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From:
Kenneth Balkey

TACs:
MD2442

To:
John Grobe

*** YELLOW ***

For Signature of:

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Description:
ASME Actions to Address Alloy 82/182/600 Materials and to Define Role of ASME Code in Ensuring Integrity of Pressure Retaining Components

Assigned To:
DCI

Contact:
GROBE, JOHN A

Special Instructions:

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1880 — 2005

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CODES & STANDARDS

June 10, 2006

Mr. John A. Grobe, Director
Division of Component Integrity
Office Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Md. 20852

Subject: ASME Actions to Address Alloy 82/182/600 Materials and to Define Role of ASME Code in Ensuring Integrity of Pressure Retaining Components

References:
1. ASME Letter from Mr. Kenneth R. Balkey, Vice President, Nuclear Codes and Standards to Mr. James E. Dyer, Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission dated February 17, 2006.
2. NRC letter from Mr. John A. Grobe, Director, Division of Component Integrity, Office of Nuclear Reactor Regulation to Mr. Kenneth R. Balkey, Vice President, ASME Nuclear Codes and Standards dated March 13, 2006.
3. Nuclear Energy Institute letter from Mr. Jack W. Roe, Director, Operations Support, Nuclear Generation Division to Ms. Catherine Haney, Director, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission dated May 4, 2006.

Dear Mr. Grobe:

Per Reference 1, it was indicated that we would provide updates to cognizant U.S. Nuclear Regulatory Commission and industry management as significant activities have been accomplished related to actions for addressing ASME Boiler and Pressure Vessel (B&PV) Code inspection requirements for managing primary water stress corrosion cracking (PWSCC) in butt weld connections in reactor coolant pressure boundary piping. Key activities did occur during the ASME Boiler Code meetings in Phoenix in May 2006 regarding the development of a draft Code Case for defining inspection frequencies for the subject dissimilar metal weld connections. In addition, the Executive Committee of ASME Boiler & Pressure Vessel Code Subcommittee XI also took action to address the topic that you raised in your letter (Reference 2) regarding the role of the ASME Code in ensuring the integrity of pressure retaining components. This letter provides an update on both of these developments.

During the May 15th meeting of the ASME Section XI Task Group on Alloy 600, NRC representatives presented a draft Code Case for examination requirements for PWR primary system piping butt welds subject to PWSCC. NRC staff representatives offered to prepare a draft of this Code Case at the February 2006 Task Group meeting to initiate the development of these examination requirements. The efforts of the NRC staff members to prepare and present this draft Code Case are appreciated by our ASME Nuclear Codes and Standards members.

Given the complexity of several elements involved in this standards action, many comments and questions on the proposed examination requirements were raised by both Task Group members and from other interested parties who attended the meeting. Because of this level of discussion and the need to have a well documented and understood technical basis, the Task Group Chair recommended and obtained a small team of volunteers to address these comments and questions to bring forward a revision of the draft Code Case for consideration at their next meeting in August 2006. A small task team of utility, vendor, and NRC representatives has been formed and has already begun working together to keep this key action moving forward. In order to facilitate development of the next draft of the Code Case, a conference call for the task team members was held on June 7, 2006 to identify the future actions needed to bring forward the revised Case. In short, a draft Code Case with proposed examination requirements for the subject weld connections has been developed, and a team is in place to address comments, to seek supporting technical information, and to bring recommendations forward to move the action through the consensus process.

The Executive Committee of the ASME B&PVC Subcommittee XI met on May 16 and reviewed developments related to NRC interest in discussing the role of the ASME Code in ensuring the integrity of pressure retaining components, including the aspect of ensuring leakage integrity. The Committee was also aware of a recent letter from the Nuclear Energy Institute to the NRC (Reference 3) that included an NEI White Paper titled, *"Treatment of Operational Leakage from ASME Class 2 and 3 Components,"* dated May 2006. This document discusses, in part, NEI's position on the relationship of ASME B&PVC Section XI inservice inspection requirements to NRC guidance on operability determinations regarding pressure boundary leakage in ASME Code Class 1, 2 and 3 components.

Given the NRC stated interest in the role of the ASME Code in ensuring pressure boundary integrity, along with ASME's interest in reviewing the recent NEI White Paper, the Executive Committee decided that it would be prudent to develop an ASME position paper on this topic. To this end, cognizant ASME Subcommittee XI representatives volunteered to form a Project Team that will report to the Subcommittee XI Executive Committee.

As key progress is made on the above developments, updates will be provided to you and cognizant industry management. As always, if you have any questions, please do not hesitate to contact either me or Kevin Ennis in our New York office, at your convenience.

Sincerely,

Kenneth R. Balkey

Kenneth R. Balkey, PE
Vice President,
Nuclear Codes and Standards

cc: Mr. James E. Dyer, U.S. Nuclear Regulatory Commission
Dr. Brian W. Sheron, U.S. Nuclear Regulatory Commission
Mr. William Bateman, U.S. Nuclear Regulatory Commission
Mr. Ted Sullivan, U.S. Nuclear Regulatory Commission
Mr. Terence Chan, U.S. Nuclear Regulatory Commission
Mr. Kevin Ennis, ASME Staff, Director, Nuclear Codes & Standards
Mr. Richard Porco, Vice Chair, ASME Board on Nuclear Codes & Standards Operations
Mr. Bryan Erler, Vice Chair, ASME Board on Nuclear Codes & Standards Strategic Initiatives
Mr. Gary Park, Chair, ASME Subcommittee on Nuclear Inservice Inspection
Mr. Richard Swayne, Vice Chair, ASME Subcommittee on Nuclear Inservice Inspection
Mr. Robin Dyle, Chair, Task Group Alloy 600
Mr. Guido Karcher, Chair, ASME Boiler & Pressure Vessel Standards Committee
Mr. Mike Robinson, Chair, MRP Issue Integration Group (IIG)
Mr. Jeff Gasser, Executive Chair of PWR Materials Management Program (PMMP)
Mr. Dave Modeen, Chief Nuclear Officer, Electric Power Research Institute
Mr. Alex Marion, Executive Director of Nuclear Operations, Nuclear Energy Institute

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February 17, 2006

Mr. James E. Dyer
Director Office Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Md. 20852

Subject: ASME Actions to address Alloy 82/182/600 materials

References:
1. ASME Letter from Ken Balkey, Vice President, Nuclear Codes and Standards dated February 8, 2006.
2. NRC letter from J. E. Dyer, Director Office of Nuclear Reactor Regulation, dated 20 December 2005

Dear Mr. Dyer:

Per Reference 1, we provided the approach that ASME would use during upcoming Code meetings in Portland, Oregon to respond to your letter in Reference 2. In that letter you requested that ASME Section XI take actions necessary to develop needed improvements to existing ASME Boiler and Pressure Vessel (B&PV) Code inspection requirements for managing primary water stress corrosion cracking (PWSCC) in butt weld connections in reactor coolant pressure boundary piping. The ASME approach would include presentations delivered at the February 13, 2006 meeting of the ASME Section XI Task Group on Alloy 600 by representatives from the Electric Power Research Institute Materials Reliability Project (MRP) and the U.S Nuclear Regulatory Commission Staff followed by discussion by other ASME stakeholders in attendance. The presented information and follow-on discussion would help ASME Section XI determine a course of action to address the subject issue.

Both the MRP and NRC presentations and the follow-on discussions were valuable in making that determination. A vote of the Task Group members and visiting stakeholders was taken, and the consensus was to proceed with ASME Code action to address the frequency of examination of dissimilar metal butt welds. On Tuesday, February 14, 2006, the Executive Committee of ASME Subcommittee XI reviewed the Task Group vote and approved by vote to have the Task Group move forward to develop an ASME Code Case providing appropriate examination frequency requirements for the piping butt welds of concern.

During the Task Group discussion, it was made evident that certain challenges will be involved in developing this Code Case. For example, writing this Code Case will entail the development of inspection frequencies and bases for these frequencies. Industry has mitigative actions underway to address PWSCC in reactor coolant pressure boundary piping, and bases will be needed for the inspection frequencies of both mitigated and non-mitigated welds. It was also recognized that some of the MRP information associated with this matter, particularly the technical and risk

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Add: James Dyer

assessments used to support inspection frequencies and mitigative actions, are proprietary. The Task Group will need input from cognizant industry and regulatory representatives to assist in forming the technical basis for the Code Case. This type of cooperation occurred in the development of ASME Code Case N-729 for examination of partial penetration welds in PWR reactor pressure vessel heads, and we are hopeful that such cooperation will be provided in the future. However, ASME has developed other Code requirements for similar situations involving proprietary information.

The Task Group plans to prepare a draft Code Case for consideration at their next meeting in May 2006 to start the Code development process. The Task Group will begin technical discussions at that meeting and will continue similar dialogue at follow-on ASME Code meetings to achieve consensus on the primary system butt weld examination frequency requirements using information that is brought forward at each meeting. Once consensus is attained by the Task Group, this Standards Action will be moved for review and approval by ASME Subcommittee XI, the ASME B&PV Standards Committee, and finally the ASME Board on Nuclear Codes and Standards. Upon ASME approval, this Code Case will allow for trial application of new examination requirements so that experience can be gained in parallel with ongoing industry actions prior to the revised examination requirements being incorporated into Section XI of the ASME B&PV Code.

We would like to thank both the representatives of the MRP and NRC Staff for taking the time to develop and deliver excellent presentations at the February 13 ASME Task Group meeting. The time and effort to support ASME Code activities by all our stakeholders is greatly appreciated.

Members of NRC Staff also indicated their willingness to help support the technical basis for this Code Case action. The ongoing participation of NRC Staff members in the ASME Code process is welcome and encouraged on this and other initiatives.

As significant activities are accomplished, updates will be provided to you and cognizant industry management. As always, if you have any questions, please do not hesitate to contact either me or Kevin Ennis in our New York office, at your convenience.

Sincerely,

Kenneth R. Balkey

Kenneth R. Balkey, PE
Vice President,
Nuclear Codes and Standards

February 17, 2006
Mr. James E. Dyer
February 17, 2006

cc: Dr. Brian W. Sheron, US NRC / NRR
Mr. John Grobe, Director of Division of Component Integrity
Mr. William Bateman, U.S. Nuclear Regulatory Commission
Mr. Ted Sullivan, U.S. Nuclear Regulatory Commission
Mr. Terence Chan, U.S. Nuclear Regulatory Commission
Mr. Kevin Ennis, ASME Staff, Director, Nuclear Codes & Standards
Mr. Richard Porco,Vice Chair, ASME Board on Nuclear Codes & Standards Operations
Mr. Bryan Erler, Vice Chair, ASME Board on Nuclear Codes & Standards Strategic Initiatives
Mr. Gary Park, Chair, ASME Subcommittee on Nuclear Inservice Inspection
Mr. Richard Swayne, Vice Chair, ASME Subcommittee on Nuclear Inservice Inspection
Mr. Robin Dyle, Chair, Task Group Alloy 600
Mr. Guido Karcher, Chair, ASME Boiler & Pressure Vessel Standards Committee
Mr. Mike Robinson, Chair, MRP Issue Integration Group (IIG)
Mr. Jeff Gasser, Executive Chair of PWR Materials Management Program (PMMP)
Mr. Dave Modeen, Chief Nuclear Officer, Electric Power Research Institute
Mr. Alex Marion, Senior Director, Engineering, Nuclear Energy Institute

March 13, 2006

Mr. Kenneth R. Balkey, Vice President
Nuclear Codes and Standards
American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Dear Mr. Balkey,

By letter dated December 20, 2005, the Nuclear Regulatory Commission (NRC) staff requested that the ASME Boiler and Pressure Vessel Code (ASME Code), Section XI, take actions necessary to develop needed improvements to the existing ASME Code inspection requirements for managing primary water stress corrosion cracking in dissimilar metal (DM) butt weld connections in reactor coolant pressure boundary (RCPB) piping. In response to this request you indicated in your letter of February 17, 2006, that the ASME Code, Section XI, Task Group on Alloy 600 will move forward to develop a code case providing appropriate examination frequency requirements for DM butt welds in RCPB piping.

The NRC appreciates the actions taken by ASME to reach this decision to revise the inspection requirements for DM butt welds. In your letter you noted the importance of input from cognizant industry representatives in developing the technical basis for the code case. We share this view. Willingness to assist in the development of the code case and its technical basis, including resolution of any proprietary concerns, was affirmed by representatives of the industry's Materials Reliability Program during the senior management meeting held at the NRC on February 22, 2006.

NRC staff actively participated on the Task Group on Alloy 600 in its work to develop ASME Code Case N-729 on reactor vessel upper head control rod drive penetrations. The NRC staff will continue to be actively involved on the task group as it develops this new code case and its technical basis.

The Nuclear Energy Institute (NEI) recently sent a letter to the NRC (ML060610761) that deals, in part, with the role of the ASME Code in ensuring the integrity of pressure retaining components. This topic is of great interest to the NRC, including the aspect of ensuring leakage integrity. We would be interested in discussing this topic further with representatives of the ASME and NEI and with other interested stakeholders.

Please feel free to contact me regarding any questions you have on this matter.

Sincerely,

/RA/

John A. Grobe, Director
Division of Component Integrity
Office of Nuclear Reactor Regulation

cc: A. Marion, Senior Director of Engineering, Nuclear Energy Institute
G. Park, Chairman, ASME Subcommittee on Nuclear Inservice Inspection
J. Ling, Associate Executive Director, ASME Codes and Standards
K. Ennis, Director, Nuclear Codes and Standards
P. McCullough, V.P. Accreditation, Institute of Nuclear Power Operations
G. L. Vine, Executive Director, Washington Representative, EPRI
R. L. Dyle, Southern Company
M. Robinson, Chair, MRP Issue Integration Group
J. Gasser, Executive Chair of PWR Materials Management Program
D. Modeen, Chief Nuclear Officer, Electric Power Research Institute

Please feel free to contact me regarding any questions you have on this matter.

Sincerely,

/RA/

John A. Grobe, Director
Division of Component Integrity
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NEI

NUCLEAR ENERGY INSTITUTE

Jack Roe
DIRECTOR, OPERATIONS SUPPORT
NUCLEAR GENERATION DIVISION

May 2, 2006

Ms. Catherine Haney
Director, Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: NEI White Paper, "Treatment of Operational Leakage from ASME Class 2 and 3 Components"

Dear Ms. Haney:

This letter is addressed to you in your capacity as Chairman of the NRC Licensing Action Task Force (LATF). NEI has prepared the attached White Paper to document industry concerns with Appendices C.11 and C.12 in the NRC guidance on operability determinations and functionality assessments that was published in Regulatory Issue Summary 2005-20, "Revision to Guidance Formerly Contained in NRC Generic Letter 91-18, 'Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability.'" The White Paper describes the potentially adverse implications of using an NRC guidance document to define component operability. NEI requests that NRC review and comment on the White Paper.

In the near term, NEI requests that NRC promptly publish interim guidance that endorses a process similar to that described in Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," for temporary acceptance of flaws in Class 3 components. The objective is to preclude unnecessary plant shutdowns. Timely action is requested because the guidance contained in RIS 2005-20 has become an inspection issue for several licensees.

In the longer term, NEI recommends that NRC and industry hold working meetings to develop revisions to Appendices C.11 and C.12. As a starting point, NEI has included proposed revisions after the White Paper. The objective would be to reach consensus on the regulatory treatment for operational leakage and the evaluation of flaws in ASME Code Class 1, 2, and 3 components.

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Enclosure 3

As a separate matter, NEI believes that it is inappropriate for NRC to use inspection procedures or generic communications to revise or reinterpret operability requirements that are the purview of plant-specific Technical Specifications. In this regard, our concerns are similar to those expressed in OIG-05-A-19, "Audit of NRC's Generic Communications Program," issued by the NRC Office of the Inspector General on September 30, 2005.

If you have questions or require additional information, please contact me at (202) 739-8138 (jwr@nei.org) or Mike Schoppman at (202) 739-8011 (mas@nei.org).

Sincerely,

Jack Roe

Jack Roe

Enclosure

c: William H. Bateman, NRC, Division of Component Integrity
Thomas H. Boyce, NRC, Technical Specifications Branch
Terrence L. Chan, NRC, Piping & NDE Branch
Christopher I. Grimes, NRC, Division of Policy and Rulemaking
John A. Grobe, NRC, Division of Component Integrity
Edwin M. Hackett, NRC, Division of Operating Reactor Licensing
Cornelius F. Holden, Jr., NRC, Division of Operating Reactor Licensing
Christopher P. Jackson, NRC, Generic Communications and Power Uprate Branch

Acknowledgements

NEI acknowledges the assistance of the following individuals during the development of this White Paper:

Jerry Burford, Entergy
John Dosa, Constellation
Rick Graham, Southern Nuclear Co.
Lesa Hill, Southern Nuclear Co.
Richard Kersey, South Texas Project
Steve Lewis, Entergy
Mike Schoppman, NEI
Joe Weicks, Entergy
Ed Weinkam, NMC

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NEI White Paper

Treatment of Operational Leakage from ASME Class 2 and 3 Components

May 2006

1.0 PURPOSE

The purpose of this White Paper is three-fold:

1. Describe the operational implications of Appendices C.11 and C.12 in the NRC Inspection Manual chapter (Reference 1) that was published in Regulatory Issue Summary (RIS) 2005-20 (Reference 2),

2. Request near-term, interim guidance for the treatment of through-wall flaws in ASME Class 3 components.

3. Recommend working meetings to reach consensus on the treatment of operational leakage and the evaluation of flaws in ASME Code Class 1, 2, and 3 components.

2.0 PROBLEM STATEMENT

The NRC guidance in Appendices C.11 and C.12 of Reference 1 defines an ASME Class 1, 2, or 3 component as <u>inoperable</u> if it has a through-wall flaw, i.e., if it exhibits any amount of pressure boundary leakage. This guidance was distributed publicly by a generic communication (Reference 2). Thus, it appears that NRC has used internal processes (i.e., the NRC Inspection Manual and a Regulatory Issue Summary) to define operability differently from the way it is defined in the Standard Technical Specifications. Industry is concerned that a default definition of inoperability that precludes a licensee from conducting an "immediate determination" of operability may constitute a backfit because it was not promulgated as a formal licensing action.

A default definition of inoperability establishes a potential shutdown scenario for any small operational leak in a Code Class component that is subject to a Technical Specification (TS) Limiting Condition for Operation (LCO). The NRC guidance states that the plant operator must enter the LCO and restore component operability within a specified time or take additional action in accordance with the LCO action statement. In many cases, the additional action is a plant shutdown. To preclude plant shutdown, the plant operator must characterize the flaw geometry by non-destructive examination (NDE) in accordance with Code requirements within the time allowed by the LCO and, if supported by the NDE results, declare the component operable or "operable but degraded." If the LCO time limit is not long enough to complete the Code characterization of the flaw, the plant operator must initiate reactor shutdown. The time constraint is most acute if the flaw is in a common header that affects an entire system. If the <u>system</u> is declared inoperable, the plant operator may have as little as 1 hour to initiate shutdown. It is NEI's position that a plant shutdown may not be the most effective response, from either a safety or risk perspective, to the discovery of a through-wall flaw in a Code component during plant operation. Furthermore, operability is defined by plant-specific Technical Specifications, which have precedence over guidance documents and generic communications.

3.0 EVALUATION

3.1 Impact of NRC Guidance

At least 12 utility companies, with 37 units at 23 sites, could experience a shutdown scenario if they implement the NRC's operability guidance as currently written (see Table 1 for a summary by reactor type and Region).

3.1.1 Single-Train Inoperability

At least 12 utility companies, with 37 units at 23 sites, have TS LCOs for Class 2 and 3 systems. If a Class 3 component with operational leakage were to be declared inoperable, as discussed in NRC Appendices C.11 and C.12, a through-wall leak would render one train of the system inoperable.

3.1.2 Multiple-Train Inoperability

As a subset of Section 3.1.1, several units have common headers in Class 2 and 3 systems. If a Class 2 or 3 component with operational leakage in a common header were to be declared inoperable, as discussed in NRC Appendices C.11 and C.12, a through-wall leak would require initiation of unit shutdown within one hour.

3.1.3 Value-Impact

Implementing the operability determination guidance in NRC Appendices C.11 and C.12 will have cost and risk impacts at operating commercial nuclear plants. The impacts derive from:

- shutdown transition safety/risk implications
- procedure changes
- training program changes
- the cost of additional shutdowns

NEI considers the value of initiating a plant shutdown due to a through-wall leak in a Class 2 or 3 component to be offset by the impacts listed above.

3.2 Comparison of NRC Guidance with Industry Practice

3.2.1 NRC Guidance

The first paragraph, 7th sentence, of NRC Appendix C.11 (Flaw Evaluation) states:

> "If the flaw is through-wall or does not meet the limits established by the Code, the component and part of the system containing the flaw is inoperable."

The third paragraph, 3rd sentence, of NRC Appendix C.12 (Operational Leakage from Class 1, 2, and 3 Components) states:

> "Upon discovery of leakage from a Class 1, 2, or 3 pressure boundary component (pipe wall, valve body, pump casing, etc.), the licensee must declare the component inoperable."

Alternatively, other sections in Reference 1 allow more flexibility than Appendices C.11 and C.12. For example, Section 3.9 (Reasonable Expectation) underscores the importance of flexibility in making sound operability determinations:

> "Reasonable Expectation: The discovery of a degraded or nonconforming condition may call the operability of one or more SSCs into question. <u>A subsequent determination of operability should be based on the licensee's "reasonable expectation," from the evidence collected, that the SSCs are operable and that the operability determination will support that expectation. Reasonable expectation does not mean absolute assurance that the SSCs are operable.</u> The SSCs may be considered operable when there is evidence that the possibility of failure of an SSC has increased, but not to the point of eroding confidence in the reasonable expectation that the SSC remains operable. The supporting basis for the reasonable expectation of SSC operability should provide a high degree of confidence that the SSCs remain operable. It should be noted that the standard of "reasonable expectation" is a high standard, and that there is no such thing as an indeterminate state of operability; an SSC is either operable or inoperable." <u>[emphasis added]</u>

Similarly, Section 6.0 (Operations Based on Operability Determinations) states that a component or system in a degraded or nonconforming condition may be considered "operable but degraded" if it is capable of performing its required safety function and meets applicable technical specification requirements.

In contrast to the language in the body of Reference 1, NRC Appendices C.11 and C.12 default to a restrictive definition of inoperability that precludes a licensee from exercising judgment to reach a "reasonable expectation" of operability for Class 2 or 3 components with through-wall leaks.

3.2.2 Industry Practice

Plant shutdown in response to operational leakage from moderate energy components is contrary to typical industry practice. For example, in the event of a pinhole leak in moderate energy Class 3 piping, licensees apply engineering judgment to determine if the component remains operable based on its ability to accomplish its intended safety function. A follow-up evaluation is then conducted in accordance with the guidance in Generic Letter 90-05 (Reference 3) for temporary acceptance of flaws in Class 3 piping. If the acceptance criteria of GL 90-05 are satisfied, a followup relief request is submitted to NRC in accordance with 10 CFR 50.55a (Reference 4). If the acceptance criteria are not satisfied, the component is declared inoperable and the licensee enters the TS LCO for the affected component or system.

In addition, ASME Code Cases approved by the NRC in Regulatory Guide 1.147 (Reference 5) may provide different methods of evaluating and establishing structural integrity of piping with through-wall flaws.

The factors that can be used to support a presumption of operability upon discovery of a thru-wall flaw in a Class 2 or 3 component are:

- TS surveillance requirements are met
- Design basis safety functions can be accomplished
- System pressure and temperature
- Applicability of relevant ASME Code and Code Cases
- Flaw location
- Low impact on surrounding equipment due to leakage
- Low potential for flaw propagation (based on visual examination)
- Bounding operating experience from previous leakage events and associated inspections and analyses
- Risk information (PRA considerations)
- Engineering judgment

3.3 10 CFR 50.55a and the ASME Code

10 CFR 50.55a invokes the inservice inspection rules of ASME Section XI (Reference 6). However, Section XI rules are not intended to apply to all flaws in all components at all times.

3.3.1 Applicability of ASME Section XI

NRC Appendix C.11 currently states:

> "If a flaw is discovered by any means (including surveillance, maintenance activity, or inservice inspection) in a system subject to Code requirements (whether during normal plant operation, plant transition, or shutdown operation) the flaw must be promptly evaluated using Code rules."

This guidance applies Section XI flaw acceptance and evaluation standards to all component flaws regardless of how they are identified. However, the inservice inspection rules of Section XI apply only to Section XI inservice inspections and tests, not to flaws identified during the performance of maintenance activities, plant walk-downs, or other inspection activities that are not under the jurisdiction of Section XI. For example:

- IWA-1100 states, "This Division provides requirements for inservice inspection and testing of light water nuclear power plants."
- IWA-3100(a) states, "Evaluation shall be made of flaws detected during an inservice examination as required by IWB-3000 for Class 1 pressure retaining components, IWC-3000 for Class 2 pressure retaining components, IWD-3000 for Class 3 pressure retaining components, IWE-3000 for Class MC pressure retaining components, or IWF-3000 for component supports."
- IWA-3300(a) states, "Flaws detected by the pre-service and inservice examinations shall be sized by ...."
- IWB-1100 states, "This Subsection provides requirements for inservice inspection of Class 1 pressure retaining components and their welded attachments in light-water cooled plants."

The limited applicability of the inservice inspection rules of ASME Section XI is illustrated by the three ASME Section XI interpretations described below:

3.3.1.1 *XI-1-89-67*

Question: Is it a requirement of Section XI that additional examinations be performed within the same Examination Category for flaws detected outside the course of an inservice examination that exceed the standards of IWB/IWC/IWD/IWF-3000?

Response: Section XI does not address additional examinations for flaws detected outside the course of an inservice examination.

3.3.1.2 *XI-1-92-03*

Question: Do the provisions of Section XI, IWA-5250 apply to leakage found at times other than during a system pressure test?

Response: No

3.3.1.3 *XI-1-92-19*

Question 1: If leakage identified during the conduct of a visual (VT-2) examination performed in conjunction with a Section XI required pressure test (Table IWA-5210-1) exceeds the acceptance criteria of IWB-3000, IWC-3000, and IWD-3000, are corrective measures required in accordance with IWA-5250(a) prior to continued service?

Response 1: Yes.

Question 2: Does leakage identified during the conduct of normal plant operation, but not in conjunction with a Section XI required pressure test (Table IWA-5210-1), require corrective measures in accordance with IWA-5250(a)?

Response 2: No. Section XI, IWA-5250(a) does not apply during normal plant operation.

This position is also supported by Volume 2 of the Companion Guide to the ASME Boiler & Pressure Vessel Code (Reference 7). With respect to the three interpretations cited above, paragraph 28.4.1 of the Companion Guide states:

> "The referenced interpretations ... include several examples of how ASME Section XI does not provide requirements for the evaluation and acceptance of flaws identified by means other than a required inservice inspection or examination. Thus, if a flaw is found by other than a required inservice examination, no corrective action is prescribed by Section XI."

As described above, the inservice inspection rules of ASME Section XI apply only to flaws identified during the performance of Section XI inservice inspections and tests. Nevertheless, the repair/replacement rules of IWA-4000 always apply regardless of how a flaw is identified. For example, flaws identified during an ASME Section XI inservice inspection, plant walkdown, or plant maintenance are subject to the repair/replacement rules of IWA-4000. As stated in IWA-4110(a):

> "The requirements of this Article apply regardless of the reason for the repair/replacement activity or the method that detected the condition requiring the repair/replacement activity."

3.3.2 <u>Section XI Acceptance Standards and Flaw Evaluation Rules</u>

Appendix C.11 applies Section XI acceptance standards and flaw evaluation rules to any flaw that could be identified in the Section XI pressure boundary. However, Section XI acceptance standards and flaw evaluation rules apply only to welds and materials for which an inservice inspection is required. There are many flaws (e.g., through-wall flaws in pipes or pipe elbows) that could be identified during plant maintenance or inspection activities for which there are no applicable Section XI acceptance standards or flaw evaluation rules.

3.3.2.1 Acceptance Standards

Section XI inservice inspection requirements are specified in the tables of IWB, IWC, IWD, IWE, and IWF-2500 depending on the classification of the component (e.g. ASME Class 1, 2, 3, MC, or NF, respectively).

For a given examination category, these tables identify all required inservice inspections for specific welds (and materials), examination methods, inspection acceptance standards, and other pertinent information. Because Section XI acceptance standards are delineated in IWB, IWC, IWD, IWE -3500 and IWF-3400 (for supports), the tables of IWX-2500 simply refer to the applicable paragraphs in IWX-3000 to invoke the required acceptance standards.

Section XI acceptance standards either do not apply or do not exist for welds and materials that do not require inservice inspection pursuant to the tables in IWX-2500. While Section XI acceptance standards may exist for some welds and materials that are exempt from inservice inspections, there are many cases where there are no Section XI acceptance standards. Examples of cases for which ASME Section XI acceptance standards do not exist are:

- Base materials including base material repair welds in ASME Class 1 vessels (other than reactor pressure vessels) such as pressurizers, steam generators, and heat exchangers
- Base materials including base material repair welds in ASME Class 1, 2, and 3 piping
- Base material including base material repair welds in ASME Class 2 and 3 vessels, pumps, and valves
- ASME Class 1, 2, and 3 partial penetration welds such as those used to attach instrument nozzles to reactor coolant pressure boundary components

3.3.2.2 Flaw Evaluation Rules

Flaws that comply with the acceptance standards of IWB, IWC, IWD, IWE - 3500 and IWF-3400 (for supports) are "acceptable as is" without further action. If flaws do not comply with these acceptance standards, the components containing the flaws may be corrected by a repair or replacement activity, or may be accepted by a supplemental examination or an IWX-3600 flaw evaluation. This position is consistent with IWA-3100(a), which is quoted on page 5.

3.3.3 Section XI and Operability

The inservice inspection requirements of Section XI are established to identify and monitor degradation in components and systems due to mechanisms such as corrosion and fatigue. When a flaw is detected during a Section XI inservice inspection, the flaw is evaluated in accordance with IWA-3100(a). If the flaw complies with these standards, it is "acceptable as is," and the component containing the flaw is acceptable for continued service. If the flaw does not comply with these standards, the component containing the flaw cannot be returned to service until the component is repaired, replaced, accepted by supplemental examination, or accepted by a flaw evaluation in accordance with IWX-3600. In these cases, the acceptable continued service of a component is directly affected by the performance of Section XI inservice inspections.

However, the inservice inspection provisions of Section XI do not apply to flaws identified by plant maintenance and inspection activities outside the scope of Section XI. Therefore, if a flaw (though-wall or non-through-wall) is identified in an ASME Class 2 or 3 component during activities not associated with ASME Section XI, the acceptability of continued service of the component or system is not covered by Section XI.

The ASME Code does not address "operability" in the same context as the Technical Specifications. The senior reactor operator on shift is responsible for making Technical Specification operability determinations. Information from many sources, including ASME Code inspections and evaluations, may be factored into an operability determination. The ASME Code by itself should not be the sole determinant of operability.

4.0 CONCLUSIONS

The acceptability of a component or system for continued service is not based on ASME Section XI except when the flaw is identified while performing a Section XI inservice inspection. Furthermore, a Class 2 or 3 component should not be declared inoperable, as specified in NRC guidance (Reference 1), based solely on the discovery of a through-wall leak if the leak would not prevent the component from performing its design-basis safety function. The corresponding operability determination should be conducted based on flaw characterization, degradation mechanism, structural integrity, flaw evaluation, and leakage effects. The full range of analytical information and techniques should be applied to determine if the component is operable, operable but degraded, or inoperable.

A typical sequence for identifying, evaluating, and repairing a through-wall flaw in an ASME moderate energy Class 2 or 3 component is:

- discover the flaw,
- establish the scope of the operability determination in accordance with Section 4.4 (Scope of Operability Determinations) in Reference 1,
- determine if there is reasonable assurance that component failure will not occur before repair,
- perform an "immediate determination" of operability to determine if the leaking component is operable, "operable but degraded," or inoperable,
- include engineering judgment and operating experience in the immediate operability determination,
- if the component is determined inoperable, follow the plant-specific TS,
- if the component is determined operable but degraded, perform expeditious NDE to characterize the flaw,
- use the results of the NDE in an engineering analysis to make a timely confirmation of operability in support of the immediate determination,
- perform expeditious flaw repair in accordance with the corrective action program, and
- keep the NRC resident inspector informed during the process.

Operability is defined by plant-specific Technical Specifications, which take precedence over NRC Regulatory Issue Summaries and the NRC Inspection Manual. For components that exhibit operational leakage, licensees should base immediate determinations of operability on a reasonable expectation that a leaking component is capable of performing its design-basis safety function(s) and that subsequent flaw characterization will confirm that expectation.

5.0 REFERENCES

1. NRC Inspection Manual, Part 9900: Technical Guidance, "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety," September 26, 2005.

2. NRC Regulatory Issue Summary 2005-20, "Revision to Guidance Formerly Contained in NRC Generic Letter 91-18, 'Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability,'" September 26, 2005.

3. NRC Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," June 15, 1990.

4. 10 CFR 50.55a, Codes and standards.

5. NRC Regulatory Guide 1.147, Revision 14, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," August 2005.

6. American Society of Mechanical Engineers (ASME) Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1998 Edition and 2000 Addenda.

7. ASME Boiler and Pressure Vessel Code, Companion Guide, Volume 2.

Table 1

Industry Survey
(response from approximately 1/3 of operating units)

Units that could experience a TS shutdown scenario if a Class 3 component with a pinhole leak is defined as inoperable on discovery

Utility	# units	PWR	BWR	Region
A	1	x		1
A	2	x		2
A	2	x		2
B	2	x		1
B	2		x	1
B	1	x		1
C	1		x	3
C	1	x		3
C	2	x		3
C	2	x		3
D	2	x		4
E	2		x	2
E	1	x		2
F	1	x		4
F	2	x		4
F	1		x	1
F	1		x	4
G	2	x		2
H	2	x		1
I	2	x		4
J	2	x		4
K	1	x		1
L	2	x		2

C.11 Flaw Evaluation

In accordance with 10 CFR 50.55a(g), ~~structural integrity~~inservice inspection must be ~~maintained~~ performed in conformance with ASME Code Section XI for those parts of a system that are subject to Code requirements. The Code contains rules describing acceptable means of inspecting welds in piping, vessels, and areas of high-stress concentration. The Code also specifies acceptable flaw sizes based on the material type, location, and service of the system within which the flaw is discovered. If the flaw exceeds the generally acceptable limits, the Code also describes an alternate method by which a refined calculation may be performed to evaluate the acceptability of the flaw. At no time does the Code allow an unrepaired through-wall flaw to be returned to service. If a flaw is discovered ~~by any means (including surveillance, maintenance activity, or inservice inspection) in a system subject to Code requirements (whether during normal plant operation, plant transition, or shutdown operation)~~during an inservice inspection of a system subject to ASME Code inservice inspection requirements, the flaw must be promptly evaluated using Code rules. If the flaw is through-wall or does not meet the limits established by the Code, the component and part of the system containing the flaw is ~~inoperable~~unacceptable for continued service. If the flaw is within the limits established by the Code, the component and part of the system is ~~operable~~acceptable for continued service. However, the licensee should determine how long the flawed component will remain ~~operable~~ in service before the flaw grows to exceed Code limits.

Evidence of leakage from the pressure boundary indicates the presence of a through-wall flaw. It may be possible to use visual methods to determine the exterior dimension(s) and orientation of a through-wall flaw in a leaking component. When the outside surface breaking dimension of a through-wall flaw is small, the length and extent of the flaw inside the component wall may be quite long~~and potentially outside the limits established by the Code~~. For these reasons, ~~the component is declared inoperable while methods such as ultrasonic examination are performed to characterize the actual geometry of the through-wall flaw~~operability is based on identification of the degradation mechanism, verification of structural integrity, performance of a flaw evaluation, and assessment of the effects of leakage. There must be a reasonable expectation of operability for the component to be considered "operable but degraded" during the aforementioned steps.

Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," and Code Case N-513-1, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," describe acceptable alternate means for evaluating and accepting flaws in moderate-energy piping. Generic Letter 90-05 describes a method by which a flaw not acceptable under the Code may be returned to service without prior NRC approval. It also describes an acceptable method for obtaining NRC relief from Code requirements under 10 CFR 50.55a. Because an evaluation and acceptance of a flaw, using the guidance in GL 90-05, is not in conformance with the requirements of the Code, the relief must be reported to the NRC, as stated in GL 90-05. If a flaw meets the guidance of GL 90-05, the system containing the flaw is operable.

When a Code Cases~~-that~~ describes methods, criteria, or requirements different from the Code of record referenced in 10 CFR 50.55a, ~~cannot be used without prior NRC review and approval unless they are endorsed in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1."~~but the Code Case has not been endorsed by the NRC, its use must be approved by a plant-specific relief request. NRC Code Cases ~~N-513, which~~that describes~~-an~~ acceptable alternatives to the methods described in the Code for the acceptance of a flaw in a ~~Class 3~~ moderate-energy piping system~~, is~~ are endorsed in RG 1.147. A flaw that is evaluated in accordance with ~~, and meets the acceptance criteria of,~~a RG 1.147 Code Case ~~N-513~~ is acceptable to both ASME and to the NRC. ~~If the flaw does not satisfy the requirements of Code Case N-513, the system containing the flaw is inoperable.~~

~~NRC has accepted Code Case N-513 for application in the licensees inservice inspection programs, with the following conditions:~~

~~a. Specific safety factors in paragraph 4.0 of Code Case N-513 must be satisfied, and~~

~~b. Code Case N-513 may not be applied to:~~
~~(1) components other than pipe and tubing,~~
~~(2) leakage through a gasket;~~
~~(3) threaded connections employing nonstructural seal welds for leakage prevention (through seal weld leakage is not a structural flaw, but thread integrity must be maintained), and~~
~~(4) degraded socket welds.~~

~~If a flaw exceeds the thresholds of the ASME Code, Generic Letter 90-05, Code Case N-513, or any other applicable NRC-approved Code Case, the system containing the flaw is inoperable until the NRC approves an alternative analysis, evaluation, or calculation to justify the system's return to service with the flaw and the subsequent operability of the system. The inoperable system is subject to the applicable TS LCO before receiving the NRC approval for the alternative analysis, evaluation, or calculation.~~

C.12 Operational Leakage from Code Class 1, 2, and 3 Components

Leakage from the reactor coolant system~~, as specified in TSs,~~ is limited to specified values in the TSs depending on whether the leakage is from identified, unidentified, or specified sources such as the steam generator tubes or reactor coolant system pressure isolation valves. If the leakage exceeds TS limits, the LCO must be declared not met and the applicable conditions must be entered. For identified reactor coolant system leakage within the limits of the TS, the licensee should determine operability for the degraded component and include in the determination the effects of the leakage on other components and materials.

Existing regulations ~~and TSs~~ require that the structural integrity of ASME Code Class 1, 2, and 3 components be maintained in accordance with the ASME Code. ~~In the case of specific types of degradation, other regulatory requirements must also be met.~~ If a leak is discovered in a Class 1, 2, or 3 component in the conduct of an inservice inspection, maintenance activity, or facility operation, corrective measures may require repair or replacement activities in accordance with IWA-4000 of Section XI. In addition, the leaking component should be evaluated for flaws according to IWB-3000, which addresses the analytical evaluation and acceptability criteria for flaws.

~~The TSs do not permit any reactor coolant pressure boundary (RCPB) leakage. The operational leakage LCO must be declared not met when pressure boundary leakage is occurring. Upon discovery of l~~Leakage from a Class 1, 2, or 3 ~~pressure boundary~~ component (pipe wall, valve body, pump casing, etc.) ~~, the licensee must declare the component inoperable. Evidence of leakage from the pressure boundary~~ indicates the presence of a through-wall flaw. It may be possible to use visual methods to determine the exterior dimension(s) and orientation of a throughwall flaw in a leaking component. When the outside surface breaking dimension of a through-wall flaw is small, the length and extent of the flaw inside the component wall may be quite long and potentially outside the limits established by the Code. For ~~these reasons the component is declared inoperable while methods such as ultrasonic examination are performed to characterize the actual geometry of the through-wall flaw. However, after declaring inoperability for leakage from~~ Class 2 and 3 moderate-energy piping, the licensee may evaluate the structural integrity of the piping by fully characterizing the extent of the flaw using volumetric methods and evaluating the flaw using the criteria of paragraph C.3.a of Enclosure 1 to GL 90-05. If the flaw meets the criteria, the piping ~~can subsequently be deemed~~is confirmed "operable but degraded" until relief from the applicable Code requirement or requirements is obtained from the NRC. Alternatively, the licensee can evaluate the structural integrity of leaking Class 2 and 3 moderate-energy piping using the criteria of Code Cases ~~N-513, which is approved with limitations imposed by the NRC staff~~(including limitations) that are endorsed in RG 1.147 and incorporated by reference in 10 CFR 50.55(a)(b)(2)(xiii). ~~The limitations imposed by the NRC staff are as follows:~~

~~a. Specific safety factors in paragraph 4.0 of Code Case N-513 must be satisfied, and~~

~~b. Code Case N-513 may not be applied to:~~
~~(1) components other than pipe and tubing,~~
~~(2) Leakage through a gasket,~~
~~(3) threaded connections employing nonstructural seal welds for leakage prevention (through seal weld leakage is not a structural flaw, but thread integrity must be maintained), and~~
~~(4) degraded socket welds.~~

~~Following the declaration of inoperability, the licensee may also decide to evaluate the structural integrity of leaking Class 2 or 3 moderate-energy piping using the criteria of Code Case N-513-1. The same limitations imposed by the NRC staff on Code Case N-513 apply to Code Case N-513-1. Code Case N-513-1 has been reviewed and found acceptable by the NRC. However, Code Case N-513-1 has not yet been incorporated into RG 1.147 or the Code of Federal Regulations for generic use. Therefore, until Code Case N-513-1 is approved for generic use in either RG 1.147 or 10 CFR 50.55a, the licensee must request relief and obtain NRC approval to use Code Case N-513-1.~~

If the piping meets the criteria of ASME Code Case N-513-1, continued temporary service of the degraded piping components is permitted. If the licensee decides to control the leakage by mechanical clamping means, the requirements of Code Case 523-2, "Mechanical Clamping Devices for Class 2 and 3 Piping Section XI, Division 1," may be followed, as referenced in ~~10 CFR 50.55a(b)(2)(xiii)~~RG 1.147. This Code Case is to maintain the structural integrity of Class 2 and 3 piping which is 6 inches (nominal pipe size) and smaller and shall not be used on piping larger than 2 inches (nominal pipe size) when the nominal operating temperature or pressure exceeds 200°F or 275 psig. These and other applicable Code Cases which have been determined to be acceptable for licensee use without a request or authorization from the NRC are listed in RG 1.147. These Code Cases do not apply to Class 1 pressure boundary components.

The NRC has no specific guidance or generically approved alternatives for temporary repair of flaws (through-wall or non-through-wall) in Class 1, 2, or 3 high-energy system components, or for Class 2 or 3 moderate-energy system pressure boundary components other than piping. Therefore, all such flaws in these components must be repaired in accordance with Code requirements, or relief from Code requirements must be requested of and approval obtained from the NRC.