectibility of cast austenitic piping, dissimilar metal welds, and weld overlays, and the regulatory action affecting UT examinations. These meetings are a continuation of formal dialog between Nuclear Regulatory Commission and the industry on PDI's implementation of Appendix VIII and other nondestructive testing issues of mutual interest. The dialog provides opportunities to discuss testing difficulties, review PDI's program methodology for the selected supplements, and address issues regarding the ASME Code. The meeting participants and agenda are listed in Enclosures 1 and 2 respectively. Handouts provided at the meeting are included as Enclosures 3 through 12.

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OPEN ITEMS FROM NOVEMBER 7 & 8, 2006 MEETING

Status of Depth Sizing Flaws in Dissimilar Metal

PDI is in the process of developing a manual generic procedure using phased array UT techniques for depth sizing flaws in dissimilar metal welds. To date no one is qualified for manual depth sizing from the inside diameter. Action item: PDI is continuing with technique development.

PDI Definitions of Terms

PDI has used the terms: gaps, limitations, add-on, and site specific to explain aspects of performance demonstrations. PDI is in the process of developing definitions and application examples. At the May 2 through 4, 2007 meeting, PDI explained that: "Site Specific" is used for narrowing the settings within essential variable ranges in a qualified procedure to address a site specific configuration that was not represented in the performance demonstration test specimens. Site specific applications do not expand the range of any essential variables. PDI used the term "gap" for samples which are generic configurations needed to narrow the essential variable ranges in order to improve examination results. Action item: PDI is continuing the development of definitions and examples.

Location Accuracy of Ligaments

PDI presented in Enclosure 3, "Ligament Measurement Accuracy," an intuitive approach for determining a ligament root mean square (RMS) error which relies on tip diffraction signals. For Supplement 4 surface breaking flaws, the measurement of ligament error is equal to the flaw RMS error. For Supplement 6 non-surface breaking flaws, the measurement of ligament error depends on an error distribution because only the differences of two signals are recorded with each signal having its own measurement error. PDI proposed using a ligament error equal to ½ of the flaw RMS error. In the absence of data, the U.S Nuclear Regulatory Commission (NRC) questioned the accuracy of the proposal. The NRC requested that future Supplement 6 test results record in the database the actual performance demonstration values along with the difference in values. This knowledge can be used to verify PDI's proposed ligament error. Action item: PDI will propose to their management a study of Supplement 6 ligament error.

High Density Polyethylene (HDPE) Pipe

The use of HDPE pipe is currently not addressed by ASME Code. The proposed Code case moving through Section XI for replacement of Class 3 piping with HDPE piping has no UT examination requirements. In the absence of any UT requirements, PDI will not be taking any action on HDPE piping issues.

PDI Performance Demonstration Database

In early 2005, PDI informed the NRC that they were updating the performance demonstration databases which are used for recording test specific parameters and results. The NRC expressed an interest in reviewing some of the information to study the effectiveness of performance-based ultrasonic testing (UT). PDI requested that the NRC provide a list of variables. On March 15, 2005, the NRC sent a letter listing the variables of interest which was

discussed at the May 24 & 25, 2005, semi-annual NRC-PDI meeting (meeting minutes dated September 8, 2005, ADAMS No. ML052580257). PDI informed the NRC that most of the variables listed in the March 15, 2005, letter will be in the updated performance demonstration database. On July 27, 2006, the NRC sent a letter to PDI requesting a list of all variables used in the PDI performance demonstration database and a description of each variable. The NRC presented a list of subjects for queries (expressed at previous NRC-PDI meetings) and an example of a query for IGSCC in Enclosure 4. On January 19, 2007, PDI responded to NRC's July 27, 2006 letter with a recommendation that key NRC and EPRI personnel have an information meeting. PDI will address NRC's July 27, 2007 letter and discuss the application of the variables for queries at an information meeting scheduled for July 24 and 25, 2007, tentatively, at the EPRI NDE Center, Charlotte, North Carolina. Action item for PDI and NRC.

NRC Letter dated May 31, 2006

On May 31, 2006, NRC sent PDI a letter requesting collaborative assistance in assembling probability of detection and component configurations data on dissimilar metal welds. The information is for assessing the reliability of dissimilar metal, nickel-based alloy weld inspections in leak-before-break applications. Action item: EPRI-MRP is developing a response to the NRC's request.

STATUS OF REACTOR PRESSURE VESSEL QUALIFICATION PROGRAM

PDI presented an update of their reactor pressure vessel (RPV) program which is summarized in Enclosure 5, "PDI RPV Updates." The RPV performance demonstration schedule is booked through the end of the year. The PDI program is a mature program. The continued high demand for RPV qualifications was unexpected this late after the initial qualification surge. Much of PDI's performance demonstration activity is on qualifying new equipment for domestic and foreign suppliers. PDI is not considering the effects of new reactor design on the PDI program. No action items.

STATUS OF ASME CODE WORK

PDI presented a brief discussion on the accomplishments sponsored by EPRI for 2006 and the work that will be done in 2007. Descriptions of these actions are summarized in Enclosure 6, "ASME Code Update." These actions are in various stages of the ASME Code approval process. PDI also included in Enclosure 6 comments on significant changes to the current proposed rules. Starting with the 2007 Edition, Appendix VIII, PDI and 10 CFR 50.55a(b)(2)(xv) will be in agreement.

PDI will be presenting at the next ASME Code committee meeting an Intent Interpretation IN 07-02 which expands the use of Appendix VIII, Supplement 1, Paragraph 4110(d) regarding the evaluation and substitution of pulsers, receivers, and search units to include other components of the examination system identified as essential variables, provided the examination system is within the tolerances of the original system. Supplement 1 identifies the important parameters as receiver center frequency and receiver band width. Action item: PDI will develop a paper on the equipment equivalence that will include signal-to-noise ratios, electronic noise versus acoustic noise of the material being inspected, and phased array systems and components.

In a discussion on phased array equipment, a comment was made that vendors may stop supporting older models of phased array equipment. Without available replacement parts and repair facilities, the phased array equipment owners would experience forced obsolescence of their equipment. The discussion expanded to the need for a less than full performance demonstration when changes are made to existing equipment. Action item: PDI will propose to their management a project for qualifying changes made to existing equipment and for supporting present equipment that is no longer supported by equipment vendors.

There was a discussion on determining coverage for examinations performed with phased array. Since the phased array transducer consists of multiple angles, the data generated from these angles provide overlapping information. Currently, ASME Code does not provide criteria for determining the importance of a lost angle or the contributions from neighbor angles. Action item: PDI will propose to their management a project for determining coverage using phased array equipment.

STATUS OF PIPING AND BOLTING

PDI presented an update of its Piping and Bolting Program which is summarized in Enclosure 7, "PDI Piping & Bolting Program Update." PDI expanded the diameter and wall thickness range for generic procedures PDI-UT-1 & PDI-UT-3 to accommodate steam generator welds. The number of personnel qualifications are 84 year-to-date with over a 100 tests scheduled for the rest of the year. All of the techniques being qualified this year used the phased array technique. The demand for pipe qualifications is attributed, in part, to increases in foreign participation and improvements to equipment and techniques.

Licensees have been providing PDI with dissimilar metal welds (DMW) configurations. PDI is using this information to determine configuration representation in the performance demonstration test specimen inventory. NRC is also interested in the information which would be used for procuring DMW mockups for a research at the PNNL. To procure representative test specimens and minimize duplication of effort, the NRC/PNNL asked PDI for recommendations of common configurations. Action item: NRC, PNNL, and PDI will discuss at the July 24 & 25, 2007, database meeting.

STATUS OF WELD OVERLAY

PDI presented an update of weld overlays (WOLs) over butt welds which is summarized in Enclosure 8, "Inspection Experience and Welding Guidance for Alloy 600 Welds and Overlays." In 2005 and 2006, 18 Pressure Water Reactors (PWR) applied weld overlays (WOL) on butt welds, 22 PWRs will be applying WOL during 2007 and 9 PWRs are planning to install WOLs in 2008. The presentation contained microphotographs of typical flaws associated with WOLs. Flaw disposition is dependent on flaw type and a multi-level flaw evaluations. An example of flaw disposition using Code Case N-740-1 was included in the presentation.

The surge of ASME Code activity to develop criteria for WOLs has resulted in examination differences between Nonmandatory Appendix Q, "Weld Overlay Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Weldments," Code Case N-504-3, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping," and Code Case N-740-1,

"Dissimilar Metal Weld Overlay for Repair of Class 1, 2, and 3 Items." The examination differences will have to be worked out through the ASME Code committee process. No assigned action.

PDI is developing a WOL guideline document to minimize welding flaws and to assure inspectability. The guideline will contain lessons learned and recommendations for welding and NDE. Revision 0 of the guideline will be issued in summer of 2007.

NDE of Base Metal Beneath WOL

PDI presented their program for inspection and mitigating Alloy 82/182 primary water stress corrosion cracking which is summarized in Enclosure 9, "Inspection & Mitigation of Alloy 82/182 Butt Welds." The project is to develop UT techniques for examination of cast austenitic base metal beneath a WOL and UT techniques for examination of the wrought austenitic base metal beyond the outer 25% beneath pre-emptive WOL. PDI conducted preliminary work on three cast austenitic specimens containing HIP (hot isostatic pressure) notches. The specimen were examined with conventional and phased array UT techniques. The UT techniques could detect corner trap signals but could not detect the HIP notches. For future efforts, PDI is considering low frequency search units and evaluate another flaw making process. PDI had some success looking for flaws located beneath the WOL and 25% outer base metal using conventional and phased array UT techniques. Many of the inside surface connected flaws greater than 43% through wall were detected; none of the flaws less than 35% through wall were detected. Action item: PDI will continue with current action.

NDE of Weld Inlays

PDI is developing a program for inspection of weld inlays which is summarized in Enclosure 10, "Weld Inlay Examination Capability." Weld inlays have been used for mitigating cracks in Alloy 600 head penetration tubes (WCAP-15987-P, Revision 2-P-A) and for preventing intergranular stress corrosion cracking in non-L grades of stainless steel. Installing weld inlays is similar to the approach used for corrosion resistant cladding. Weld inlays have a machined surface which is optimal for scanning using UT techniques. The objectives of this project is to provide documented evidence that the inlay repair and mitigation approach can be effectively examined using existing inside surface qualified procedures. If the project is successful, PDI will initiate action to include corrosion resistant cladding requirements in Appendix VIII, Supplement 14. Action item: PDI will continue with this effort.

COVERAGE LIMITATION OF AUSTENITIC WELDS

NRC initiated a discussion on the applicability of using Supplement 10 qualified procedures for examination of austenitic-to-austenitic welds (Supplement 2), where applicable, to improve examination coverage. Supplement 2 mockups are representative of the non-optimum surface, geometry, and alignment conditions. Currently, Supplement 2 qualifications are only applicable to near side weld examinations, thus coverage is limited to 50% maximum per weld side. Because of the component configurations, welds may be limited to the near side because of the component configuration being non-conducive to UT examinations. There was a question on the frequency of flaws occurring for plant operations on the component side of the weld. Action items: PDI will survey the industry for examples of Supplement 2 examinations that found flaws on the component side of the weld.

Supplement 2 qualifications are also applicable to welds with optimum surface, geometry, and alignment conditions. However, the coverage for welds with optimum conditions is based on the result from the performance demonstration conducted on specimens fabricated with non-optimum surface, geometry and alignment conditions. The specimens used for Supplement 10 performance demonstration have welds with optimum surface, geometry, and alignment conditions. The major differences between Supplement 2 and Supplement 10 are that Supplement 10 qualifications are performed on specimens with the weld crown removed and the flaws are located on the far side of the austenitic weld (the carbon steel side). Title 10 of the code of Federal Regulations (10 CFR) 50.55a(b)(2)(xv)(B) requires that Supplement 10 performance demonstrations be scanned from the austenitic side of the DMW, thus the performance demonstration, as administered by PDI, is a single side demonstration.

The concerns were that similar metal welds experience more base metal shrinkage, poorer crown removal, greater pipe misalignment, different flaw location in the specimens, and inside surface geometry than existed in DMWs. It was mentioned that flaws are normally located in the base metal for similar metal welds and in the welds for DMW. The concerns did not address current situations that may experience coverage improvement as a result of a performance demonstration conducted on specimens with optimum surface and alignment conditions. For instance, IGSCC welds in an examination program that follows the EPRI RISK-informed examination criteria have smooth surfaces.

The discussion of single side qualification for Supplement 2 was mentioned as a possibility. The 10 CFR 50.55a(b)(2)(xv)(2) states in part that "Where examination from both sides is not possible on austenitic welds or dissimilar metal welds, full coverage credit from a single side may be claimed only after completing a successful single-sided Appendix VIII demonstration using flaws on the opposite side of the weld.

Action item: PDI will examine the differences in examination techniques between Supplements 2 and 10. NRC will locate drawing examples of requests for relief that may benefit from a Supplement 10 examination.

OTHER ITEMS OF INTEREST

There is a lot of activity in the industry on new reactor design. 10 CFR Part 50, Appendix A, Criterion 32 stipulates that components which are part of the reactor coolant pressure boundary shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leaktight integrity. For volumetric examinations, inspectability has to consider both ASME Section III emphasis on radiography and ASME Section XI emphasis on UT. PDI is developing a guideline for the "Design for Inspectability" of welds and components in new reactors. The guideline will be available to the utilities near the end of 2007. Action item: PDI will continue with guideline development.

NRC recognized that when utilities follow RISK-informed examination programs, the examination of socket welds are performed using UT. The industry is currently applying socket weld UT as a go no-go examination. With RISK-informed criteria being adopted in ASME Code, the question is should the industry develop a consensus position for socket weld UT? Action item: open item for future discussions.

Many of the proposed action items discussed at these NRC - PDI semi-annual meetings must receive approval and funding from EPRI management. The time span between the

semi-annual meetings slow the exchange of information on EPRI's approval of proposed action items back to the NRC, thus agenda items are unnecessarily carried to the next semi-annual NRC/PDI meeting. These items are carried as open items to the next semi-annual meeting. Action item: PDI will provide timely notification to the NRC of EPRI approvals on proposed action item.

Code Case N-729-1

PDI made a presentation commenting on NRC's proposed conditions to Code Case N-729-1, Enclosure 11, "Draft Response to NRC Proposed Rule Conditions for Code Case N--729-1." The presentation was informative. PDI will formally submit a letter with their comments to the NRC before the end of the public comment period.

Code Case N-659

PDI made a presentation commenting on NRC's proposed conditions to Code Case N-659, Enclosure 12, "Code Case N-659 Implementation." The presentation was informative. PDI will formally submit a letter with their comments to the NRC before the end of the public comment period.

NEXT MEETING

The next semi-annual NRC/PDI meeting is tentatively scheduled between November 2007 and December 2007. The exact date and location will be announced at a later date.

Enclosures:
1. Public Meeting With EPRI-PDI Attendance
2. Agenda For Meeting With EPRI-PDI
3. Ligament Measurement Accuracy
4. Database Queries
5. RPV Update
6. ASME Code Update
7. Piping & Bolting Program Update
8. Inspection Experience and Welding Guidance for Alloy 600 Welds and Overlays
9. Inspection & Mitigation of Alloy 82/182 Butt Welds
10. Weld Inlay Examination Capability
11. Draft Response to NRC Proposed Rule Conditions for Code Case N-729-1
12. Code Case N-659 Implementation

ATTENDANCE FOR PUBLIC MEETING WITH EPRI-PDI, MAY 2 THROUGH 4, 2007

NAME	ORGANIZATION
Don Naujock	NRC
Terence Chan	NRC
Tim Lupold	NRC
Melvin Holmberg	NRC - Region III
Steve Doctor	Pacific Northwest National Laboratory
Gary Lofthus	Nuclear Management Company
Randy Linden	PPL Susquehanna
Carl Latiolais	EPRI - NDE Center
Mike Gothard	EPRI - NDE Center
Brad Thigpen	EPRI - NDE Center
Robert Barnes	EPRI - NDE Center
Terry McAlister	SCANA Company
Jim McArdle	Duke Power Company
Damon Priestley	Progress Energry
Dan Nowakowski	Florida Power & Light Company
John Leonard	IHI Southwest Technologies
Ronald Swain	Entergy Nuclear South
Kevin Hacker	Dominion -Virginia Power
James Lents	Tennessee Valley Authority
David Anthony	Amergen Energy
Michael Canny	Constellation Energy
Steven Mortensen	General Electric
David Kurek	Westinghouse
David Zimmermann	Duke Power
Adam Conti	AREVA
Dom Sutton	Southern Nuclear Operating
John Hayden	Structural Integrity Associates

ENCLOSURE 1

AGENDA FOR MEETING WITH EPRI - PDI

EPRI Office, 942 Corridor Boulevard, Knoxville, Tennessee

May 2 through 4, 2007

May 2, 2007

1. Introduction and Administrative
2. Open items from last meeting (November 7 & 8, 2006).
3. Status of PDI Reactor Pressure Vessel Demonstration Program.
4. ASME Code Update.

May 3, 2007

1. Status of Dissimilar Metal Weld Program Update.
2. Status of Weld Overlays.
3. Status of weld inlays.
4. New Issues of Mutual Interest.

May 4, 2007

1. Carry-Over from Previous Day's Agenda.
2. Miscellaneous.
3. Review of Open items.
4. Public Comment.

ENCLOSURE 2

semi-annual meetings slow the exchange of information on EPRI's approval of proposed action items back to the NRC. These items are carried as open items to the next semi-annual meeting. Action item: PDI will provide timely notification to the NRC of EPRI approvals on proposed action item.

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