

November 29, 2001

MEMORANDUM TO: Terence L. Chan, Chief  
Materials Inspection Section  
Materials and Chemical Engineering Branch  
Division of Engineering

FROM: Donald G. Naujock, Metallurgist */ra/*  
Materials Inspection Section  
Materials and Chemical Engineering Branch  
Division of Engineering

SUBJECT: SUMMARY OF PUBLIC MEETING HELD JUNE 12 THROUGH JUNE 14,  
2001, WITH PDI REPRESENTATIVES (TAC NO. MB1766)

From June 12 through June 14, 2001, the staff participated in a public meeting with representatives from the Electric Power Research Institute (EPRI) - Performance Demonstration Initiative (PDI) program at the EPRI NDE Center, Charlotte, North Carolina. The purpose of the meeting was to discuss PDI's approach for implementing Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (Code); Supplement 2, "Qualification Requirements for Wrought Austenitic Piping Welds;" Supplement 10, "Qualification Requirements for Dissimilar Metal Piping Welds;" and Supplement 11, "Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds." Other subjects discussed at the meeting were: Application of Section XI, Appendix VIII for Section III examinations, corrosion resistant cladding, an alternative flaw production process, and the detection of a small flaw in thick material. The NRC participants were D. Naujock and M. Modes, and Pacific Northwest National Laboratory (PNNL) personnel S. Doctor and G. Schuster under contract with the NRC. The EPRI and industry participants are listed in Attachment 1. The meeting agenda is Attachment 2. Handouts provided by PDI for selected items in the agenda are provided in Attachments 3 through 8.

In addition to the above, PNNL personnel reviewed acoustical data from a UT examination of a field-repaired dissimilar metal weld that contained an embedded base metal wedge. The review consisted of comparing UT responses from the field weld with UT responses from similar test specimen configurations containing known cracks. This review is summarized in Attachment 9.

**GENERAL COMMENTS:**

The staff informed PDI that licensees have been submitting requests to use ASME Code, Section XI, Appendix VIII, PDI qualifications and Section III examination and acceptance criteria for repair/replacement in lieu of Section III requirements. The staff asked PDI if they were considering the development of a performance demonstration program for Section III. PDI indicated it was unaware of these requests. The staff was informed by PDI that ASME has

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been examining the compatibility of Section III and Section XI nondestructive examination requirements for many years. However, PDI did not know the extent of ASME Code activities on this subject. There is no action on this item.

The staff expressed a need for reducing the differences in requirements between PDI and the Code. Many of these differences are embodied in code cases which have not been incorporated into Code or endorsed in Regulatory Guide 1.147. As a result, the staff has been handling these differences in responses to relief requests. The staff requested assistance from PDI in facilitating these code cases through the Code approval process.

PDI asked the staff for a briefing of NRC's proposal for an international cooperative on Inconel cracking (primary water stress corrosion cracking). NRC's Office of Nuclear Regulatory Research had presented this proposal at various past meetings. The objective of the proposal was to gather information, to discuss nondestructive examination capabilities on control rod drive mechanisms, and to develop an international cooperative on this issue. The international cooperative is in the formative stages and does not have a time line or information for action. The conclusion by the participants at this meeting is that the proposal has no immediate, if any, affect on PDI's time line for testing of dissimilar metal welds.

#### **OLD ITEMS:**

There were 9 open items from the last meeting. These items are captured in the memorandum, "Summary of Public Meeting Held January 31 - February 2, 2001, with PDI Representatives" dated March 22, 2001. These open items were discussed. The following is a summary of these discussions.

1. The NRC staff will determine if any prior recognition of the PDI weld overlay qualification program exists.

The NRC staff determined that a letter is necessary for referencing by licensees that are committed to the performance demonstration criteria recommended by GL 88-01. NRC action item.

2. The NRC requested an update of the performance demonstrations/examinations for IWB-2500-1, Examination Category B-J welds that connect to corrosion resistant cladding (CRC).

PDI in conjunction with the CRC Users Group developed a draft guideline for ultrasonic performance demonstration/examinations of CRC. The draft guideline is Attachment 3. The draft guideline is based on a demonstration performed on a representative CRC mock-up by Appendix VIII, Supplement 2, intergranular stress corrosion cracking (IGSCC) qualified personnel. A representative CRC mock-up is understood to have the same cross-sectional weld appearance, weldment configuration, and materials (wrought stainless steel, cast carbon steel, forged Inconel, etc), and similar throughwall thickness. The examination and examination volume is in accordance with Code requirements. The draft guideline will be presented at an upcoming CRC User Group meeting. PDI action item.

CRC piping/welds are of limited number (less than 300) and of unique configurations that they may be outside the scope of Appendix VIII performance demonstrations and associated examinations. By considering CRC examinations outside of Appendix VIII, a potential conflict with the requirements of Section XI, Appendix I may result. Appendix I, I-2220 directs all piping examination requirements to Appendix VIII (which may not apply) or, as directed by I-2400, all other examinations are conducted according to Section V, Article 4. The draft guideline does not appear to satisfy I-2220 or I-2400. The NRC asked the PDI/CRC representatives to resolve/address the apparent differences with Appendix I. PDI action item.

3. The NRC asked PDI for an update on the difficulty with the detection of a small ID flaw in a 7.89-inch thick carbon steel mock-up.

The difficulty is associated with an examination performed from the OD which used manual UT techniques. PDI concluded that the mock-up was designed for automated examination from the ID. Therefore, ASME Code proximity rules were not considered in the location of ID flaws. However, when the examination was conducted from the OD, a deeper flaw shadowed the shallow flaw in question. The shallow flaw could not be detected from two sides. PDI determined that the mock-up would not be used for performance demonstrations conducted from the OD. Instead, performance demonstrations from the OD would use a currently available, thicker carbon steel mock-up. This item is closed.

4. The NRC ask PDI to discuss the bases for selecting weld configurations and flaws that will be used for dissimilar metal weld (DMW) mock-ups.

PDI gathered information on DMW configurations frequently found at BWR and PWR plants, common pipe sizes, and service induced pipe failures. Their findings are in Attachments 4, 5, and 6. PDI grouped their data in order to design mock-ups and representative test specimens. The NRC staff believes that the test specimens with the proposed complexities are sufficiently difficult to challenge the procedures and personnel taking the performance demonstration tests. The staff did not take exception to PDI's grouping of configurations, mock-up size selection, or flaws. PDI is in the process of designing test specimens and evaluating the effectiveness of practice mock-ups. PDI action item.

5. The NRC asked PDI to discuss their evaluation of fabricated cracks for selected DMW and weld overlay test specimens.

PDI presented data on their fabricated cracks for weld overlay specimens in Attachment 7. PDI developed procedures for applying the hot isostatic pressing (HIP) process to electrical discharge machined (EDM) notches in order to produce simulated (fabricated) cracks. The HIP-EDM notches were evaluated for their appearance and acoustic responses with those of real cracks. The criteria for appearance was a crack tip with a maximum tip diameter of .002 inch. PDI examined the fabricated cracks with UT and recorded the acoustic data. Then, the fabricated cracks were cross-sectioned for metallographic examinations. The metallographic examinations showed that the tip diameters for the fabricated cracks easily satisfied the .002 inch maximum. In fact,

several fabricated flaws were so tight that tip diameters could not be detectable at 100x magnification. PDI provided the recorded acoustic responses and metallographic record images for our review. The consensus was that the fabricated cracks (HIP-EDM notches) had acoustic responses similar to real cracks. The application of fabricated cracks for weld overlay specimens, however, is not approved in the Code. PDI will proceed with establishing the acceptability of fabricated cracks in selected weld overlay and DMW test specimens. PDI action item.

6. NRC asked PDI to discuss examination coverage of DMW welds from four directions.

The PDI made the decision to perform DMW performance demonstrations from one side of the weld and a best effort examination through the weld and far side. The reasoning is that many of the DMWs are accessible only from one side. Currently, Code requires that DMWs be examined axially and circumferentially from both sides of the weld. In order to achieve the required coverage, the examination would have to be performed on both sides of the weld. For licensees using PDI's limited qualifications (one side with a best effort on the other), there is the question of how licensees will assure weld integrity based on an examination using the PDI limited qualifications. A second question is whether to allow use of the limited DMW qualifications for plant-specific, unique configurations.

In response to Question 1, PDI stated that since inspection can only be performed from one side of a DMW, they were going to perform the qualification from one side and a best effort for the opposite side. The best effort may effectively detect a flaw much deeper (greater percentage throughwall) than the Code minimum that is part of a qualification. Therefore, plants will have to perform flaw analyses based on what can be detected on the opposite side during an examination. The coverage is still based on examinations being performed from both sides of the weld. Inability to achieve the required coverage will result in a need to request Code relief or exemption from the regulatory requirements (whichever applies). If access is available from both sides of the weld, the examination is conducted from both sides in order to achieve the necessary coverage. This item is closed.

In response to Question 2, PDI presented a proposal for expanding DMW qualifications for site-specific situations in Attachment 6. The proposal would allow the licensee to determine if a particular configuration is within the scope of the procedure. If not within the scope, the license must perform a site-specific demonstration on a representative mock-up. If a meaningful examination cannot be demonstrated using UT, the licensee can examine the configuration using a different volumetric method, e.g. radiography. There may, however, be site-specific designs that cannot be reliably inspected using a UT qualified procedure. If the coverage is not achievable or the weld cannot be inspected, the licensee must seek relief. This item is closed.

7. The NRC asked PDI for supporting information that show Inconel welds are acoustically similar to stainless steel ones.

PDI is continuing to gather the information. PDI action item.

8. The NRC asked PDI to discuss the status of the two draft code cases for DMWs.

The draft code cases are an alternative to Appendix VIII, Supplement 10. One is for pipe examinations performed from the outside diameter and the other is for pipe examinations performed from the inside diameter. PDI will present the drafts to the appropriate working group at the August 2001 ASME Code meeting. PDI action item.

9. PDI presented a conceptual application of using computer-based UT data for satisfying annual training requirements, e.g., computer simulation of examinations. PDI mentioned that the language for computer-based UT training may already exist in Code Case N-583. The NRC staff believes that CC N-583 is not clear on its application and is not compatible with 10 CFR 50.55a(b)(2)(xiv). Instead, the NRC staff suggested possible wording for a revision to CC N-583 (CC N-583-1) which would be compatible with 10 CFR 50.55a(b)(2)(xiv).

"...Personnel shall practice UT techniques by examining welds containing cracks or analyzing prerecorded data of examinations performed on material containing cracks. The cracks must be similar to those that may be encountered during inservice examinations. This training shall be at least 8 hours of hands-on practice per year and completed no earlier than 6 months prior to performing UT examinations at a licensee's facility. The training shall be administered by an NDE Instructor or Level III."

PDI is conducting trials with novice and expert UT personnel in order to assess the effectiveness of the computer software. This item is closed.

#### **OTHER ITEMS:**

The test specimens from the Tri-party agreement between EPRI, the Boiling Water Reactor Owners Group (BWROG), and NRC dated July 3, 1984, have been incorporated into the PDI weld overlay program. These test specimens do not comply with Code. Therefore, PDI developed a draft code case that permits continued use of these specimens for performance demonstration testing. PDI has submitted the draft code case to ASME.

PDI provided a status of their program of weld overlay testing in Attachment 7. PDI is expecting to start performance demonstration testing in late August 2001.

The staff raised the issue of inspection frequency for weld overlays. Inspection frequencies are not addressed by the Code. For BWRs, inspection frequencies are addressed in the Boiling Water Reactor Vessel Inspection Program topical reports for the mitigation of IGSCC. These topical reports have been approved by the NRC staff. Inspection frequencies for pressure water reactors (PWR) have not been established. However, inspection frequencies for weld overlays are outside the scope of the PDI program. PDI indicated that an EPRI staff member will present the subject to PWR personnel at an upcoming Materials Reliability Program (MRP) meeting. PDI will relay information acquired from the MRP meeting back to the staff. PDI action item.

**FUTURE NRC /PDI INTERACTIONS:**

The next meeting will occur in January or February 2002 at a location and date to be announced.

Attachments: As stated

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PUBLIC MEETING WITH EPRI-PDI, JUNE 12 THROUGH 14, 2001

NAME	TITLE	ORGANIZATION
Donald Naujock	Metallurgist	NRC
Michael Modes	Senior Inspector	NRC
Steve Doctor	Senior Staff Engineer	PNNL
George Schuster*	Staff Engineer	PNNL
Carl Latiolais	PDI Project Manager, Piping/Bolting	EPRI
Gary Lofthus	Senior Nuclear Specialist	Southern Nuclear Power
Larry Becker	PDI Program Manager	EPRI
Jack Spanner	Project Manager	EPRI
Ron Ervine	Consultant	Independent Consultant for EPRI
Robert Smilie	Consultant	Independent Consultant for EPRI
Richard Fuller	PDI Chairman, Piping/Bolting	Dominion Nuclear Conn.
Mike Gothard	RPV Project Manager	EPRI
Randy Linden	PDI Vice Chairman	PPC
Mike Bratton	PDI Chairman	NDE/Entergy

\*Attended June 14, 2001.



PUBLIC MEETING BETWEEN EPRI-PDI AND NRC  
JUNE 12- 14, 2001  
AGENDA

**June 12, 2001**

8:30 AM        Introduction

8:45 AM        Review of Action Items From Previous Meeting

- Status of Code Cases
- Conferring GL 88-01 weld overlay to PDI
- Status of Rule Making

12:00 PM       Lunch

1:00 PM        Weld Overlay Program

- Present measurements on HIP flaws
- View finger printing of specimens
- Discuss examination frequency

4:30 PM        Adjourn

**June 13, 2001**

8:30 AM        Dissimilar Metal Weld

- MRP/PDI coordinated efforts
- Discuss NRC Plans for coordinated research on Inconel cracking as documented in NRC presentation
- Present data on alternative flaw manufacturing

12:00 PM       Lunch

1:00 PM        Dissimilar Metal Welds (Continued)

- Discuss UT responses from alternative flaws and UT responses from field flaws (Ringhals and V.C. Summers)
- Review mock-up configurations and weld fabrication process
- Use of Site-Specific Mock-ups

3:00 PM        Summary and Review of Action Items

4:30 PM        Adjourn

ATTACHMENT 2

**June 14, 2001**

8:30 AM        Dissimilar Metal Weld Data Review

- Review/demonstrate TOMOSCAN data from a DMW mock-up containing a replacement weld and compare the data with actual data from a similar field weld

4:30 PM        Adjourn



