NRC Responses to Public Comments

Final Rule:
Approval of American Society of Mechanical Engineers' Code Cases

NRC-2017-0025; RIN 3150-AJ94

U.S. Nuclear Regulatory Commission

Introduction

This comment response document presents the U.S. Nuclear Regulatory Commission (NRC) responses to public comments received on the proposed rule, documents to be incorporated by reference, and related guidance for "Approval of American Society of Mechanical Engineers' Code Cases." The NRC published the proposed rule in the *Federal Register* on February 2, 2021 (86 FR 7820), for public comment with a 60-day public comment period.

Overview of Public Comments

The NRC received a total of 13 public comment submissions on the proposed rule and related draft regulatory guides (RGs). A *comment submission* is a communication or document submitted to the NRC by an individual or entity, with one or more individual comments addressing a subject or issue. Two comment submissions were submitted shortly after the comment period closed. The NRC considered these comments in its analysis. The NRC also received a comment submission (comment submittal number 13 in the table below) that was filed over three months after the close of the comment period. The NRC determined that comment submittal number 13 did not raise any safety or security concerns or other issues that would cause the NRC to make changes to the final rule, but it was not practical to formally summarize and respond to the submittal at the time it was received. As stated in the proposed rule, the NRC considers late-filed comments if it is practical to do so, but the NRC is able to ensure consideration only of comments received on or before the close of the comment period.

In this document, individual comments are identified in the form [XX-YY], where XX represents the comment submission number in the table below, and YY represents the individual comment number within the public comment submission. In general, the NRC addresses each individual comment. However, when similar comments can be readily grouped together, the NRC has binned those comments and treated them as a single comment. The NRC's response addresses the binned comment.

Comment Submittal Number	Commenter	Affiliation	ADAMS Accession No.
1	Mark Moenssens	Westinghouse	ML21034A599
2	Edward Cavey	Private citizen	ML21039A704
3	Chakrapani Basavaraju	Private citizen	ML21095A096
4	Chakrapani Basavaraju	Private citizen	ML21095A097
5	Alexander Tsirigotis	Private citizen	ML21095A098
6	Thomas Basso	Nuclear Energy Institute (NEI)	ML21095A100
7	Thomas Vogan	American Society of Mechanical Engineers (ASME)	ML21095A101
8	Kaihwa Hsu	Private citizen	ML21098A243

Comment Submittal Number	Commenter	Affiliation	ADAMS Accession No.
9	Anonymous	Anonymous	ML21098A244
10	Patrick Vibien	Plastics Pipe Institute	ML21098A245
11	Edwin Lyman	Union of Concerned Scientists	ML21103A337
12	Parmod Siwach	Government of India, Ministry of Commerce and Industry, Export Inspection Council	ML21109A313
13	Carrie Fosaaen	NuScale Power, LLC	ML21208A441

Public comment submissions are available online in the NRC Library at http://www.nrc.gov/reading-rm/adams.html. From this page, the public can access the Agencywide Documents Access and Management System (ADAMS), which supplies text and image files of the NRC's public documents. If you do not have access to ADAMS, or if you have problems in accessing the documents located in ADAMS, contact the NRC's Public Document Room reference staff at 1-800-397-4209 or 301-415-4737, or by sending an e-mail to pdr.resource@nrc.gov. In addition, public comments and supporting materials related to this rulemaking can be found at https://www.regulations.gov by searching for Docket ID NRC-2017-0025.

Comment Categorization

This document places the public comments into one of the following categories:

(1) Comments on Draft Regulatory Guide (DG)-1366 (Regulatory Guide (RG) 1.84, "Design, Fabrication, and Materials Code Case Acceptability, ASME Section III," Revision 39)

(2) Comments on DG-1367 (RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 20)

(3) Comments on DG-1368 (RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," Revision 4)

(4) Comments on RG 1.193, "ASME Code Cases Not Approved for Use," Revision 7, Table 2

(5) General Comments

Within each category, this document either reproduces comments as written by the commenters or summarizes comments for conciseness and clarity. At the end of each comment or comment summary, this document references the source of the comment.

<u>Category 1: Comments on DG-1366 (RG 1.84, Revision 39)</u>

Code Case N-755-4: Use of Polyethylene Class 3 Plastic Pipe, Section III, Division 1

Comment Summary: The commenters stated that the proposed conditions on the use of this Code Case are consistent with similar requirements specified in the ASME Boiler and Pressure Vessel (BPV) Code, Section III, Division 1, Mandatory Appendix XXVI. In addition, with conditional acceptance of Appendix XXVI in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and standards," ASME has annulled this Code Case. The commenters recommend that the NRC move Code Case N-755-4 to Table 4 of RG 1.84. (6-1, 7-2)

NRC Response: The NRC does not agree with the commenters, because in this rulemaking the NRC is addressing only Section III code cases listed in Supplements 0–7 to the 2015 Edition, Supplements 0–7 to the 2017 Edition, and Supplements 0–1 to the 2019 Edition of the ASME BPV Code. Code Case N-755-4 was annulled after the publication of the supplements addressed in this rulemaking and will be considered at a later time.

The staff made no revisions as a result of this comment.

Code Case N-886: Use of Polyethylene Pipe for Class 3, Section III, Division 1

Comment Summary: The commenters stated this code case is only for design of above ground high-density polyethylene (HDPE) piping systems; according to the case, all other requirements for materials, fabrication and installation, examination, testing, overpressure protection, nameplates, stamping, and reports are to conform to ASME BPV Code, Section III, Mandatory Appendix XXVI. The commenters stated Conditions 1–3 are the conditions imposed on the use of Mandatory Appendix XXVI in the current version of 10 CFR 50.55a(b)(1)(xi) and relate to fabrication and examination. Thus, they do not apply to the content of this code case and are redundant to the requirements in 10 CFR 50.55a concerning Mandatory Appendix XXVI. This could result in conflicts should the NRC change or add requirements on the use of Mandatory Appendix XXVI in areas other than design. The commenters recommended removing Conditions 1–3. (6-2, 7-3)

NRC Response: The NRC agrees with the commenters recommending the removal of Conditions 1–3, because these three conditions are the same as those for ASME BPV Code, Section III, Mandatory Appendix XXVI, which the NRC conditionally accepted in 10 CFR 50.55a. Therefore, it is redundant to respecify these conditions for Code Case N-886.

Comment Summary: The commenters stated proposed Condition 4 on the use of Code Case N-886 relates to fire protection for aboveground applications. The NRC may impose additional requirements on licensees above and beyond what the ASME BPV Code requires. However, Section III of the ASME BPV Code is a component construction code for pressure boundary integrity. Section III provides no rules for such a design requirement. Such a requirement should be addressed in the plant fire protection program and any specific limitations or requirements for fire protection on the piping system should be communicated by the Piping Design Specification. The commenters recommended removing proposed Condition 4 or at least limiting it as in the following: "The use of HDPE piping in aboveground applications shall be considered in the plant fire protection program." (6-3, 7-4)

NRC Response: The NRC does not agree to remove Condition 4, because HDPE is a flammable material. However, the NRC agrees to revise Condition 4 as follows: "For aboveground applications, licensees must ensure the plant fire protection program addresses any HDPE consistent with the requirements of 10 CFR 50.48."

Comment Summary: The commenters stated proposed Condition 5, requiring carbon black distribution in HDPE pipe to be homogeneous to prevent windows and delamination, is adequately addressed by the requirements of ASME BPV Code, Section III, Mandatory Appendix XXVI-2231(b), during the pipe manufacturing process. The commenters recommended removing Condition 5. (6-4, 7-5, 10-1)

NRC Response: The NRC agrees to remove Condition 5 for Code Case N-886. The requirement that carbon black distribution in HDPE pipe be homogeneous to prevent windows and delamination is a pipe manufacturing process issue. The staff has determined that the requirements in Mandatory Appendix XXVI-2231(b) adequately address this issue. Code Case N-886 is only for design, and all materials must meet the requirements of Mandatory Appendix XXVI.

Code Case N-884: Procedure to Determine Strain Rate for Use with the Environmental Fatigue Design Curve Method and the Environmental Fatigue Correction Factor, F_{en}, Method as Part of an Environmental Fatigue Evaluation for Components Analyzed per the NB-3200 Rules, Section III, Division 1

Code Case N-891: Alternative Requirements to Appendix XXVI, XXVI-2400, XXVI-4130, and XXVI-4131 for Inspection and Repair of Indentations for Polyethylene Pipe and Piping Components, Section III, Division 1

Comment Summary: The commenter thanked the NRC for including Code Cases N-884 and N-891 in Table 1 of RG 1.84. (7-1)

NRC Response: This comment does not require a NRC response.

Code Case N-883: Construction of Items Prior to the Establishment of a Section III, Division 1 Owner, Section III, Division 1

Comment Summary: The commenter would like to know how the NRC plans to condition Code Case N-883. (12-1)

NRC Response: As stated in the *Federal Register* notice (86 FR 7820; February 2, 2021), the NRC approves Code Case N-883 only for use by holders of construction permits, operating licenses, or combined licenses, not for use by holders of manufacturing licenses or standard design approvals, or by design certification applicants. Absent a condition, the code case might mistakenly be assumed to be approved for use by other entities. Therefore, the NRC is conditioning the code case to limit the scope of its approval to holders of construction permits, operating licenses, or combined licenses. For clarity, the NRC is modifying the condition in the final rule as follows: "This Code Case may only be used for the construction of items by a holder of a construction permit, operating license, or combined license under 10 CFR Part 50 or Part 52. This Code Case may not be used by a holder of a manufacturing license or standard design approval or by a design certification applicant."

Category 2: Comments on DG-1367 (RG 1.147, Revision 20)

Table 1: Acceptable Section XI Code Cases

***Comment Summary*:** The commenter appreciated the action taken by the NRC to propose the addition of Code Cases N-561-3, N-768, N-885, and N-892 to Table 1. The commenter specifically requested that these cases be included in the draft of RG 1.147, Revision 20, by letter dated July 10, 2019 (ADAMS Accession No. ML19261B399). The commenter had no further comments on the addition of other code cases to Table 1. (7-6)

NRC Response: This comment does not require a NRC response.

Code Case N-513-5: Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping and Gate Valves, Section XI, Division 1

Comment Summary: The commenter stated proposed Condition 2 creates confusion with the following requirement: "If a significant flaw is present, an additional augmented examination in accordance with Section 5 of N-513-5 must be performed." The commenter asked what is meant by an additional augmented examination if a significant flaw is found when additional examinations are already required to be performed if a flaw is found. The commenter also asked if this condition requires more examinations than the additional samples already required. The commenter recommended removing or clarifying the quoted sentence above in proposed Condition 2 since the code case already requires additional samples if flaws are found. If the NRC is requiring additional inspections beyond the expanded inspections already mandated by the code case, then the agency should provide a technical and safety justification for the additional burden placed on licensees. (6-5)

NRC Response: The NRC agrees with the commenter that the last sentence of proposed Condition 2 could be confusing. Proposed Condition 2 states the following:

> For the purposes of Section 5 of Code Case N-513-5, the term "significant flaw" means any flaw found during augmented examinations performed per Section 5 of N-513-5 that has a depth greater than 75 percent of the pipe wall thickness or that does not satisfy the applicable requirements of the flaw evaluation per Section 3 of N-513-5. If a significant flaw is present, an additional augmented examination in accordance with Section 5 of N-513-5 must be performed.

The last sentence means that if a significant flaw is detected in the first sample, a second sample examination must be performed in accordance with Section 5 of N-513-5; if a significant flaw is detected in the second sample, a third sample examination must be performed, and so on. The augmented examinations must continue until, in the last sample, no significant flaw is detected. The staff intends the second sentence in Condition 2 to clarify that more sample examinations are required, apart from the additional samples already required by the code case.

In the past, the NRC has found that licensees have misinterpreted the provisions in Section 5 of Code Case N-513-3. Some licensees have not performed the necessary augmented examinations in accordance with Section 5 of Code Case N-513-3 after degradation in moderate-energy Class 2 and 3 piping covered by this Code Case. For example, after a leaking pipe was detected in a nuclear plant, the licensee performed the initial sample examination of five pipe locations in accordance with Section 5(a) of the code case. A pipe location in the first sample examination showed wall thinning. The licensee did not wish to perform a second sample examination as wall thinning is not a flaw. After clarification, the licensee performed a second sample examination. The NRC is imposing Condition 2 to clarify that if a significant flaw, as defined in the condition, is present in any sample examinations, additional augmented examination must be performed in accordance with Section 5 of the code case.

For clarity, the NRC will revise proposed Condition 2 to read as follows:

For the purposes of Section 5 of Code Case N-513-5, the term “significant flaw” means any flaw found during augmented examinations performed per Section 5 of N-513-5 that has a depth greater than 75 percent of the pipe wall thickness or that does not satisfy the applicable requirements of the flaw evaluation per Section 3 of N-513-5. If a significant flaw as defined above is present, then the licensee must perform the additional augmented examination specified in Section 5.

Code Case N-516-5: Underwater Welding, Section XI, Division 1

Comment Summary: The commenter stated this condition should be removed because it is framed in terms that, although appropriate for a boiling-water reactor (BWR), the condition is not necessarily appropriate for a pressurized-water reactor (PWR). In addition, the commenter stated NRC should consider removing conditions currently specified in 10 CFR 50.55a(b)(2)(xii) during the next 10 CFR 50.55a rulemaking. (7-7)

NRC Response: The NRC disagrees with this comment. The code case condition requires licensees to obtain NRC approval before performing underwater welding of components whose weldability can be compromised by the effects of neutron fluence. The effect of neutron fluence on the weldability of reactor vessel materials is the same for BWRs and PWRs. If the neutron fluence differs between the types of reactor vessels, these differences are properly managed by the neutron fluence thresholds in the code case condition. This code case condition is technically equivalent to the condition imposed on Code Case N-516-4 in RG 1.147, Revision 19, issued March 2020. The public comment on Code Case N-516-5 does not provide a sufficient basis to change the condition, which was finalized during rulemaking on RG 1.147, Revision 19. Therefore, the NRC has not modified the condition in RG 1.147, Revision 20, on the use of Code Case N-516-5.

The staff made no revisions as a result of this comment.

Code Case N-557-1: In-Place Dry Annealing of a PWR Nuclear Reactor Vessel

Comment Summary: The commenter stated this case has not been updated for use with any version of ASME BPV Code, Section XI, beyond the 1995 Edition. Code Case N-557-1 was annulled by ASME on May 13, 2020, and should therefore appear in the Annulled Cases section of the RG rather than in the Conditionally Approved section. (6-6)

NRC Response: The proposed Revision 20 to RG 1.147 addresses code cases through Supplement 1 to the 2019 Edition. Code Case N-557-1 was annulled after the publication of Supplement 1 to the 2019 Edition. This code case will be addressed in the next revision to RG 1.147.

Code Case N-569-1: Alternative Rules for Repair by Electrochemical Deposition of Class 1 and 2 Steam Generator Tubing

Comment Summary: The commenter stated this case has not been updated for use with any version of ASME BPV Code, Section XI, beyond the 2019 Edition. Code Case N-569-1 was annulled by ASME on May 13, 2020, and should therefore appear in the Annulled Cases section of the RG rather than in the Conditionally Approved section. (6-7)

NRC Response: The proposed Revision 20 to RG 1.147 addresses code cases through Supplement 1 to the 2019 Edition. Code Case N-569-1 was annulled after the publication of Supplement 1 to the 2019 Edition. This code case will be addressed in the next revision to RG 1.147.

Code Case N-597-3: Evaluation of Pipe Wall Thinning, Section XI

Comment Summary: The commenter stated proposed Condition 2(a) cites the use of EPRI/NSAC 202L–2. This EPRI document however has been updated to Revision 4. (6-8)

NRC Response: The NRC agrees with the commenter that Condition 2(a) cites an earlier version of EPRI/NSAC 202L. However, the NRC does not plan to revise Condition 2(a) to incorporate Revision 4 of the EPRI report in this rulemaking. The currently referenced revision remains adequate for licensees to safely use N 597-3. Further, incorporating by reference Revision 4 would require additional procedural steps that would significantly, and unnecessarily, delay this rulemaking. The NRC anticipates reviewing ASME's updated revision to this code case (N-597-4) in the next rulemaking to approve code cases and will consider whether the conditions on N-597-3 continue to apply or can be modified in light of ASME's revisions. If the revisions do not justify removing the condition, in response to this comment, the NRC will consider updating the reference to Revision 4 of the EPRI report in that rulemaking.

Comment Summary: The commenter stated proposed Condition 2(b) references Figure-3622.1(a)(1) which does not exist in Code Case N-597-3. (1-1)

NRC Response: The NRC agrees with the comment. The NRC will revise Condition 2(b) to reference Figure 3622-1 of the code case, which specifies how t_{min} should be calculated for hoop stress due to internal pressure inside of a pipe.

Code Case N-705-1: Evaluation Criteria for Temporary Acceptance of Degradation in Moderate Energy Class 2 or 3 Vessels and Tanks, Section XI, Division 1

Comment Summary: The commenter stated Code Case N-705-1 provides a technical approach for limiting the time which the temporary repair can be in place. The commenter asked what's the technical bases for the condition that limits the temporary repairs under this code case to the next refueling outage when N-705-1 includes *"…for a limited time not exceeding the evaluation period as defined in this Case?"*. The commenter recommended endorsing Code Case N-705-1 with no conditions and relocate N-705-1 to Table 1 of RG 1.147. (6-9)

NRC Response: The NRC disagrees with the commenter's recommendation. The condition for Code Case N-705-1 in the draft of RG 1.147, Revision 20, is consistent with the condition for Code Case N-705 in RG 1.147, Revision 19. The updated code case (i.e., N-705-1) did not sufficiently address the timing of the repair/replacement activities for through-wall flaws and the condition on Code Case N-705 described in RG 1.147, Revision 19. The NRC conditionally accepts Code Case N-705-1 because the case's evaluation methods provide reasonable assurance that the structural integrity of the component will not be impacted during the period of the evaluation. The plant has the option to continue to operate for a limited period of time with a monitored and evaluated low-safety-significance degraded condition as a potential means to avoid a plant shutdown to repair the degradation before the next scheduled refueling outage.

With respect to the evaluation period, the NRC agrees that flaws that are not through-wall and that have been evaluated in accordance with the code case should be allowed to remain in service for the entire evaluation period defined by the code case (i.e., up to 26 months from the initial discovery of the condition). However, the NRC considers through-wall flaws that have been evaluated in accordance with the code case to be subject to repair/replacement at the next scheduled refueling outage. The NRC's longstanding policy is to require known through-wall flaws, even those accepted under ASME BPV Code provisions such as Nonmandatory Appendix U, to be repaired no later than the next scheduled outage. This ensures that through-wall flaws are corrected before they can affect the component's ability to function. However, licensees can request NRC authorization of alternatives under 10 CFR 50.55a(z) on a case-by-case basis to extend the acceptance of such flaws. As the NRC explained when approving Code Case N-705 previously, "This [condition] is consistent with the current regulations for the use of ASME Code, Section XI, Non-Mandatory Appendix U which is where the ASME Code has incorporated this case into ASME Section XI" (85 FR 14736, 14744).

The staff made no revisions as a result of this comment.

Code Case N-766-3: Nickel Alloy Reactor Coolant Inlay and Onlay for Mitigation of PWR Full Penetration Circumferential Nickel Alloy Dissimilar Metal Welds in Class 1 Items, Section XI, Division 1

Comment Summary (a): The commenter stated the NRC should remove proposed Condition 1, because there are no reductions in preservice or inservice examinations as specified in paragraph 3(e)(1) of Code Case N-766-3, which requires preservice and inservice examination to be performed in accordance with Code Case N-770, "Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated with UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities, Section XI, Division 1." Paragraph 2220 in Code Case N-770-5 requires a preservice examination for all items affected by a repair/replacement activity. Inservice examinations are performed in accordance with paragraph 2410 of Code Case N-770-5. The regulatory analysis identified a concern related to performing flaw evaluation for flaws that exceed the acceptance standards of ASME BPV Code, Section XI, IWB-3514, thus allowing a flaw with a maximum depth of 75 percent through-wall in service. While Code Case N-770 allows a flaw to be analytically accepted in accordance with Section XI, IWB-3600, the rules of IWA-3000 and IWA-3320 limit the flaw depth to significantly less than 75 percent through-wall for embedded flaws. It is therefore unnecessary to restrict the allowable flaw lengths to those specified in the NRC condition. Paragraph 2(c)(2) of Code Case N-766-3 requires using the detected flaw depths and lengths to perform a crack growth evaluation in accordance with IWA-3640. In addition, paragraph 2(c)(2) requires analysis of postulated flaws with depths of 10 percent. Once the inlay/onlay is installed, the dissimilar-metal weld is isolated from the reactor coolant environment. Therefore, the embedded flaw can no longer grow by primary water stress corrosion cracking (PWSCC). To ensure that the embedded flaw at the inlay/onlay interface does not grow through the inlay/onlay, paragraph 2(c) of Code Case N-766-3 requires performance of a fatigue crack growth (FCG) evaluation of the detected flaw and postulated flaws in accordance with IWB-3600. The commenter recommended removing proposed Condition 1. (7-8)

NRC Response: The NRC disagrees with the two points raised by the commenter on (1) examination in accordance with Code Case N-770-5 and (2) unnecessary specification of flaw sizes in Condition 1. Condition 1 states that credit cannot be taken to reduce the preservice inspection (PSI) and inservice inspection (ISI) requirements specified by this code case if an inlay or onlay is applied to an Alloy 82/182 dissimilar-metal weld that contains an axial indication that has a depth of more than 25 percent of the pipe wall thickness and a length of more than one half of the axial width of the dissimilar-metal weld, or a circumferential indication that has a depth of more than 25 percent of the pipe wall thickness and a length of more than 20 percent of the circumference of the pipe.

For the first point, the NRC notes that paragraph 3(e)(1) of Code Case N-766-3 specifies that PSI and ISI examinations should be performed in accordance with Code Case N-770-1 or a later version. Table 1 of Code Case N-770-5 does contain examination requirements for uncracked dissimilar-metal welds mitigated with inlay/onlay (Inspection Items G and H) and for cracked dissimilar-metal welds mitigated with inlay/onlay (Inspection Items J and K). Using that table, a licensee might mistakenly reduce the PSI and ISI examinations, believing that once the inlay/onlay is installed on a dissimilar-metal weld, that weld becomes mitigated for PWSCC. Proposed Condition 1 clarifies that in this situation, a licensee must not reduce PSI and ISI examinations of the repaired weld.

The commenter's second point asserts that it is unnecessary to restrict the allowable flaw lengths as done in proposed Condition 1 because paragraph 2(c) requires FCG calculations. However, the NRC's condition is consistent with the requirements of the code case, merely clarifying when to apply Inspection Items J and K in Code Case N-770-5. Performance of the FCG calculations in paragraph 2(c) in Code Case N-766-3 does not eliminate the need for examinations that are required to monitor the structural integrity of the repaired weld. The NRC finds that it is necessary to specify a significant flaw size to clarify when the repaired weld must be examined according to specific inspection items in Table 1 of Code Case N-770-5. The staff included proposed Condition 1 to clarify that a licensee cannot reduce the required PSI and ISI examinations if a repaired dissimilar-metal weld contains certain indication size. The condition provides clarification and does not add any further requirements beyond the inspection requirements of Code Cases N-766-3 and N-770-5.

The staff made no revisions as a result of this comment.

Comment Summary (b): The commenter stated there is insufficient technical basis to require evaluation of a thin inlay/onlay of thickness less than or equal to 1/8 of the repaired pipe wall thickness, as required by NRC proposed Condition 2. The shrinkage from an inlay/onlay that is ≤ 1/8*t* (where *t* = pipe wall thickness) is negligible and will have no significant effect on the piping system support loads, design clearances, nozzle loads, changes in the system flexibility, or a significant weight increase. The axial length of an inlay/onlay has negligible effect because the inlay/onlay extends only about ¼ inch past the weld fusion lines, and therefore the full inlay/onlay thickness is only required to be about 3 inches in total length. For a thickness of *t*/8, the resulting volume is far too small to have an impact. The requirement to evaluate this effect for inlays or onlays greater than *t*/8 is itself very conservative, as even much larger thicknesses are unlikely to have any impact. The commenter stated proposed Condition 2 is unnecessary when comparing the inlay/onlay with the weld overlay. The commenter recommended removing proposed Condition 2. (7-9)

NRC Response: The NRC disagrees with the comment. Paragraph 2(e) of the code case requires evaluation of weld shrinkage, pipe system flexibility, and impact of the weight of the inlay/onlay on the repair pipe only if the inlay/onlay is thicker than *t*/8, where *t* is the wall thickness of the dissimilar-metal weld. Proposed Condition 2 states that in lieu of the requirements in paragraph 2(e) of Code Case N-766-3, pipes with any thickness of inlay/onlay must be evaluated for weld shrinkage, pipe system flexibility, and additional weight of the inlay/onlay. The NRC disagrees with the comments that (1) the shrinkage from an inlay/onlay of thickness ≤*t*/8 (where *t* = pipe wall thickness) is negligible and will have no significant effect on the piping system support loads, pipe flexibility, or weight, (2) the axial length of an inlay/onlay has a negligible effect, and (3) the resulting volume for a thickness of *t*/8 is far too small to have an impact. The comment did not provide a technical basis to substantiate its contentions. The NRC finds that welding of an inlay/onlay of thickness ≤ *t*/8 is not negligible in terms of impact to the pipe system. In addition, the NRC notes that ASME BPV Code, Section XI, states that once welding is applied to a pipe, the repaired pipe needs to be evaluated for shrinkage, flexibility, and pipe support loads. The NRC finds that regardless of the thickness of inlay/onlay, the licensee needs to evaluate weld shrinkage, pipe system flexibility, and impact of the inlay/onlay weight on the repaired pipe as required by Section XI because evaluation of these effects is necessary to ensure the structural integrity of the components involved.

The staff made no revisions as a result of this comment.

Comment Summary (c): The commenter stated proposed Condition 3 is incorrect and should be removed. This condition requires three successive examinations if an indication in the weld exceeded the acceptance standards of ASME BPV Code, Section XI, IWB-3514, and was accepted in accordance with IWB-3132.3 or IWB-3142.4. Successive examination requirements for inlays/onlays are specified in Table 1 of Code Case N-770-1 or later, not in IWB-2420. Code Case N-766-3 never intended successive examinations to be performed in accordance with IWB-2420. The commenter recommended removing proposed Condition 3. (7-10)

NRC Response: The NRC disagrees with the comment. Proposed Condition 3 states that if an inlay/onlay is applied to an Alloy 82/182 dissimilar-metal weld that contains an unacceptable indication in accordance with the acceptance standards of ASME BPV Code, Section XI, IWB-3514, but is accepted for continued service under Section XI, IWB-3132.3 or IWB-3142.4, the repaired dissimilar-metal weld must be inspected in three successive examinations after inlay/onlay installation. The commenter stated that successive examination requirements for inlays/onlays are specified in Table 1 of Code Case N-770-1 or later. The NRC notes that Note 16(a) in Table 1 of Code Case N-770-5 specifies successive examination requirements for inlays and onlays only when inservice examinations reveal crack growth or new cracking in the repaired weld. If there is no flaw growth, successive examinations on inlays and onlays are not performed. The NRC finds that it is inadequate to perform successive examinations only on the basis of inservice examination results, for the following two reasons:

(1) If a repaired weld with an existing flaw is not required to have an inservice examination after installation, it will not undergo successive examinations and its integrity will be unknown.

(2) If a crack does not grow during one fuel cycle, it may still grow during the next few fuel cycles.

For these reasons, the NRC is requiring licensees to apply successive examinations in accordance with IWB-2420, which calls for three successive examinations regardless of crack growth, thereby ensuring that the repaired weld will be monitored for a period of time to confirm the stability of the crack and verify the flaw evaluation.

The commenter further stated that Code Case N-766-3 never intended successive examinations to be performed under IWB-2420. The NRC finds that Code Case N-766-3 would be inadequate if successive examinations under IWB-2420 were not required, because the purpose of the successive examinations is to verify the adequacy of the flaw evaluations with respect to flaw growth and to monitor the structural integrity of the degraded weld. The NRC notes that an inlay/onlay merely provides a barrier between the repaired weld and reactor coolant; it does not provide structural support for the repaired weld. Consequently, in terms of flaw growth, an existing flaw in a repaired dissimilar-metal weld with an inlay/onlay is no different from a remnant flaw in a weld without an inlay/onlay. If three successive examinations under IWB-2420 are required for a weld with a remnant flaw (without an inlay/onlay), the same requirement must apply to a repaired dissimilar-metal weld with an inlay/onlay.

The staff made no revisions as a result of this comment.

Comment Summary (d): The commenter stated proposed Condition 4 prohibits acceptance of subsurface indications detected by eddy current testing (ECT) in inlays/onlays during acceptance examinations. Appendix IV, Supplement 2, to ASME BPV Code, Section XI, contains ECT qualification requirements for detection of flaws with maximum depths of 0.0508 cm (0.020 inch). According to the technical basis document, PVP2012-78265, "Technical Basis for Case N-766-1 Nickel Alloy Reactor Coolant Inlay and Only for Mitigation of PWR Full Penetration Circumferential Nickel Alloy Welds in Class 1 Items," July 2012, ASME 2021 Pressure Vessels and Piping Conference, recent testing has demonstrated that ECT can detect flaws as little as 0.0305 cm (0.012 inch) deep. ECT procedures qualified in accordance with Code Case N-766-3 and Appendix IV, Supplement 2, can detect small surface-connected flaws in an inlay/onlay that do not exceed 0.158 cm (1/16 inch) in length and 0.0508 cm (0.020 inch) in depth. If a surface-connected flaw is postulated, the inlay/onlay must also be evaluated for FCG. The fatigue evaluation must demonstrate that the flaw will not grow through the inlay/onlay during the remaining life of the plant, so that the inlay/onlay will maintain its function as a barrier between susceptible material and the reactor coolant. Weld inlays/onlays must be installed using weld filler metals that contain at least 28-percent chromium. Furthermore, the chromium content of each inlay/onlay layer credited in the design must contain at least 24-percent chromium. Because inlays/onlays are considered resistant to PWSCC, Code Case N-766-3 does not require a PWSCC crack growth evaluation for postulated flaws along the inside-diameter surface. The technical basis document, PVP2012-78265, does present the results of a generic PWSCC crack growth evaluation demonstrating that an inside-diameter connected flaw will not grow through the inlay/onlay during a 10-year ISI interval. (7-11)

NRC Response: The NRC partly agrees and partly disagrees with the comment. Proposed Condition 4 states that if ECT reveals any detectable subsurface indication in the inlay/onlay during acceptance examinations, the item is prohibited from remaining in service. The commenter stated that (1) ASME BPV Code, Section XI, specifies ECT qualification requirements, (2) the FCG analysis required by N-766-3 is sufficient to guarantee that the flaw will not grow, and (3) the analyses in PVP2012-78265 provide a technical basis for Code Case N-766-3.

With respect to the first item, the NRC agrees that the ECT qualifications in ASME BPV Code, Section XI, can detect flaws. Proposed Condition 4 relies on this fact. The condition is concerned with what licensees must do if a flaw is detected, because of how quickly even small flaws can grow in a relatively thin inlay/onlay.

Therefore, the NRC disagrees with respect to the second and third items. The NRC finds that the FCG analyses specified in N-766-3 and documented in PVP2012-78265 do not provide reasonable assurance of the structural integrity of the inlay/onlay if it contains a flaw, because the inlay/onlay wall is so thin that the flaw may quickly grow through it. An FCG analysis may not adequately predict such growth, and there is not much safety margin for flaw growth in thin-walled inlay/onlay. The NRC has determined that any indication detected will most likely grow through the thin inlay/onlay under various applied loadings. Once the flaw has grown through 100 percent of the inlay/onlay thickness, the underlying dissimilar-metal weld will be in contact with the reactor coolant, which will initiate stress corrosion cracking in the weld. In such a scenario, the inlay/onlay would not be performing its intended function and must not remain in service.

The staff made no revisions as a result of this comment.

Code Case N-778: Alternative Requirements for Preparation and Submittal of Inservice Inspection Plans, Schedules, and Preservice and Inservice Inspection Summary Reports, Section XI, Division 1

Comment Summary: The commenter stated the condition on Code Case N-778 requires the submittal of the inservice inspection summary report to the USNRC to be within 90 days of the completion of each refueling outage. In contrast, Code Case N-892, which is proposed by this draft Regulatory Guide as an Acceptable ASME Section XI Code Case, alters the submission time of the Form OAR-1 (Owner's Activity Report) inservice inspection report to 120 days. The N-778 condition directly conflicts with Code Case N-892. The commenter recommended revising the N-778 condition to allow the inservice inspection summary report to be submitted within 120 calendar days of the completion of each refueling outage vs 90 calendar days to be consistent with Code Case N-892 which allows for report submittals in 120 days. (6-10)

NRC Response: The NRC agrees with this comment. ASME developed Code Case N-778 to provide an alternative to the requirements in ASME BPV Code, Section XI, paragraph IWA-1400(d), in editions and addenda through the 2009 Addenda, which required licensees to submit plans, schedules, and PSI and ISI summary reports to the enforcement and regulatory authorities having jurisdiction at the plant site. In accordance with Code Case N-778, licensees would have to submit these items only if specifically required by the enforcement and regulatory authorities.

The NRC has reviewed its needs with respect to the submittal of the subject plans, schedules, and reports and has determined that it is not necessary to require the submittal of plans and schedules. This is because up-to-date plans and schedules are available at the plant site, and the NRC can request them at any time. However, the NRC has determined that summary reports still need to be submitted. Summary reports provide valuable information about examinations performed, conditions noted during the examinations, the corrective actions performed, and the status of the ISI program implementation. Therefore, the NRC has approved Code Case N-778 with conditions to require that licensees continue to submit summary reports in accordance with paragraph IWA-6240 of the 2009 Addenda to ASME BPV Code, Section XI, as discussed below.

Since the 2010 Edition, ASME BPV Code, Section XI, has not required the submittal of these reports to the regulatory authority; the code states only that the reports shall be completed. The timeframes specified in RG 1.147, Revision 19, for submittal of these reports were based on the timeframes provided for completion of the reports in Section XI through the 2017 Edition. The conditions rely on the date of commercial service and the completion of a refueling outage to determine when licensees must submit the reports to the regulatory authority. Through the 2017 Edition of Section XI, owners were required to prepare summary reports or owner's activity reports of preservice examinations, inservice examinations, and repair/replacement activities within 90 calendar days of the completion of each refueling outage. Code Case N-892, "Alternative Requirement for Form OAR-1, Owner's Activity Report, Completion Time, Section XI, Division 1," and the 2019 Edition of Section XI extended this timeframe to 120 days. The NRC has no objections to allowing licensees up to 120 days to submit the reports and sees no reason to require earlier submittal for users of previous editions. Therefore, the NRC proposes to relax the requirement for all licensees and will modify the second condition on Code Case N-778 in RG 1.147, Revision 20, to read as follows: "The inservice inspection summary report must be submitted within 120 calendar days of the completion of each refueling outage."

Code Case N-809: Reference Fatigue Crack Growth Rate Curves for Austenitic Stainless Steels in Pressurized Water Reactor Environments, Section XI, Division 1

Comment Summary**:** The NRC received five comments from the public requesting that the NRC condition Code Case N-809 to require use of the 95th-percentile upper tolerance bound fit of the data instead of the mean curve proposed in the code case. The commenters asserted that, since 50 percent of the laboratory crack growth data fall above the mean curve described in Code Case N-809, the code case requirement is nonconservative. The commenters also stated that Code Case N-809 contains the first FCG curve in ASME BPV Code, Section XI, that addresses FCG in PWR environments. The commenters referenced operating experience and described FCG rules in other codes and standards. The commenters expressed concern over the treatment of uncertainties and the potential emergence of unknown degradation mechanisms in the future. (3-1, 4-1, 5-1, 8-1, 11-1)

NRC Response: The NRC disagrees with the commenters, because Code Case N-809 is applied within the larger context of ASME BPV Code, Section XI, flaw evaluation procedures, which provide a structural margin consistent with the original component design and construction. The acceptance criteria on flaw size (and associated structural factors) in Section XI were originally developed with the purpose of maintaining the design margins of ASME BPV Code, Section III.[1] When the mean crack growth rate is used in Section XI, not just for Code Case N-809, a high confidence upper bound mean for crack growth is applied (i.e., the crack growth data represent the 95 percent upper confidence limit on the mean of the data). Use of the upper bound mean curve for FCG has been common practice in Section XI for over twenty years, because the scatter in the FCG data is accounted for by other margins in the flaw evaluation procedure. In the rare cases where ASME determined the data scatter to be too large, ASME implemented the 75th percentile curve, as is the case with primary water stress corrosion cracking growth rate curves in Section XI. The structural margins in the flaw evaluation procedure guarantee that the degraded component will maintain the design margins of Section III throughout its specified lifetime, assuming the mean FCG curve.

Within ASME BPV Code, Section XI, flaw growth analyses are conducted when a flaw is found in service and its size exceeds the acceptance criteria stated in IWB-3500. These analyses are used to demonstrate the acceptability of flaws within a stated time interval. Typically, Nonmandatory Appendix A to Section XI is used for vessel flaw analyses, and Nonmandatory Appendix C is used for piping flaw analyses. Section XI uses both implicit and explicit margins. Typical explicit margins include structural factors related to either the crack driving force or critical crack size. Implicit margins include the use of bounding values for material strength and toughness, design loads, and other parameters. For example, assuming lower bound material properties (i.e., toughness and strength) provides margin in the flaw growth calculation. As another example, assuming design loads is conservative since actual loads under normal operation are not as severe.

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1 See *Companion Guide to the ASME Boiler & Pressure Vessel Code*, Volume 2, Fourth Edition, issued 2012. ASME BPV Code, Section III, presents rules for design and construction of nuclear components. ASME BPV Code, Section XI, presents rules for ISI of nuclear components.

In reviewing this code case, the NRC staff did an analysis to verify the impact of the prescribed structural factors in ASME BPV Code, Section XI, on the prediction of time to critical flaw size using the mean of the FCG curve. Using the mean FCG curve leads to a margin of 2.6, which meets the original design margins. Using the 95th-percentile FCG curve leads to a margin of 5.1, thereby exceeding the design margins of ASME BPV Code, Section III. The staff's preliminary analyses demonstrated that the structural factors in Section XI are sufficiently conservative. The use of the 95th-percentile FCG curve is overly conservative, going beyond the original design margins, and would therefore be inconsistent with the NRC's risk-informed decision-making process. Finally, the staff notes that the scope of Code Case N-809 is clearly defined to address the specific known degradation mechanism of FCG. The operating experience cited by the comments involves other degradation mechanisms that are outside the scope of the code case. Given how the code case will be applied in practice, conditioning it as suggested by the comments would not protect against the cited events or unknown future degradation mechanisms.

The staff made no revisions as a result of these comments.

Code Case N-831-1: Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic or Austenitic Pipe, Section XI, Division 1

***Comment Summary*:** The commenter stated the condition noted for this case prohibits the use of ultrasonic examination (UT) in lieu of radiographic examination (RT) for ferritic and austenitic piping welds in new construction but provides no technical rational for this prohibition or alternative options. RT that is normally performed by construction codes (e.g., ASME III) are merely confirmatory examinations of acceptable workmanship. They are not based on ASME XI based acceptance criteria founded in fracture mechanics which are more robust and relevant. The commenter stated the use of ASME XI based UT methods and related techniques are far more appropriate to (1) establish baseline exam results for future ISI and (2) are more revealing to be able to identify deleterious anomalies in piping welds (e.g., planar flaws) rather than common but benign weld anomalies revealed by RT such as slag inclusions or porosity. The commenter recommended deleting this condition and permit use for new construction. (6-11)

NRC Response: The NRC disagrees with the comment. Code Case N-831-1 updated Code Case N-831 to include ultrasonic inspection of stainless steel in addition to ferritic steel. The proposed condition on Code Case N-831-1 is identical to the condition on Code Case N-831 that the NRC approved in RG 1.147, Revision 19. When ASME revised Code Case N-831, it did not modify the code case in a way that would make it possible for the NRC to remove the condition. Additionally, N-831-1 is an ASME BPV Code, Section XI, Code Case, so its scope is as an alternative to the requirements of Section XI, Article IWA-4000; it does not apply to ASME BPV Code, Section III, examinations. Therefore, the NRC is retaining the condition for Code Case N-831-1. The NRC detailed the technical rationale for prohibiting the use of ultrasonic inspection in lieu of radiography for new construction in the *Federal Register* notice for RG 1.147, Revision 19 (85 FR 14736), which included the following justification:

> History has shown that the combined use of radiographic testing for weld fabrication examinations followed by the use of Ultrasonic Testing for preservice inspections and ISI ensures that workmanship is maintained (with radiographic testing) while potentially critical planar fabrication flaws are not put into service (with Ultrasonic Testing). Until studies are completed that demonstrate the ability of Ultrasonic Testing to replace radiographic testing (repair/replacement activity), the NRC will not generically allow the substitute of Ultrasonic Testing in lieu of

radiographic testing for weld fabrication examinations. In addition, ultrasonic examinations are not equivalent to radiographic examinations as they use different physical mechanisms to detect and characterize discontinuities. These differences in physical mechanisms result in several key differences in sensitivity and discrimination capability. As a result of these differences, as well as in consideration of the inherent strengths of each of the methods, the two methods are not considered to be interchangeable, but are considered complementary. In addition, using ultrasonic examinations instead of radiographic testing has a particular advantage for operating plants that is not present during new reactor construction. Operating plants must take into account the additional dose from irradiated plant equipment, which may present challenges to keeping radiological dose (man-rem) as low as reasonably achievable. In contrast, there is no irradiated plant equipment present during new reactor construction. Thus, the additional dose that may be received during radiographic testing in operating plants may present a hardship or unusually difficulty without an equal compensating increase in the level of quality or safety for operating plants, but does not justify the reduction in quality assurance for new construction. In addition, performing ultrasonic examination under a repair or replacement activity for operating plants allows the ultrasonic examination results to be available for comparison in future inservice inspections that use ultrasonic examination. Therefore, the NRC has determined that this Code Case is not acceptable for use on new reactor construction.

The NRC does not agree that the criteria in ASME BPV Code, Section XI, are more robust or appropriate, since ultrasonic and radiographic examinations are considered complementary, not interchangeable, as they use different physical mechanisms to detect and characterize discontinuities.

The staff made no revisions as a result of this comment.

Code Case N-847: Partial Excavation and Deposition of Weld Metal for Mitigation of Class 1 Items, Section XI, Division 1

Comment Summary—Condition 1: The commenters stated there is insufficient technical basis for limiting the use of Code Case N-847 to full 360-degree excavate-and-weld repairs; examination requirements for partial-arc excavate-and-weld repairs should be identical to those of unmitigated welds. The commenters point out additional resources to demonstrate the effectiveness of the partial-arc excavate-and-weld repair process. The commenters recommended removing Condition 1. (6-12, 7-12)

NRC Response: The NRC disagrees with the comment. The condition remains consistent with 10 CFR 50.55a(g)(6)(ii)(F)(*16*), which requires the review and acceptance of partial embedded flaw repairs for PWR applications. Initial research into stress fields and crack growth associated with the ends of a repair has indicated that crack growth rates may exceed those expected in the absence of the repair. Furthermore, the NRC notes that there is potential for confusion about the inspection interval for such repaired welds, given Note 5 of Code Case N-770-5, which concerns the ISI requirements for these welds. The NRC also notes that while mockups have been created as noted by the commenters, the NRC did review these previously. The NRC notes that these uncertainties have increased impact, for three reasons:

(1) There is a lack of field application experience with this repair technique.

(2) The technique is only expected to be used in areas with limited access to perform other repair techniques.

(3) The subject welds would be located within a radiation area making up the reactor coolant pressure boundary.

The NRC accepts that the technical basis for the repair provides a reasonable basis for acceptance, and the agency has approved the full 360-degree application for use without a relief request. However, partial-arc excavate-and-weld repair requires NRC review and approval, since designs acceptable under the code case may vary in their ability to resolve all uncertainties related to nondestructive examination, weld residual stress profiling, and flaw analysis. Each of these factors must be verified to be addressed by the design to allow this weld modification to provide reasonable assurance of structural integrity when a crack remaining in the reactor coolant pressure boundary of the primary system of a nuclear reactor in the United States.

The staff made no revisions as a result of this comment.

Comment Summary—Condition 2: The commenters asserted that Condition 2 is implying greater detail than intended in Figures 1A and 1B of N-847. The commenters noted that weld joint details, such as a corner radius requirement, are addressed in weld detail drawings or the welding procedure specification. The commenters recommended removing Condition 2. (6-13, 7-13)

NRC Response: The NRC disagrees with the comment. The basis for the effectiveness of the repair is the weld residual stress profile through the repair and original weld. While weld detail drawings or the welding procedure specification may address the geometry of the excavated surface before application of the weld repair, the NRC condition will ensure that the design of an excavate-and-weld repair addresses any potential geometric stress concentrators. The NRC reiterates that the inclusion of a simple note verifying the NRC condition for both figures would fulfill the condition.

The staff made no revisions as a result of this comment.

Comment Summary—Condition 3: The commenters noted that Condition 3 points to paragraph 2(d)(2) and should point to paragraph 2(d)(1) for nickel-based alloys. The commenters recommended deleting or replacing paragraph 2(d)(2). (6-14, 7-14)

NRC Response: The NRC agrees with the comment. The NRC will revise Condition 3 for N-847 to the following: "The evaluation in Section 2(d)(1) of the Code Case must include evaluation of crack growth into the Alloy 690 weld material, including the dilution zones and allowing for change in flaw growth direction."

Comment Summary: The commenters stated Condition 3 is unnecessary, because first-layer dilution zones in full penetration groove welds using high-chromium nickel-based weld metals such as 52i, 52M, or 52MSS (for new construction or new replacement groove welds) are considered resistant to stress corrosion cracking in a PWR environment. The commenters recommended removing or rewording Condition 3. (6-15, 7-15)

NRC Response: The NRC disagrees with the comment. While more resistant to PWSCC, Alloy 690 weld metals are not impervious to the cracking mechanism, as demonstrated in NRC-sponsored validation work at Pacific Northwest National Laboratory and Argonne National

Laboratory. Additionally, dilution zone crack growth rates remain an open item in the Electric Power Research Institute (EPRI) Materials Reliability Program report MRP-386, "Recommended Factors of Improvement for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) Growth Rates of Thick-Wall Alloy 690 Materials and Alloy 52, 152, and Variants Welds," issued December 2017. The NRC therefore concludes that flaw growth analysis must cover the dilution zones and Alloy 690 weld metal zones of the repair material. This is further supported by information in the presentation "Primary Water SCC of High-Cr Ni-Based Welds at or near Interfaces" (Bogdan Alexandreanu and Yiren Chen, EPRI Alloy 690 Conference, January 13, 2021; ADAMS Accession No. ML21140A005). This presentation documents crack growth rate testing that showed the growth of a stress corrosion crack from Alloy 600 weld material into diluted Alloy 690 weld material and then into Alloy 690 weld material. While the growth rate decreased, flaw growth did occur. Furthermore, the flaw turned along the boundary and continued to grow in the diluted Alloy 690 weld material. The possibility of such behavior should be evaluated to obtain reasonable assurance of structural integrity of the weld repair for its design life.

The staff made no revisions as a result of this comment.

Code Case N-864: Reactor Vessel Threads in Flange Examinations, Section XI, Division 1

Comment Summary—Condition 1: The commenters stated the first condition of Code Case N-864 is not necessary and should be deleted. The industry has shown that crack growth in the threads in flange is insignificant, and it has demonstrated the robustness of the threads in flange through many years of operating experience and inspections. Maintenance practices and testing and monitoring provide sufficient means of detecting adverse conditions in the threads in flange. The basis for the condition has no technical merit. (6-16, 7-16)

NRC Response: The NRC disagrees with the comment. The NRC proposed this condition based on experience with previously approved licensee requests for alternatives. The NRC documents the technical bases of the agency's approval of those requests in the staff's safety evaluations of the requests. The requests were for relief from examinations of the threads in flange for up to two intervals based solely on a deterministic analysis. The NRC does not consider deterministic analysis (i.e., crack growth analysis) alone to provide a sufficient basis for eliminating the examinations for the threads in flange, because deterministic analysis does not provide the performance monitoring needed to protect against new degradation or changes in degradation in the threads in flange. The staff calls for the monitoring and maintenance activities in the second condition to ensure adequate performance monitoring during the examination periods eliminated by Code Case N-864. Leakage testing is a required systemwide method for detecting potential degradation from all components within the scope of the leakage testing and thus does not necessarily focus on the threads in flange. The examinations that effectively detect degradation in the threads in flange are the volumetric examinations that Code Case N-864 proposes to eliminate. Therefore, to ensure the detection of any degradation in the threads in flange, the NRC is limiting the scope of examinations eliminated by Code Case N-864.

The staff made no revisions as a result of this comment.

Comment Summary—Condition 2: The commenters stated the second condition of Code Case N-864 is not clear on what monitoring and maintenance activities satisfy the condition. The commenters stated the condition is not necessary and should be deleted or, at a minimum, clarified. (6-17, 7-17)

NRC Response: The NRC agrees with the commenters that the proposed second condition needs clarification but does not agree with the commenters that the condition is not necessary and should be deleted. The condition ensures sufficient performance monitoring during the examination periods eliminated by Code Case N-864. The NRC has clarified the second condition of Code Case N-864 as follows: "Performing and documenting the facility's maintenance procedures for removal, care, and visual inspection of the reactor head closure studs and threads in flange during each refueling outage is sufficient to satisfy this condition." Condition 2 as revised, therefore, ensures that previously voluntary plant maintenance activities for the vessel threads in flange are applied and documented in a retrievable manner as part of reduced inspection frequency.

Code Case N-876: Austenitic Stainless Steel Cladding and Nickel Base Cladding Using Ambient Temperature Automatic or Machine Dry Underwater Laser Beam Welding (ULBW) Temper Bead Technique, Section XI, Division 1

Comment Summary: The commenters stated that the first condition should be removed, and the NRC should consider removing the conditions currently specified in 10 CFR 50.55a(b)(2)(xii) during the next 10 CFR 50.55a rulemaking. (7-18)

NRC Response: The NRC disagrees with the comment. Condition 1 requires licensees to obtain NRC approval before performing underwater welding of components whose weldability can be compromised by the effects of neutron fluence. The effect of neutron fluence on the weldability of reactor vessel materials is the same for BWRs and PWRs. If the neutron fluence differs between the types of reactor vessels, these differences are properly managed by the neutron fluence thresholds in the code case condition. This Code Case condition is technically equivalent to the condition imposed on Code Case N-516-4 in RG 1.147, Revision 19. The public comment on Code Case N-876 does not provide a sufficient basis for changing the NRC position, which was finalized during rulemaking on RG 1.147, Revision 19.

The staff made no revisions as a result of this comment.

Code Case N-878: Alternative to QA Program Requirements of IWA-4142, Section XI, Division 1

Comment Summary: The commenter stated that the proposed conditions provide only two options for a licensee to employ the use of this code case. The purpose of these imposed conditions as stated in the draft rule is to address how to ensure the non-welded fittings met the design and testing requirements of Section III NB/NC/ND-3671.7 since this is not addressed in the two code cases. As written in DG-1367, each individual licensee is required to repeat this qualification process that is onerous, costly and is not commensurate with an increase in plant safety. This burden is especially impactful because as written, each individual licensee is expected to individually supervise the ASME III required qualification testing or perform a separate analysis to support the use of a patented fitting.

The commenter stated current industry efforts (e.g., EPRI) are in progress to generically qualify the design or testing requirements of such fittings to Section III. The NRC should permit a licensee to use such industry accepted studies demonstrating compliance with Section III design and testing requirements rather than requiring each licensee to individually supervise and monitor qualification testing, or to reconduct qualification tests or design analysis of patented fittings. The commenter stated a licensee would only need to ensure that the testing conducted meets the requirements of any application Design Specification.

The commenter recommended adding to the condition cited in DG 1.1.47 for Code Cases N-878 and N-880 the following: ", or iii) The Licensee may utilize the results from industry organizations that have qualified the fitting to ASME Section III NB/NC/ND-3671.7 provided the Licensee's design specification requirements are also met." (6-18)

NRC Response: The NRC disagrees with the commenter because the agency is not permitted to generically approve the use of future standards as alternatives to regulatory requirements. Should a case be developed in the future to validate the safe use of such fittings, licensees will be able to request NRC authorization to use the fittings as alternatives on a case-by-case basis under 10 CFR 50.55a(z).

The staff made no revisions as a result of this comment.

Comment Summary: The commenter stated that the NRC should clarify that proposed Condition 1 is only imposed on a licensee when the original construction code was ASME BPV Code, Section III. If a licensee procures a Section III small fitting for a plant that was not originally constructed to Section III, this condition should not apply, as the licensee's quality assurance program would govern the applicable procurement requirements for the item. This case requires the owner to approve the repair/replacement organization's (RRO's) quality assurance program [IWA-4142(a)(2)]. This approval should suffice to ensure that the RRO's design documentation and methods comply with the licensee's design specifications, as well as with the requirements of ASME BPV Code, Section III, NB/NC/ND-3671.7. This case requires that records of all examinations or testing be included with the certified material test report or certificate of compliance, which shall be reviewed and accepted by the owner. The commenter stated that the proposed Condition 2 is unnecessary because this case requires that the owner make all records available to the authorized nuclear inservice inspector (ANII) before installing an item using this case, and the ANII will always have the opportunity to review the design report as well.

For the reasons described above, the commenter recommended removing proposed Conditions 1 and 2 from RG 1.147, Revision 20, Table 2, and documenting approval of this case in Table 1. If the NRC does not remove the conditions, then the commenter requested that the NRC address Comment 1 above. (7-19)

NRC Response: The NRC partly disagrees and partly agrees with the comment.

The NRC agrees with the recommendation to clarify Condition 1. The NRC will clarify that this condition applies only to licensees whose original construction code implemented ASME BPV Code, Section III, design requirements and/or to licensees that have upgraded their original design requirements to Section III.

The NRC disagrees with the recommendations to remove proposed Conditions 1 and 2, because the code case removes the stamping requirements for fabrication of parts manufactured off site. This does not provide the same level of quality oversight by the owner, ANII (or authorized nuclear inspector), and ASME. Specifically, the design and fabrication of small, nonstandard nonwelded or welded fittings away from the owner's facility by an organization (a fitting fabricator) without a quality assurance program that complies with ASME BPV Code, Section XI, IWA-4142, does not provide the same quality assurance and consistency as design, qualification testing, and fabrication by an ASME NPT certificate holder. The NRC has determined that the owner's oversight of the fabricator is necessary to provide reasonable assurance that these fittings are designed and fabricated with sufficient quality and consistency to ensure that the components maintain their structural integrity during operations. Therefore, the NRC made no changes to Conditions 1 and 2 in response to this comment.

Code Case N-880: Alternative to Procurement Requirements of IWA-4143 for Small Nonstandard Welded Fittings, Section XI, Division 1

Comment Summary: The commenter stated the comments noted above for the conditions cited for Code Case N-878 apply to the conditions cited for Code Case N-880. The commenter recommended the same changes to the conditions on Code Case N-880 as noted for the condition on Code Case N-878 above. (6-19)

NRC Response: The NRC disagrees with the comment for the same reason as stated above in response to Comment 6-18.

The staff made no revisions as a result of this comment.

Comment Summary: The commenter stated the comment repeats the comment on Code Case N-878 (Comment 7-19) as also applicable to Code Case N-880. (7-20)

NRC Response: The NRC partly agrees and partly disagrees with this comment, for the same reasons as stated above in response to Comment 7-19. The NRC has made the same clarifications to Condition 1 for Code Case N-880 as for Code Case N-878.

Category 3: Comments on DG-1368 (RG 1.192, Revision 4)

ASME OM Code Case OMN-18: Alternate Testing Requirements for Pumps Tested Quarterly within ±20% of Design Flow

Comment Summary: The commenter requested the NRC remove the condition from ASME Code Case OMN-18 , "Alternate Testing Requirements for Pumps Tested Quarterly Within ±20% of Design Flow," in NRC Regulatory Guide (RG) 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," and relocate Code Case OMN-18 to Table 1 of RG 1.192." The condition placed on Code Case OMN-18 does not provide an increase in the level of safety or quality. The ASME OM Code and Code Case OMN-18 provide an appropriate approach for pump testing to assess operational readiness and to identify any adverse trends without the additional requirements imposed by the condition on OMN-18; which adds undue burden to licensees. OMN-18 already requires Owners to test with very accurate instrumentation; meeting the requirements of OM Table ISTB-3510-1. Even though the testing may be at +20 percent of pump design flow rate, the required testing would be more than sufficient to show any degradation/adverse trends for an Owner to take the appropriate actions. The intent and origin of Code Case OMN-18 was to address an unintended consequence resulting from major changes in OM pump test requirements that introduced separate Group A, Group B, Comprehensive, and Preservice test requirements and became effective in the 1995 Edition of OM code. The unintended consequence occurs at plants that perform quarterly Group A pump testing at the same hydraulic condition as the Comprehensive pump testing. In this scenario, the high side of the OM hydraulic acceptance criteria is 1.10 times the reference value for the Group A test and 1.03 times the reference value for the Comprehensive test. This creates an issue when test data enters the range between 1.03 and 1.10 times the reference value during quarterly testing. Technically this data meets the quarterly test acceptance criteria, but would be in the required action range and require the pump to be declared inoperable if the test data was collected during a comprehensive test. This creates concern among the on-shift operations personnel when they learn that test data collected would not meet future acceptance criteria. Code Case OMN-18 eliminates the comprehensive test for those plants that perform quarterly testing at hydraulic conditions and instrumentation that would meet the comprehensive test requirements.

Before the major pump test changes in OM 1995 Edition, pumps were required to be tested quarterly under repeatable conditions, but there were no specific flow requirements for the testing. As a result, a large percentage of quarterly IST pump testing in the industry at that time was performed using a pump minimum flow recirculation line or similar test line that provided a relatively low flow rate due to limitations in plant design. In addition, many plant Technical Specifications at the time included hydraulic acceptance criteria for the ECCS pumps tested at the low flow test conditions. It was recognized that testing at relatively low flow did not provide a lot of value in detecting pump degradation because the flow point was back on the flat portion of the pump curve. Therefore, OM made major changes to pump testing and introduced the requirement to perform comprehensive pump tests every two years which required all pumps to be tested within 20 percent of design flow where there is sufficient slope in the pump curve to better detect degradation in pump performance. The issue with the change to the pump testing in the OM 1995 Edition was that it failed to recognize that some plants' design and testing methods allowed essentially full flow testing quarterly. In retrospect, the comprehensive test requirement should have only applied to those pumps that were not tested within 20% of design flow during quarterly testing. Code Case OMN-18 was intended to correct that error.

Pump hydraulic performance doesn't normally improve as a pump degrades. Therefore, the intent of a reduced high acceptance criteria for the comprehensive pump test was to detect problems with the test or instrumentation. This seemed appropriate at the time because it was expected that the comprehensive test would use a different flow path/alignment than the quarterly test and would be performed much less frequently (every two years). Code Case OMN-18 recognized the error in that thinking and those plants capable of performing their quarterly pump tests at the same hydraulic conditions as the comprehensive pump test would use the same flow path/alignment and there was no benefit in reduced high acceptance criteria. Quarterly test data at essentially the same flow conditions was more than adequate to monitor degradation of the pump and identify issues with data scatter or flow path/alignment issues without reducing the high acceptance criteria. (6-20)

NRC Response: The NRC agrees with the comment. ASME OM Code Case OMN-18 allows the Group A test to be performed quarterly within ±20 percent of pump design flow rate, with instrumentation meeting the requirements of the applicable ISTB table for Comprehensive and Preservice Tests, and no Comprehensive Test is required. In RG 1.192, the NRC specified the following condition for the use of Code Case OMN-18:

> The upper-end values of the Group A test acceptable ranges for flow and differential pressure (or discharge pressure) must be $1.06Q_r$ and $1.06\Delta P_r$ (or $1.06P_r$), respectively, as applicable to the pump type. The high values of the required action ranges for flow and differential pressure (or discharge pressure) must be $>1.06Q_r$ and $>1.06\Delta P_r$ (or $1.06P_r$), respectively, as applicable to the pump type.[2]

In response to the comment, the NRC reviewed the bases for the condition on the use of ASME OM Code Case OMN-18 specified in RG 1.192. The Comprehensive Test is required every 2

2 In this condition, Q_r is the reference flow rate, ΔP_r is the reference differential pressure, and P_r is the reference pressure applicable to the specific pump and its type.

years with specific acceptance criteria, including upper-end values of the acceptable ranges for flow and differential pressure (or discharge pressure) as $1.03Q_r$ and $1.03\Delta P_r$ (or $1.03P_r$), as applicable to the pump type.[3] A Group A test is performed quarterly with a reduced set of acceptance criteria, including upper-end values of the acceptable ranges for flow and differential pressure (or discharge pressure) as $1.10Q_r$ and $1.10\Delta P_r$ (or $1.10P_r$), as applicable to the pump type. Based on the quarterly performance of the Group A Tests with more accurate gauges (compared to every 2 years for the Comprehensive Tests) within ±20 percent of pump design flow rate and the absence of operating experience concerns with the pump acceptance criteria, the NRC has determined that the condition to require the slightly more restrictive upper-end values of the acceptable ranges for flow and differential pressure (or discharge pressure) are not necessary to provide reasonable assurance that the implementation of ASME OM Code Case OMN-18 will demonstrate the acceptable performance of pumps within the scope of the ASME OM Code. Therefore, the NRC will delete the condition for the use of ASME OM Code Case OMN-18 from RG 1.192.

Category 4: Comments on DG-1369 (RG 1.193, Revision 7, Table 2)

Code Case N-826: Ultrasonic Examination of Full Penetration Vessel Weld Joints in Fig. IWB-2500-1 through Fig. IWB-2500-6, Section XI, Division 1

Comment Summary: (a) The commenter stated that NRC prohibits the use of Code Case N-826 in Regulatory Guide (RG) 1.193 because of three main points: (1) potential conflict with ability to meet requirements of 10 CFR 50.61a, (2) recent experience with missed defects during UT examinations, and (3) lack of a hardship for fulfilling existing examination volume requirement. The commenter stated these three main points do not constitute a sound technical basis for not approving the use of Code Case N-826. The commenter recommended NRC remove Code Case N-826 from RG 1.193 and approve the use of Code Case N-826 in RG 1.147 for the reasons provided in (b) through (d) below.

(b) The commenter stated 10 CFR 50.61a is an optional rule that is only applicable to PWRs. As of this date, only one plant has been approved to use 10 CFR 50.61a, and that plant is scheduled to shut down in 2022. The remainder of the PWR fleet and the entire BWR fleet could still benefit from the use of this code case while not having any conflict with the requirements of 10 CFR 50.61a. In addition, use of 10 CFR 50.61a requires NRC approval prior to its use. Therefore, to address the concern of a potential conflict, it seems that it would be more prudent for the NRC to condition use of the code case such that it is not allowed for use for plants that adopt 10 CFR 50.61a rather than disallowing use for the entire PWR and BWR fleet.

(c) The commenter is not aware of the specific event(s) that the NRC is referring to with regards to their concerns about missed defects during ultrasonic examinations. The commenter stated NRC's concern may stem from an event involving the examination of nickel-based alloy dissimilar metal welds. Those welds would have been inspected using the ASME Code, Section XI, IWB-2500 figures (and the associated examination volumes) that are not within the scope of this code case. Furthermore, there has been no similar experience regarding missed defects during examination of similar metal welds of low alloy steel that are within the scope of this code case. In particular, data from the performance demonstration initiative have shown that the probability of detection for flaws in welds within the scope of Code Case N-826 is very high (i.e., greater than 90 percent) as shown in Figures 2-1 through 2-3 of EPRI

[3] The multiplier for the upper-end of the acceptable range was revised to 1.06 in the 2011 Addenda (2009 Edition) to the ASME OM Code.

Report-3002013319, Nondestructive Evaluation: Probabilistic Analysis of Performance Demonstration Ultrasonic Flaw Detection and Through-Wall Sizing Results for Reactor Pressure Vessel Inspections (Revision 2), EPRI, Palo Alto, CA, 2018.

(d) The commenter stated code cases are not intended to solely address hardships. Many code cases provide an alternative approach to the existing ASME Code requirements for the purposes of efficiency, simplicity, reduced costs, and as low as reasonably achievable (ALARA) concerns. The Code case approval process requires that all actions have a sufficiently robust technical basis for the proposed alternative, but demonstration of a hardship is not required. The technical basis for Code Case N-826 is consistent with the technical basis for Code Case N-613, which has been approved for use by the NRC. This technical basis points to the fact that flaws, if they should exist, are typically near the weld fusion line. As such, an examination volume of ½ inch on either side of the weld would be sufficient to identify any flaws of significance. This conclusion is supported by service experience and the extensive research on reactor vessel flaw conditions that was conducted and documented in the NRC report, NUREG/CR-6817, Revision 1, F.A. Simonen, S.R. Doctor, G.J. Schuster, and P.G. Heasler, “A Generalized Procedure for Generating Flaw-Related Inputs for the FAVOR Code,” August 2013 (ADAMS Accession No. ML13240A258). The NRC’s approval of the use of Code Case N-613 is indicative of the Staff’s approval of the underlying technical basis. If the technical basis is acceptable for Code Case N-613, it should be equally acceptable for Code Case N-826. The commenter recommends Code Case N-826 be removed from Regulatory Guide 1.193 and placed in Regulatory Guide 1.147 for approval. (7-21)

NRC Response: The NRC disagrees with the comment.

With respect to paragraph (a) of the comment, Code Case N-826 concerns the volumetric examination of the shell welds in the reactor pressure vessel, steam generator, pressurizer, and heat exchanger, as required in ASME BPV Code, Section XI, Table IWB-2500-1. Table IWB-2500-1 identifies the subject welds as belonging to Examination Categories B-A and B-B. For the vessel weld, Figures IWB-2500-1 to IWB-2500-6 in Section XI require the examination of the vessel base metal extending to a distance of $t/2$ on each side of the weld (where t = wall thickness of the shell/component). Code Case N-826 reduces the $t/2$ examination length to 1.27 cm (½ inch).

With respect to paragraph (b) of the comment, the NRC recognizes that 10 CFR 50.61a, “Alternate fracture toughness requirements for protection against pressurized thermal shock events,” is an optional rule that applies only to PWRs. However, the NRC has previously indicated that the reduction of the inspection volume from $t/2$ to 1.27 cm (½ inch) in Code Case N-826 conflicts with 10 CFR 50.61a. The NRC recognizes that only one PWR so far has used 10 CFR 50.61a; however, other PWR owners may request the use of 10 CFR 50.61a in the future. The NRC recognizes that entire BWR fleet could benefit from the use of Code Case N-826 while having no conflict with the requirements of 10 CFR 50.61a. However, as the NRC has noted previously, current ultrasonic examination technology cannot reliably detect and accurately size smaller flaws, which affects the validity of the comparison with the flaw density requirement of 10 CFR 50.61a. In addition, recent experiences at operating plants involving missed defects during examinations that used qualified methods and complied with ASME BPV Code, Section XI, Appendix VIII, have raised concerns about the reliability of ultrasonic examinations. As for the suggestion to approve Code Case N-826 with conditions, the NRC finds that this is not a viable solution because of the concerns and reservations discussed above and below.

With respect to paragraph (c) of the comment, the NRC is concerned that the examination length of 1.27 cm (½ inch) specified in Code Case N-826 is not an adequate replacement for the examination length of *t*/2 (where *t* is the wall thickness of the component) in ASME BPV Code, Section XI, IWB-2500. The difference between the required examination lengths (volumes) in Code Case N-826 and in Figures IWB-2500-1 to IWB-2500-6 is significant. The wall thickness of the reactor pressure vessel is, on average, approximately 6 inches for a BWR and 8 inches for a PWR. According to the *t*/2 length requirement in accordance with Figures IWB-2500-1 to IWB-2500-6, a licensee must examine 3 inches in axial length (for a BWR) or 4 inches in axial length (for a PWR) of the reactor vessel base metal on either side of a reactor vessel weld. The Code Case examination length of only 1.27 cm (½ inch) is much smaller. The less volume is examined in the reactor vessel weld and associated shell, the higher the probability is that flaws in the unexamined volume will go undetected. The NRC finds that it is appropriate to inspect *t*/2 inches of base metal on each side of a vessel weld because this will entail examination of a sufficient volume to provide reasonable assurance of the structural integrity of the vessel weld.

With respect to paragraph (d) of the comment, the NRC recognizes that code cases are not intended solely to address hardships and that many code cases provide alternatives to existing ASME code requirements. However, the NRC notes that the provisions in many code cases are less conservative than those in the ASME code, which may increase risk without a compensating hardship caused by the underlying code provisions. The NRC recognizes that the technical basis for Code Case N-826 is consistent with the technical basis for Code Case N-613, "Ultrasonic Examination of Full Penetration Nozzles in Vessels, Examination Category B-D, Item Nos. B3.10 and B3.90, Reactor Vessel-to-Nozzle Welds, Figures IWB-2500-7(a), (b), and (c)," which the NRC has approved for use. However, Code Case N-613 concerns the volumetric examination of nozzles and nozzle inner radius. The shell welds in the reactor pressure vessel, steam generator, and pressurizer are more significant than nozzle welds in terms of plant safety and defense-in-depth measures. Therefore, in terms of risk and consequence, the reduction in examination volume in Code Case N-826 is more critical to plant safety than that of Code Case N-613. The NRC's approval of Code Case N-613 does not mean that Code Case N-826 should be approved, because the two code cases address different components.

The NRC finds that the risk and consequence associated with the failure of the reactor vessel, steam generator, and pressurizer are significant. Therefore, the NRC does not find the ½-inch inspection length to be adequate.

The staff made no revisions as a result of this comment.

Category 5: General Comments

Comment: Please provide copies of the draft Reg Guides (DG-1366, 1367 and 1368) in the Docket Folder on regulations.gov or on ADAMS. This will allow a better review of this proposed rulemaking. (2-1)

NRC Response: The NRC added the draft RGs (DG-1366, DG-1367, and DG-1368) to regulations.gov on March 8, 2021. These documents are also publicly available in ADAMS under Accession Nos. ML20120A633, ML20120A631, and ML20120A629, respectively.

Comment: Good tool. (9-1)

NRC Response: The NRC appreciates the feedback.