REACTOR COOLANT SYSTEM DISSIMILAR METAL BUTT WELDS

CORNERSTONE: Barrier Integrity
Initiating Events

APPLICABILITY: This temporary instruction (TI) applies to all holders of operating licenses for pressurized-water reactors (PWRs).

2515/172-01 OBJECTIVES

The objective of this TI is to:

a. Support NRC staff oversight of licensees' dissimilar metal butt weld (DMBW) mitigation and inspection activities that are being implemented in accordance with the industry guidelines of the Materials Reliability Program (MRP) -139, "Primary System Piping Butt Weld Inspection and Evaluation Guidelines," July 2005.

b. Verify that each pressurized water reactor (PWR) plant conforms to its commitments to conduct an inspection program consistent with the industry's MPR-139 guidelines.

c. Verify that mitigation techniques implemented by licensees are consistent with MRP-139 as discussed in the inspection requirements section of this TI.

d. Define and initiate information gathering so that NRC staff can identify and develop possible future regulatory positions, generic communications, and rulemaking in this area.

This TI pertains to primary system piping dissimilar metal butt welds 1" NPS or larger, including**:**

a. pressurizer nozzle dissimilar metal butt welds (DMBWs).

b. DMBWs less than or equal to 14 inches exposed to temperatures equivalent to the hot leg.

c. DMBWs larger than 14 inches exposed to temperatures equivalent to the hot leg.

d. DMBWs exposed to temperatures equivalent to the cold leg.

MRP-139 indicates that the baseline volumetric inspections of butt welds in these four sets of locations are to be completed in 2007, 2008, 2009, and 2010, respectively. The baseline examinations are the initial examinations credited by the licensee under its MRP-139 program. Baseline examinations are usually conducted subsequent to the issuance of MRP-139, but a licensee may be able to take credit for a prior examination. Under MRP-139, the initial examinations may be performed on unmitigated welds and, in the case of mitigation by full structural weld overlay, may be performed after mitigation.

2515/172-02 BACKGROUND

Operating experience has demonstrated that Alloy 600/82/182 materials exposed to primary coolant water (or steam) at the normal operating conditions of PWR plants have cracked due to primary water stress corrosion cracking (PWSCC). The NRC has issued several bulletins and an order since 2001 related to the occurrence of PWSCC in reactor coolant system components and welds containing Alloy 600/82/182.

Several methods have been used or are being considered by industry to address PWSCC. These methods include increased frequency of inspection, replacement of the Alloy 600/82/182 materials with Alloy 690/52/152 materials, structural weld overlays with Alloy 52/152 materials, stress improvement processes that place the susceptible materials in compression to prevent crack initiation and growth, and application of Alloy 52 onlay or inlays on the inside surface of the susceptible Alloy 82/182 material. Onlays are similar to cladding applied to the ID of the pipe to provide a PWSCC resistant barrier between the original DM weld and the reactor coolant. Onlays are applied to the ID of the pipe and result in a reduction of the pipe inside diameter. Inlays are similar to onlays, but are deposited in a machined groove on the ID of the pipe so that the weld build-up restores the original pipe inside diameter.

Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), which is incorporated into NRC regulations by 10 CFR 50.55a, "Codes and Standards," specifies examination requirements for reactor coolant system components and piping, including DMBWs. Volumetric, surface, and visual examinations are required to ensure the integrity of the reactor coolant pressure boundary and safe operation of the plant.

In September 2005, NEI issued MRP-139, “Material Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline,” with mandatory implementation for all PWRs under the industry’s proactive management of materials degradation initiative, NEI 03-08. MRP-139 provides industry’s guidance for the volumetric and visual inspections of butt welds in PWR primary systems. The MRP-139 inspections augment examinations of these locations already required by the ASME Code, Section XI. MRP-139 Section 1.2 on Implementation, Section 5 on Examination Requirements, and Section 6 on Examination Schedules were assigned the mandatory implementation category under NEI 03-08.

Based on recent experience with industry that arose from multiple flaws found in pressurizer nozzle welds at Wolf Creek, the staff concluded that it is essential that NRC

staff monitor more closely the MRP-139 inspection programs and, in particular, the deviations utilities may be planning to take from the guidelines stated in MRP-139. This TI contains inspection and reporting requirements pertaining to deviations taken from MRP-139.

The NRC staff is relying on the industry MRP-139 program as a short term approach for addressing PWSCC, but the NRC staff needs to verify that each licensee has developed an inspection program and is implementing its commitments to conduct the inspections in accordance with MRP-139. As a long term approach for addressing PWSCC, the NRC staff has worked with the ASME Code to develop inspection requirements for dissimilar metal butt welds. These Code inspection requirements are contained in ASME Code Case N-770 that the NRC is assessing for incorporation in the upcoming 10 CFR 50.55a rulemaking.

2515/172-03 INSPECTION REQUIREMENTS

03.01 Licensee's Implementation of the MRP-139 Baseline Inspections.

Verify the following:

a. The licensee's inspection program includes inspections of the Alloy 82/182 pressurizer, hot leg and cold leg temperature butt welds within the scope of MPR-139 and the schedules for these baseline inspections are consistent with the requirements stated in MRP-139. For any welds that are not in the licensee's program and are listed as typical Alloy 82/182 welds in MRP-139 or other primary system butt welds the inspector believes falls under the scope of MRP-139, the inspector is to verify that the licensee has appropriate records to support its determination.

   The inspector will review licensee records which:

   1. Identify which DM welds are within the scope of the MRP-139 for each Unit,

   2. Identify basis for excluding DM butt welds from MRP-139 inspection requirements,

   3. Document the baseline inspection schedule for each of the DM welds within the scope of MRP-139 for each Unit.

   If any baseline inspection scope, categorization, schedule, or method deviates from MRP-139 guidelines, determine what deviations occurred or are planned and the general basis for the deviations.

b. The licensees completed their MRP-139 baseline inspections of all pressurizer DMBWs.

03.02 Volumetric Examinations.

Licensees perform volumetric examinations as part of the inspection/mitigation activities as described in MRP-139. Inspectors should use Inspection Procedure (IP) 57080, "Ultrasonic Testing Examination" and ASME Code Section XI, Appendix VIII, "Performance Demonstrations for Ultrasonic Examination Systems" as guidance when observing or reviewing the volumetric examinations performed by the licensee. During refueling outages, for DM butt welds scheduled to be inspected and/or mitigated as part of the site program that implements MRP-139 requirements, perform the following inspections, of the work performed during the same refueling cycle, through either direct observation (preferred method) or records review:

a. Observe or review at least one UT examination of a weld (for example, an examination of a weld that is categorized as not being mitigated, an examination of a weld prior to mitigation by either weld overlay or mechanical stress improvement, or an examination of a weld after mitigation by mechanical stress improvement or onlay or inlay). Verify that the inspection is performed in accordance with the guidelines in MRP-139, Section 5.1. Verify for inlay weld examinations included in the inspection sample, that the examination was completed in accordance with an NRC approved relief request or Code Case N-770. Also, if the licensee intends to conduct future UT examinations of the inlay repairs from a different surface than that examined for preservice, verify that the licensee has established an adequate technical basis for this decision. This observation or review will be performed one time for a pressurizer temperature DM weld, one time for a hot leg temperature weld and one time for a cold leg temperature weld at each unit.

b. Observe or review at least one weld overlay, onlay and inlay volumetric examination if each of these mitigation methods is used. Verify that the inspection performed is consistent with the NRC staff relief request authorization for the weld overlay, onlay or inlay. If the inspection coverage warrants further evaluation, review the licensee's documentation of the basis for achieving the required inspection coverage. For each Unit, this observation or review will be performed one time for each mitigation type that a licensee implements (i.e., one observation or review of a weld overlay, one observation or review of an onlay, and one observation or review of an inlay, if each of these mitigations is performed). If no mitigations by welding are performed then this observation does not need to be performed.

c. Verify that the examinations were performed by qualified personnel.

d. Verify that any deficiencies identified were appropriately dispositioned and resolved.

03.03 Weld Overlays.

MRP-139 addresses inspection of dissimilar metal welds mitigated by weld overlays as part of the strategy to address the DMBW issue. Inspectors should use guidance contained in IP 55050, "Nuclear Welding General Inspection Procedure," when

performing their review of licensee's weld overlay techniques. Perform the following inspections to verify that the proper weld overlay techniques were used. For each Unit verify for at least one weld overlay through either direct observation (preferred method) or records review that:

a. The welding activities were performed consistent with ASME Code requirements as modified by NRC staff relief request authorizations.

b. The licensee has submitted a relief request and obtained NRR staff authorization to install the weld overlays, whether full structural or optimized weld overlays.

c. The welding was performed by qualified personnel.

d. Any deficiencies identified were appropriately dispositioned and resolved.

03.04 Mechanical Stress Improvement.

MRP-139 addresses inspection of dissimilar metal welds mitigated by stress improvement (SI) as part of the strategy to address the DMBW issue. For each Unit, during one refueling cycle in which SI is applied to a weld(s), inspectors should review the SI analysis report that describes the essential parameters of the SI process (e.g., the location radial loading is applied and the applied load, as well as the inspection requirements). For at least one application of SI to a weld, verify through either direct observation (preferred method) or records review that:

a. The nozzle, weld, safe end, and pipe configurations, as applicable, are consistent with the configuration addressed in the SI analysis report.

b. The SI analysis report addresses the location radial loading is applied, the applied load, and the effect that plastic deformation of the pipe configuration may have on the ability to conduct volumetric examinations.

c. The licensee's inspection procedure records document that a volumetric examination per the ASME Code, Section XI, Appendix VIII was performed prior to and after the application of the SI. For cold leg welds that cannot be examined without removing the core barrel, if the licensee does not perform the UT examination before the MSIP™, verify the licensee either categorizes the weld as cracked, or completes an eddy current examination and a post-MSIP™ UT examination. If an eddy current examination is performed, verify that the examination is performed and qualified in accordance with requirements of 2004 Edition of ASME Section XI, Appendix IV, or if not, document the applicable codes or standards used.

d. The SI analysis report addresses limiting flaw sizes that may be found during pre-SI and post-SI inspections and that any flaws identified during the volumetric examination are within the limiting flaw sizes established by the SI analysis report.

e. Any deficiencies identified were appropriately dispositioned, and resolved.

03.05 Weld Onlay and Inlays.

MRP-139 addresses inspection of dissimilar metal welds mitigated by weld onlay and weld inlays as part of the strategy to address the DMBW. For each Unit, during a refueling cycle in which weld onlay or inlays are applied, verify for at least one onlay and one inlay application, if either or both are performed, through either direct observation (preferred method) or records review that:

a. The welding activities were performed consistent with ASME Code requirements as modified by any applicable NRC staff relief request authorizations.

b. The licensee has submitted a relief request and obtained NRR staff authorization to install temper bead welding of any inlays.

c. The welding was performed by qualified personnel.

d. The pre-mitigation examination(s) was performed in accordance with ASME Code, Section XI, requirements.

e. The licensee has determined the minimum applied onlay or inlay thickness and it satisfies the minimum thickness requirement. The material used for the onlay or inlay wetted surface is a more resistant material than Alloy 82/182, e.g., Alloy 52, 52M, and the number of weld layers used to apply the onlay or inlay was three or more, to achieve the resistant material composition at the water interface.

f. The licensee's procedures assure that no portion of the original Alloy 82/182 butt weld is exposed to the reactor coolant after application of onlay or inlays (the heat affected zone is not considered part of the original weld for this determination).

g. The licensee followed its in-process and post-onlay or post-inlay acceptance criteria for the surface examinations, including any requirements specified by the owner in addition to Code requirements, for example PT white or no rounded indications larger than 1/16 inch.

h. Any deficiencies identified were appropriately dispositioned, and resolved.

03.06 Inservice Inspection Program.

MRP-139 contains industry mandatory requirements for baseline and inservice inspection. In accordance with MRP-139, inservice inspections are performed based on the categorization of the weld configuration, which are classified as Categories A–I for volumetric examinations and Categories J and K for visual examinations. The inspectors will perform an inspection to verify that the licensee has prepared an MRP-139 inservice inspection program (or an equivalent program such as an Alloy 600 program) and applicable welds are included in the program in categories consistent with

MRP-139 guidelines. The inspectors will verify that the licensee's inspection program and procedures specify inspection frequencies consistent with Tables 6-1 and 6-2 of MRP-139. The inspectors will determine if any welds are categorized as H or I and review the licensee's basis for the categorization and the licensee's plans for addressing potential PWSCC. The inspector will determine if any deviations are planned from the inspection guidelines in MRP-139, i.e., frequencies, examination volumes, methods.

2515/172-04 GUIDANCE

Certain inspection requirements will have to take place during plant outages when the activities occur. For inspection activities related to programs and reports, it may be necessary to perform inspection onsite during a non-outage period to obtain adequate support from the licensee's staff. Additionally, if nondestructive testing performed at a licensee's facility by an inspection vendor is not directly observed (preferred method), a records review may require that portions of the inspection be performed at vendor facilities since the data may not available at the plant.

The changes in Revision 1 of the TI to steps 3.02, 3.03, 3.04, and 3.05 are meant to be forward looking only. Hence, there is no need for the inspector to apply these steps to any refueling outages that occurred prior to issuance of Revision 1. If steps 3.01 and 3.06 (3.05 in Revision 0) were previously completed to an earlier version of the TI, then there is no need to repeat these steps under subsequent revisions to the TI. However, the inspector will review any changes to the program with respect to steps 3.01 and 3.06 since the previous inspection. Those changes may include decisions such as whether to mitigate or not and the resulting impact on inspection frequency.

Inspections conducted for steps 3.02.a or 3.02.b of the TI can be credited for step 2.01.a of IP 71111.08 and inspections conducted for steps 3.03 or 3.05 of the TI can be credited for step 02.01.e of IP 71111.08.

If step 3.02.a of the TI was completed for a particular category (pressurizer temperature, hot leg temperature or cold leg temperature) during a previous outage, then there is no need to complete that step during a subsequent outage. Likewise, if step 03.02.b of the TI was completed for a particular mitigation type (full structural weld overlay, onlay or inlay) during a previous outage, then there is no need to complete that step during a subsequent outage. If the inspector performs steps 3.02.a and/or 3.02.b on two different welds during the outage, then both can be credited for IP 71111.08 step 2.01.a, and the step 2.01.a requirement that the sample consist of two or three different types of NDE activities is waived.

If step 3.03, 3.04 or 3.05 of the TI was completed during a previous outage, then there is no need to complete that step during subsequent outages.

In some instances, licensee activities associated with steps 3.02.a, 3.02.b, 3.03, 3.04, and 3.05 of the TI may be delayed, especially with respect to generation of documentation, past the end of the ISI inspection. In such instances, the inspector may consider that step complete if the inspector performed a substantive portion of the

observations/review associated with that step. In such instances, the inspector should be careful not to claim in the inspection report completion of any substeps that were not accomplished.

04.01 Licensee's Implementation of the MRP-139 Baseline Inspections.

MRP-139 establishes an industry mandatory requirement for licensees to complete baseline inspections of DMBWs in the reactor coolant system. The licensee's baseline inspections may be performed on a number of different weld configurations based on their MRP-139 categorization. Regardless of licensee's plans to mitigate a particular weld, the MRP-139 baseline inspections must be performed using ASME, Section XI, Appendix VIII, qualified methods.

MRP-139 Table 2-1 contains a listing of typical locations involving Alloy 82/182 piping butt welds in Westinghouse, Combustion Engineering and Babcox & Wilcox design plants. This listing can be used to determine if the licensee appropriately placed these DMBWs into the MRP-139 inspection program. A complete listing of Alloy 82/182 welds should also be contained in licensee documentation prepared in response to MRP-126. Licensees may have used various source documents to develop the scope of welds addressed by MRP-139. These documents may include plant drawings, fabrication records, and reactor vendor records and reports. The records relied upon by the licensee should contain conclusive evidence of the weld material and should not contain relevant disclaimer statements that negate the presented material.

It is the NRC staff's view that if the licensee plans to mitigate a weld by a mechanical stress improvement, the licensee has to conduct a pre-stress improvement inspection, and this pre-stress improvement inspection is the MRP-139 baseline inspection. This view is generally consistent with Code Case N-770 that has been prepared by ASME Section XI on inspection of Alloy 82/182 dissimilar metal butt welds.

There were nine plants scheduled to perform the pressurizer DMBW inspections in the spring 2008 time frame. This schedule for inspection of the pressurizer weld connections was the subject of extensive NRC staff review and evaluation as documented in the NRC staff's safety assessment on this issue which can be obtained in Agency Documents Access and Management System (ADAMS) using accession number ML072400199.

The NRC staff has concluded that B&W plant core flood nozzle welds are exposed to the cold leg temperature and can be categorized accordingly.

Regional inspectors have pointed out that auxiliary head adapters (AHA) butt welds at certain ice condenser plants would appear to be within the scope of MRP-139. The MRP made a decision that AHA welds were not within the scope of MRP-139. Accordingly, the questions in Section 5 of this TI on reporting requirements do not apply to AHA butt welds.

04.02 Volumetric Examinations.

Examination of a weld prior to application of a full structural weld overlay (FSWO) is not required by either MRP-139 or the ASME code cases pertaining to weld overlays. While such an examination is not required to be performed prior to application of a FSWO, some licensees may choose to perform this type of examination.

04.03 Weld Overlays.

MRP-139 has two categories that apply to full structural weld overlays, Category B and Category F. Category B applies to uncracked welds and Category F applies to cracked welds. An overlaid weld can only be categorized as Category B if a Section XI, Appendix VIII, qualified inspection of the weld is performed prior to application of the overlay and no indications were found. To categorize a weld as Category B, the inspection should be performed in the same outage as the weld overlay. If a qualified inspection of the weld is not performed prior to the overlay, the weld has to be placed in Category F.

ASME Section XI does not presently contain inspection requirements for weld overlays. Section XI has issued Code Cases N-504-3, "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping" and N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique." These two code cases are listed in Regulatory Guide (RG) 1.147, Revision 15, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," with limitations. Although these code cases are approved with limitations in RG 1.147, their use for a weld overlay on an Alloy 82/182 weld requires a relief request, since they were not written for this application. ASME Section XI has issued N-740 and N-740-1, "Dissimilar Metal Weld Overlay for Repair of Class 1, 2, and 3 Items," and is working on the second revision to this code case. When the NRC staff approves code case N-740-X in RG 1.147 and endorses this regulatory guide in an update to 10 CFR 50.55a, application of weld overlays will no longer require NRR approval through authorization of a relief request.

04.04 Mechanical Stress Improvement.

Mechanical stress improvement is generally applied through a proprietary process referred to as the Mechanical Stress Improvement Process or MSIP™. This process was originally employed in the nuclear power industry to boiling water reactor piping susceptible to intergranular stress corrosion cracking. Each application of the process is expected to be accompanied by an analysis report that documents the specific stress improvement parameters to be applied to the weld, the basis for the parameters, and the inspection requirements. While SI has been through MSIP™ in the past, industry may begin to use what are referred to as optimized weld overlays. Optimized weld overlays are not as thick as full structural weld overlays, but are designed to develop stress improvement benefits similar to an MSIP™. ASME Code, Section XI, Appendix VIII volumetric examination must be performed prior to and after the application of stress improvement whether by an MSIP™ or an optimized weld overlay.

04.05 Weld Onlays and Inlays.

Industry maintains that mitigation of Alloy 82/182 welds by onlays and inlays can be performed in accordance with ASME Code, Section III and Section XI requirements, except for temper bead welding over the ferritic nozzle in the case of inlays. Industry presented its assessment of applicable ASME Code rules during a meeting with the NRC staff on September 18, 2008. The NRC staff has not taken exception to this assessment. ASME is preparing Code Case N-754 to consolidate the applicable ASME Code provisions to facilitate user compliance with ASME requirements. A number of replacement steam generators have Alloy 52 onlay on the Alloy 82/182 butt welds between the replacement steam generators and reactor coolant piping. The inspection requirements of 2515/172-03.05 and the reporting requirements of 2515/172-05.e. also apply to these replacement steam generator welds made prior to the issuance of MRP-139.

The NRC staff is interested in the following aspects of application of onlays and inlays to mitigate Alloy 82/182 welds. Item 1 below does not appear to be governed by a Code requirement but will be addressed in Code Case N-754. Items 2 – 4 are governed by ASME Code requirements. Draft Code Case N-754 addresses and owners may elect to implement surface examination acceptance criteria more limiting than required by the Code. According to MRP-139, Item 5 is defined by MRP-139, Category A.

1. The thickness of the onlays or inlays.

2. Preservice inspection

3. Surface testing performed during the application or build-up of the weld layers.

4. Post-onlay or post-inlay inspection.

5. Inservice inspection frequency.

MRP-139 indicates that Alloy 82/182 welds that are “effectively isolated” from reactor coolant are treated as Category A welds. ASME Code Case N-770 contains explicit inservice inspection frequency requirements for onlay and inlays. The NRC staff is assessing this code case for incorporation in the upcoming 10 CFR 50.55a rulemaking. The NRC staff is currently assessing the adequacy of draft Code Case N-754.

04.06 Inservice Inspection Program.

MRP-139 categorizes welds according to their mitigation status. Mitigation techniques noted in MRP-139 are full structural weld overlays and stress improvement. MRP-139 requires less frequent inspection of welds that have been mitigated. These categories also relate to the condition of the weld as cracked or uncracked. Categories H and I pertain to welds for which a qualified ASME examination cannot be performed. NRR is aware of some welds for which a qualified examination may not be possible without taking additional measures. Category H and I welds may include welds joined to cast austenitic stainless steel piping.

Document inspection results in section 4OA5 of the routine resident inspectors' integrated inspection report and send a copy of the inspection report to NRR/DCI, Attention: Robert Hardies or e-mail the electronic file of the inspection report to robert.hardies@nrc.gov. In addition, forward the electronic file(s) that documents the results of this TI to Mr. Robert Hardies when the TI is completed. Finally, Mr. Hardies can also be reached by telephone at (301) 415-5802.

When the inspection requirements of this TI are completed and the TI is closed for a given unit and site, Regional Branch Chiefs are to report the completion and closure, via email to E-mail robert.hardies@nrc.gov. This E-mail should identify the NRC inspection reports which documented completion of the TI 2515/172 inspections for each unit.

The purpose of this TI is to support NRR/DCI by inspecting and reporting on the licensees' performance on implementing MRP-139. Specifically, the inspectors should provide a qualitative description of the effectiveness of the licensees' DMBW inspection and mitigation program. As a minimum, the inspectors shall document the following aspects in an inspection report:

a. For MRP-139 baseline inspections:

   1. Have the baseline inspections been performed or are they scheduled to be performed in accordance with MRP-139 guidance?

   2. Is the licensee planning to take any deviations from the MRP-139 baseline inspection scope, categorization, schedule, or method requirements of MRP-139? If so, what deviations are planned and what is the general basis for the deviation? If inspectors determine that a licensee is planning to deviate from any MRP-139 baseline inspection requirements, NRR should be informed by email as soon as possible.

b. For each volumetric examination inspected, was the activity:

   1. Performed in accordance with the examination guidelines in MRP-139 Section 5.1 and consistent with NRC staff relief request authorizations for weld overlaid welds?

   2. Performed by qualified personnel? (Briefly describe the personnel training/qualification process used by the licensee for this activity.)

   3. Performed such that deficiencies were identified, dispositioned, and resolved?

c. For each weld overlay inspected, was the activity:

   1. Performed in accordance with ASME Code welding requirements and consistent with NRC staff relief requests authorizations? Has the licensee

submitted a relief request and obtained NRR staff authorization to install the weld overlays?

2. Performed by qualified personnel? (Briefly describe the personnel training/qualification process used by the licensee for this activity.)

3. Performed such that deficiencies were identified, dispositioned, and resolved?

d. For each mechanical stress improvement inspected, was the activity performed in accordance with a documented analysis report for stress improvement processes and in accordance with demonstrated procedures? Specifically,

1. Are the nozzle, weld, safe end, and pipe configurations, as applicable, consistent with the configuration addressed in the SI analysis report?

2. Does the SI analysis report address the location that radial deformation is applied, the applied load, and the effect that plastic deformation of the pipe configuration may have on the ability to conduct volumetric examinations?

3. Do the licensee's inspection procedure records document that a volumetric examination per the ASME Code, Section XI, Appendix VIII was performed prior to and after the application of the SI?

4. Does the SI analysis report address limiting flaw sizes that may be found during pre-SI and post-SI inspections and that any flaws identified during the volumetric examination are to be within the limiting flaw sizes established by the SI analysis report.

5. Performed such that deficiencies were identified, dispositioned, and resolved?

e. For application of weld onlay and inlays inspected:

1. Were the welding activities performed consistent with ASME Code requirements as modified by any applicable NRC staff relief request authorizations?

2. Did the licensee submit a relief request and obtain NRR staff authorization to install temper bead welding of any inlays?

3. Was the welding performed by qualified personnel?

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4. Was the pre-mitigation examination(s) performed in accordance with ASME Code, Section XI, requirements?

5. Was the minimum applied onlay or inlay thickness for the application(s) determined to be at least 1/8"? Was an Alloy 52 type material used to install the onlay or inlay and were at least three weld layers used to apply the onlay

or inlay? If the onlay or inlay was machined subsequent to being deposited, what actions were taken to ensure at least three layers of weld material remain on all portions of the onlay or inlay?

6. Did the licensee's procedures assure that no portion of the original Alloy 82/182 butt weld will be exposed to the reactor coolant after application of onlay or inlays? Briefly describe how.

7. What in-process and post-onlay or post-inlay acceptance criteria were used by the licensee for the surface examination? Did the licensee use a modified PT-white criteria?

8. Were the onlay and inlay activities performed such that deficiencies were identified, dispositioned, and resolved?

f. For the inservice inspection program:

1. Has the licensee prepared an MRP-139 inservice inspection or equivalent (e.g. Alloy 600) program? If not, briefly summarize the licensee's basis for not having a documented program and when the licensee plans to complete preparation of the program.

2. In the MRP-139 inservice inspection or equivalent (e.g. Alloy 600) program, are the welds appropriately categorized in accordance with MRP-139? If any welds are not appropriately categorized, briefly explain the discrepancies.

3. In the MRP-139 inservice inspection or equivalent (e.g. Alloy 600) program, are the inservice inspection frequencies, which may differ between the first and second 10-year intervals after the MRP-139 baseline inspection, consistent with the inservice inspection frequencies called for by MRP-139?

4. If any welds are categorized as H or I, briefly explain the licensee's basis for the categorization and the licensee's plans for addressing potential PWSCC.

5. If the licensee is planning to take deviations from the MRP-139 inservice inspection guidelines, what are the deviations and what are the general bases for the deviations? Was the NEI 03-08 process for filing deviations followed?

Any issues identified during this inspection should be processed and documented in accordance with NRC Inspection Manual Chapter (IMC) 0612, "Power Reactor Inspection Reports." The significance of inspection findings should be evaluated in accordance with applicable appendices of IMC 0609, "Significance Determination Process." Any noncompliance with NRC requirements resulting from this inspection should be evaluated and documented in accordance with NRC Enforcement Policy (NUREG -1600) and Section 3.12 of the NRC Enforcement Manual. Also, licensees are required to address the findings resulting from the MRP-139 inspections (i.e., perform

analyses and repairs) in accordance with existing requirements in the ASME code and 10 CFR 50.55a.

2515/172-06 COMPLETION SCHEDULE

Up to three outages may be needed to complete the inspections associated with this issue. The inspection activities identified in this TI should be completed within one cycle of the last MRP-139 baseline inspections, except that all activities should be completed by December 31, 2010. Inspectors may perform inspection of record-related aspects of the TI at any time and, if an inspection opportunity is available, perform inspections of mitigation and examination activities in this TI during the refueling outages. If a licensee is planning to mitigate welds in a future outage before the expiration date of this TI, the TI should remain open for that plant until the applicable requirements of 03.01 through 03.06 are met. If the applicable requirements of Sections 03.01 through 03.06 are met for all welds within the scope of MRP-139, the TI may be closed for that plant. If the requirements of Sections 03.01 through 03.06 cannot be met for all welds within the scope of MRP-139 because mitigation of certain welds will not be completed until after the expiration date of this TI, the TI may be closed for that plant.

This TI may be completed in phases as follows:

Step 3.1 Review of the MRP-139 or Alloy 600 program

Step 3.2.a for pressurizer temperature welds (3.2.a pzr temp)

Step 3.2.a for hot leg temperature welds (3.2.a hl temp)

Step 3.2.a for cold leg temperature welds (3.2.a cl temp)

Step 3.2.b for a weld overlay (if on is performed) (3.2.b overlay)

Step 3.2.b for an onlay (if one is performed) (3.2.b onlay)

Step 3.2.b for an inlay (if one is performed) (3.2.b inlay)

Step 3.3 for application of a weld overlay (if one is performed) (3.3 overlay)

Step 3.4 for application of mechanical stress improvement (if performed) (3.4 MSIP)

Step 3.5 for onlays or inlays (one of each if they are performed) (3.5 in/onlay)

Step 3.6 inservice inspection program review (ISI review)

2515/172-07 EXPIRATION

This TI will expire on June 30, 2011, or upon completion of the MRP-139 baseline inspections for all DMBWs in the PWR fleet, whichever is sooner. This TI will be in

effect for more than 24 months because the mitigation and MRP-139 baseline inspection of DMBWs potentially affected by PWSCC will not be fully addressed by all licensees for all affected components until at least the end of calendar year 2010.

2515/172-08 CONTACT

For questions regarding the performance of this TI and emergent issues, contact Bob Hardies at (301) 415-5802 or e-mail Bob Hardies at robert.hardies@nrc.gov.

2515/172-09 STATISTICAL DATA REPORTING

All direct inspection effort expended on this TI is to be charged to 2515/172 for reporting by the Regulatory Information Tracking System (RITS) reporting with an IPE code of TI, and the activity code of TIP for preparation of TID for documentation.

2515/172-10 ORIGINATING ORGANIZATION INFORMATION

10.01 Organizational Responsibility.

This TI was initiated by the Division of Component Integrity (NRR/DCI).

10.02 Resource Estimate.

The estimated direct inspection effort to perform this TI is estimated to be 40 to 60 hours per PWR unit per refueling cycle.

2515/172-11 TRAINING

No formal training is proposed for the performance of this TI. However, if technical support is needed during the inspection of licensees' weld mitigations, volumetric examinations or MRP-139 program, contact DCI through IRIB at least 30 days before the anticipated need for technical support.

2515/172-12 REFERENCES

Primary System Piping Butt Weld Inspection and Evaluation Guidelines, MRP-139, EPRI, Palo Alto, CA, July 2005. [ML052150196]

Primary System Piping Butt Weld Inspection and Evaluation Guidelines, MRP-139, Revision 1, EPRI, Palo Alto, CA, DATE. [ML100970671]

Safety Assessment on the Advanced Finite Element Analysis Related to Growth of Postulated Primary Water Stress Corrosion Cracking Flaws in Pressurizer Nozzle Dissimilar Metal Butt Welds, August 2007. [ML072400199]

Mayfield, M.E. letter to Marion, A., NRC Staff Comments on MRP-139, October 12, 2005 [ML052720290]

MRP 2006-018 MRP-139 Interim Guidance on Implementation Schedules, August 11, 2006 [ML080300470]

MRP 2007-039 MRP-139 Interim Guidance on Bare Metal Visual Inspection, November 1, 2007 [ML080300474]

MRP 2007-038 MRP-139 Interim Guidance on Small Bore Volumetric Inspection, November 1, 2007 [ML080300478]

MRP 2008-033 MRP-139 Interim Guidance on Cast Austenitic Stainless Steel Exam Requirements, September 11, 2008 [ML083500133]

Summary of Public Meeting on September 18, 2008, with the Nuclear Energy Institute Regarding Inlay and Onlay Applications on Dissimilar Metal Welds, October 1, 2008 [ML082770053]

Code Case N-754 - In the ASME development process

Code Case N-770 - In the ASME development process

Attachment 1

Revision History for TI 2515/172

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
N/A	02/21/08 CN 08-009	Support NRC staff oversight of licensees' dissimilar metal butt weld (DMBW) mitigation and inspection activities that are being implemented in accordance with the industry guidelines of the Materials Reliability Program (MRP) -139.	N/A	N/A	ML080390335
N/A	05/27/10 CN 10-014	Addresses questions raised by the regions after initial round of inspections. Adds inspection requirements for mitigation by onlay and inlays, not contained in Revision 0. Balances increased inspection requirements with reduced requirements on mitigation by stress improvement.	N/A	N/A	ML101160474