[7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

RIN 3150-AH80

Incorporation by Reference

of American Society of Mechanical Engineers

Boiler and Pressure Vessel Code Cases

AGENCY: Nuclear Regulatory Commission.

ACTION: Issuance and Availability of Proposed Regulatory Guides.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to incorporate by reference the latest revisions of two previously incorporated regulatory guides (RGs) that approve Code Cases published by the American Society of Mechanical Engineers (ASME). Specifically, these are Revision 34 of RG 1.84, “Design and Fabrication Code Case Acceptability, ASME Section III” (temporarily designated as Draft Regulatory Guide DG-1133), and Revision 15 of RG 1.147, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1” (temporarily designated as Draft Regulatory Guide DG-1134). This proposed action would allow licensees to use the Code Cases listed in the regulatory guides as alternatives to requirements in the ASME Boiler and Pressure Vessel (BPV) Code regarding the construction and inservice inspection of nuclear power plant components.

Toward that end, the NRC has issued for public comment drafts of the two revised guides in the agency’s Regulatory Guide Series. This series has been developed to describe and make available to the public such information as methods that are acceptable to the NRC

staff for implementing specific parts of the NRC's regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff needs in its review of applications for permits and licenses.

DATES: Submit comments on the guides by **January 2, 2007**. Comments received after this date will be considered if it is practical to do so, but the Commission is able to ensure consideration only of comments received on or before this date.

ADDRESSES: The NRC staff is soliciting comments on Draft Regulatory Guides DG-1133 and DG-1134. Comments may be accompanied by relevant information or supporting data. Please mention the draft guide number (DG-1133 or DG-1134) in the subject line of your comments. Comments submitted in writing or in electronic form will be made available to the public in their entirety through the NRC's Agencywide Documents Access and Management System (ADAMS). Personal information will not be removed from your comments. You may submit comments by any of the following methods.

Mail comments to: Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Email comments to: NRCREP@nrc.gov. You may also submit comments via the NRC's rulemaking Web site at http://ruleforum.llnl.gov. Address questions about our rulemaking Web site to Carol A. Gallagher (301) 415-5905; email CAG@nrc.gov.

Hand-deliver comments to: Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, 11555 Rockville Pike, Rockville, Maryland 20852, between 7:30 a.m. and 4:15 p.m. on Federal workdays.

Fax comments to: Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission at (301) 415-5144.

Copies of the draft regulatory guides specified in this rulemaking and other publicly available documents related to the proposed rule incorporating these regulatory guides, including public comments received, can be viewed electronically on public computers in the NRC Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland Room O-1 F21, and open to the public on Federal workdays from 7:45 a.m. until 4:15 p.m. The PDR reproduction contractor will make copies of documents for a fee. Selected documents, including public comments on the proposed rule, can be viewed and downloaded electronically via the NRC's rulemaking Web site at http://ruleform.llnl.gov. In addition, the draft regulatory guides can be viewed and downloaded electronically on the NRC's public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC's Electronic Reading Room at http://www.nrc.gov/reading-rm/doc-collections/.

Publicly available NRC documents created or received in connection with the rulemaking (including the draft regulatory guides) are also available electronically via the NRC's Electronic Reading Room at http://www.nrc.gov/NRC/reading-rm/adams.html. From this site, the public can gain entry into the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents. If you do not have

access to ADAMS or if there are problems in accessing the documents located in ADAMS contact the NRC Public Document Room (PDR) Reference staff at 1-800-397-4209, 301-415-4737 or by email to PDR@nrc.gov.

Further information about obtaining the draft regulatory guides and other rulemaking-related documents, including a list of ADAMS accession numbers, can be found in the "Availability of Documents" Section under the SUPPLEMENTARY INFORMATION heading.

FOR FURTHER INFORMATION CONTACT: Wallace E. Norris, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone (301) 415-6796, email WEN@nrc.gov.

Background

The American Society of Mechanical Engineers (ASME) develops and publishes the Boiler and Pressure Vessel Code (BPV Code), which contains the Code requirements for the design, construction, and inservice inspection (ISI) of nuclear power plant components, and the Code for Operation and Maintenance of Nuclear Power Plants (OM Code), which contains Code requirements for inservice testing (IST) of nuclear power plant components. In response to BPV and OM Code user requests, the ASME develops Code Cases which provide alternatives to BPV and OM Code requirements under special circumstances.

Discussion

The NRC staff reviews ASME BPV and OM Code Cases, determines the acceptability of each Code Case, and publishes its findings in regulatory guides. These regulatory guides are revised periodically as new Code Cases are published by the ASME. The NRC incorporates by reference the regulatory guides listing acceptable and conditionally acceptable ASME Code Cases in 10 CFR 50.55a.

The NRC is proposing to incorporate by reference Revision 34 of RG 1.84, “Design and Fabrication Code Case Acceptability, ASME Section III” (temporarily designated as Draft Regulatory Guide DG-1133), and Revision 15 of RG 1.147, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1” (temporarily designated as Draft Regulatory Guide DG-1134). Revision 34 of RG 1.84 would supersede the incorporation by reference of Revision 33 and Revision 15 of RG 1.147 would supersede the incorporation by reference of all previous revisions of the guide (Revisions 0 through 14). To make Regulatory Guide 1.147 easier to

use, the staff made an effort to ensure that the tables of annulled Code Cases in Revision 15 were all inclusive. The result should be that licensees will no longer have to refer to multiple versions of this regulatory guide in managing Code Case usage in their ISI programs.
RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code" (June 2003), has not been revised because the ASME has not published any new OM Code Cases since the last NRC staff review.

Concurrent with this action, the NRC is publishing a notice of availability of the proposed rulemaking, which incorporates these draft regulatory guides by reference. Interested parties may submit comments to the NRC on the proposed rulemaking in accordance with the instructions published in the Federal Register notice announcing its availability.

Code Cases N-659 and N-460

The NRC staff is currently considering a proposed licensee action to use Code Case N-659, "Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination, Section III, Division 1," and Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1," in an unanticipated manner. Because the proposed licensee action was received after Draft Regulatory Guides DG-1133 and DG-1134 had been published but prior to their release, the NRC is proposing to add conditions to the use of these Code Cases in the final guides, unless public comments are received that indicate that the staff's proposed technical bases for the conditions are not applicable, incorrect, unnecessary to provide reasonable assurance of adequate protection to public health and safety and common defense and security, or otherwise not justified in light of the increase in protection to public

health and safety or common defense and security that would be provided by imposition of the conditions.

Code Case N-659

Originally, concerns had been raised relative to the calibration block requirements in the Code Case, and two conditions had been developed for inclusion in the proposed Draft Regulatory Guide DG-1133. The proposed licensee action, however, has raised three new concerns that relate to the licensee's intended use of the Code Case and the capabilities of UT and RT as test methods. Currently, Section III requires that radiographic testing (RT) examinations be performed after the fabrication of certain Class 1, Class 2, and Class 3 welds. The ASME approved Code Case N-659 as an alternative to the requirements of Section III that would permit manufacturers of nuclear power plant components to use ultrasonic testing (UT) examinations in lieu of RT. However, depending on flaw type (i.e., volumetric or planar) and orientation, RT and UT are not equally effective for flaw detection and characterization. RT is effective in detecting volumetric type flaws (i.e., slag and porosity), and in detecting planar type flaws with large openings (i.e., lack of fusion and large cracks in high stressed areas), and which are oriented in a plane parallel to the x-ray beam. RT is effective in all materials common to the nuclear industry in detecting the type of flaws generated during construction. Thus, RT is a good tool to detect workmanship type defects (construction flaws) and ensures an acceptable level of weld quality and safety. In contrast, UT is effective in detecting and sizing planar type flaws in ferritic steels and to a lesser extent in wrought austenitic steels. With specific technique development and personnel training on construction flaws, UT can also be used to detect volumetric type flaws such as slag or porosity. UT is of limited value in detecting flaws in

cast stainless steels. Finally, UT requires more surface scanning area than RT to perform examinations.

During the NRC staff's assessment of the proposed licensee action, concerns were raised relative to the capability of UT, as it would be employed, to detect workmanship type defects and ensure an acceptable level of weld quality. The first concern is with regard to the option provided by the Code Case to use either Section V, Article 5, with two additional construction flaws, or Section XI, Appendix VIII, with a blind add-on demonstration to existing configuration specific qualifications that contains at least three construction type flaws. The addition of only two or three construction flaws to a demonstration is not sufficient to capture the variety of flaws common to construction or to statistically evaluate procedure effectiveness and personnel skills. Section V prescriptive-based requirements are less effective in detecting flaws than performance-based Appendix VIII requirements. Section V qualifications are based on identifying known machined reflectors that display good acoustic responses, which do not address inspection reliability. Performance-based qualifications require blind demonstrations on mockups having flaws with realistic UT responses and a statistically sufficient number of representative flaws and non flawed volumes to establish procedure effectiveness and personnel skill. The statistical approach to qualification has been shown to improve the reliability of inspections and probability of detection, and to reduce the number of false calls.

The second concern is the provision of the Code Case to use the second leg of the ultrasound metal path (V-path) to achieve two direction scanning from only one side of the weld. Single side examinations of the welds have been successfully performance demonstrated on planar flaws in ferritic carbon steel but have not been reliably demonstrated for planar flaws in

austenitic stainless steel and nickel alloys. Single side examinations have not been demonstrated for construction flaws for any material.

The third concern is the requirement in the Code Case to only examine half of the through-wall thickness (½ t) from each side of the weld to verify that the welding process did not compromise the integrity of the base material surrounding the weld. For thin-walled parts and components, ½ t may not be sufficient to capture any degradation associated with the welding process.

To address the three new concerns discussed above, the NRC proposes to place additional conditions on the use of Code Case N-659 in the final guide. In Paragraph (a) of Code Case N-659, the greater of ½ t or ½-inch from the widest portion of the weld shall be used, and any use of the second leg of the ultrasonic metal path shall be qualified by a performance-based demonstration. In lieu of Paragraphs (b) and (d), the following shall be used: procedures and personnel shall be qualified with blind performance demonstrations on representative mockups in terms of material, wall-thickness, diameter, surface roughness, and configuration of the weldment being examined. A minimum of 10 construction type flaws are required for a personnel qualification and the equivalent of three personnel qualifications required for a procedure qualification.

At least 70% of the flaws shall be located along the base metal-to-weld fusion zone on both sides of the weld. The flaws shall be randomly distributed throughout the weld thickness. Each flawed and unflawed volume shall be defined in independent grading units. The flaws shall be representative of the variety of construction flaws common to the welding process and material being examined. The demonstration must show the capability to detect flaws having a

minimum 2% through-wall depth and within the flaw length acceptance of NB-2553(c). The demonstration detection acceptance criteria shall be:

Detection Test Acceptance Criteria		False Call Test Acceptance Criteria	
No. Of Flawed Grading Units	Minimum Detection Criteria	No. Of Unflawed Grading units	Maximum Number of False Calls
10	8	15	2
11	9	17	3
12	9	18	3
13	10	20	3
14	10	21	3
15	11	23	3
16	12	24	4
17	12	26	4

Flaws shall be detected and located within 1.0-inch of true length and width location and within 10% of true through-wall depth location or within 10% of the sound beam metal path, whichever is greater. All other reported flaws within false call grading units shall be false calls.

A minimum of 10 flaws shall be used for sizing with a random distribution of lengths greater than and less than the applicable NB-2553(c) acceptance standard. The maximum flaw length shall not exceed 200% of the acceptance standard. For qualification, all flaws shall be correctly identified as acceptable or unacceptable.

Procedures shall identify the equipment and essential variable settings used for the qualification. An essential variable is any variable that has an effect on the results of an examination. The procedure shall be requalified when an essential variable is changed outside the demonstrated range.

Code Case N-460

Code Case N-460 provides alternative requirements for the inservice examination of Class 1 welds (Section XI, IWB-2500) and Class 2 welds (Section XI, IWC-2500) when the entire examination volume cannot be examined due to interference by another component or part geometry. The licensee proposed to apply this Code Case in conjunction with Code Case N-659 in those instances when the entire examination volume or area cannot be examined following fabrication, repair or replacement. The NRC does not believe that it is appropriate to use Code Case N-460 for repair and replacement during construction and replacement (fabrication) activities because a construction or replacement weld should be designed for complete access for examination. Thus, the NRC proposes to condition the use of Code Case N-460 in the final guide such that the Code Case can only be applied when performing inservice examinations in accordance with a Section XI inservice inspection program.

Evaluation of Code Cases

1 Purpose and structure of this evaluation:

This evaluation lists the Code Cases and explains NRC's rationale for any limitations. The evaluation also explains the ASME and regulatory processes concerning Code Cases. The evaluation addresses Proposed Revision 34 to Regulatory Guide 1.84 (DG-1133), "Design, Fabrication, and Materials Code Case Acceptability, ASME Section III," and Proposed Revision 15 to Regulatory Guide 1.147 (DG-1134), "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." For these revisions, the NRC staff reviewed the Code Cases in Supplement 7 through Supplement 12 to the 2001 Edition and Supplement 1 to the 2004

Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV Code). The regulatory guides do not address Code Cases pertaining to high-temperature gas-cooled reactors; certain requirements in Section III, Division 2, that are not endorsed by the NRC; liquid metal; and submerged spent fuel waste casks. The proposed disposition of each Code Case is listed below. For Code Cases determined to be conditionally acceptable, the basis for the determination is summarized to afford users of the ASME Code an opportunity to comment on the proposed disposition and basis.

2 Discussion of ASME Process:

Code Cases provide alternatives, developed and approved by ASME, to the applicable provisions of the ASME BPV Code. For the purposes of this evaluation, Code Cases can be categorized as one of three types: new, revised, or reaffirmed (it should be noted that after the review of the supplements addressed in this evaluation, the ASME made a determination to end the use of three-year terms for Code Cases and therefore, the latest supplements do not contain reaffirmed Code Cases). A new Code Case addresses for the first time a specific need. Existing Code Cases may be revised (modified) to address, for example, technological advancements in examination techniques, or to address NRC limitations and modifications. Code Cases still in use but not requiring revision may be reaffirmed (approved) without change by the ASME. As noted above, subsequent to the NRC review of the Code Cases in the subject supplements, the ASME made a determination to eliminate expiration dates for Code Cases. Thus in the future, Code Cases will no longer require reaffirmation (i.e., new 3-year terms). This change is not expected to affect the NRC Code Case review process, nor result in significant modification of the regulatory guides.

With regard to Code Cases conditioned by the NRC, it should be noted that the Subcommittee on Nuclear Power (Section III) and the Subcommittee on Nuclear Inservice Inspection (Section XI) have instructed working groups to review these Code Cases, and determine whether changes to the Code Cases are appropriate. For example, Code Case N-613 was not approved for use by the NRC because certain provisions conflicted with requirements in 10 CFR 50.55a. Section XI revised the Code Case in a manner acceptable to the NRC and Code Case N-613-1 was approved in Revision 14 of Regulatory Guide 1.147. Revisions to other Code Cases are expected to be published by the ASME in the near future with the expectation that many of them can be unconditionally approved by the NRC.

3 Discussion of Regulatory Process:

New Code Cases that are determined to be acceptable by the NRC are approved as published by the ASME and may be used in the design, construction, and ISI of components and their supports for water-cooled nuclear power plants. When a determination is made that the provisions of a new Code Case need to be augmented, that Code Case is conditionally approved. These Code Cases are acceptable to the NRC within the limitations and modifications described in the relevant regulatory guide. Unless otherwise stated, limitations recommended by the NRC staff are in addition to the conditions specified in the Code Case. A discussion of the basis for the limitation or modification is provided, and the NRC invites public comment on these conditions. A determination may be made that a new Code Case is unacceptable for use by licensees. Code Cases determined to be unacceptable are listed in Proposed Revision 2 of Regulatory Guide 1.193, “ASME Code Cases Not Approved for Use.” A summary of the basis for the determination is provided in the regulatory guide, and the NRC invites public comment on the basis for the disapproval. Revised Code Cases were modified by

the ASME, and the NRC compares the revised Code Case to the original Code Case (that has become part of the regulations through the incorporation by reference process), and a determination is made whether the revised Code Case is acceptable, conditionally acceptable, or unacceptable. Reaffirmed in the context of the regulatory guides means that a Code Case was approved in a previous version of a regulatory guide. The status of a revised Code Case remains unchanged in the regulatory guide unless additional information becomes available (e.g., emerging issue) indicating that a regulatory change in position is warranted.

4 List of Code Cases and Summary of Bases:

4.1 Acceptable Code Cases: The Code Cases in Supplement 7 through Supplement 12 to the 2001 Edition and Supplement 1 to the 2004 Edition listed below are acceptable to the NRC. The supplement in which a Code Case appears in listed in brackets behind the Code Case Number (e.g., [S7] means Supplement 7).

4.2 Section III Code Cases

CODE CASE NUMBER	TYPE	TITLE
N-7-1 [S7]	Reaffirmed	High Yield Strength Steel, Section III, Division 1, Class 1
N-60-5 [S12]	Reaffirmed	Material for Core Support Structures, Section III, Division 1
N-122-2 [S7]	Reaffirmed	Procedure for Evaluation of the Design of Rectangular Cross Section Attachments on Class 1 Piping, Section III, Division 1

N-131-1 [S7]	Reaffirmed	Material for Internal Pressure Retaining Items for Pressure Relief Valves, Section III, Division 1, Class 1, 2, and 3
N-133-3 [S7]	Reaffirmed	Use of SB-148 Alloys 952 and 954, Section III, Division 1, Class 3
N-154-1 [S7]	Reaffirmed	Projection Resistance Welding of Valve Seats, Section III, Classes 1, 2, and 3
N-160-1 [S7]	Reaffirmed	Finned Tubing for Construction, Section III, Division 1
N-208-1 [S8/9]	Reinstated	Fatigue Analysis for Precipitation Hardening Nickel Alloy Bolting Material to Specification SB-637 N07718 for Section III Division 1, Class 1 Construction
N-243 [S7]	Reaffirmed	Boundaries Within Castings Used for Core Support Structures, Section III, Division 1
N-315 [S7]	Reaffirmed	Repair of Bellows, Section III, Division 1
N-318-5 [S7]	Reaffirmed	Procedure for *Evaluation of the Design of Rectangular Cross Section Attachments on Class 2 or 3 Piping, Section III, Division 1*
N-319-3 [S7]	Reaffirmed	Alternate Procedure for Evaluation of Stresses in Butt Welding Elbows in Class 1 Piping, Section III, Division 1
N-369 [S8/9]	Reaffirmed	Resistance Welding of Bellows, Section III, Division 1
N-373-2 [S1]	Reaffirmed	Alternative PWHT Time at Temperature for P-No. 5 Material, Section III, Division 1, Classes 1, 2, and 3
N-391-2 [S1]	Reaffirmed	Procedure for Evaluation of the Design of Hollow Circular Cross Section Welded Attachments on Class 1 Piping, Section III, Division 1

N-392-3 [S1]	Reaffirmed	Procedure for Evaluation of the Design of Hollow Circular Cross Section Welded Attachments on Classes 2 and 3 Piping, Section III, Division 1
N-405-1 [S12]	Reaffirmed	Socket Welds, Section III, Division 1
N-452 [S8/9]	Reaffirmed	Specialized Subcontracted Welding Process (Electron Beam Welding), Section III, Division 1
N-454-1 [S10]	Reaffirmed	Nickel-Chromium-Molybdenum-Copper Stainless Steel (UNS N08925 and N08926) Wrought Fittings for Class 1 and 3 Construction, Section III, Division 1
N-455-1 [S10]	Reaffirmed	Nickel-Chromium-Molybdenum-Copper Stainless Steel (UNS N08925 and N08926) Forged Flanges and Fittings for Class 1 and 3 Construction, Section III, Division 1
N-469-1 [S7]	Reaffirmed	Martensitic Stainless Steel for Class 1, 2, and 3 Components, Section III, Division 1
N-500-2 [S1]	Revised	Alternative Rules for Standard Supports for Classes 1, 2, 3 and MC, Section III, Division 1
N-505 [S1]	Reaffirmed	Alternative Rules for the Examination of Butt Welds Used as Closure Welds for Electrical Penetration Assemblies in Containment Structures, Section III, Division 1
N-511 [S1]	Reaffirmed	Design Temperature for Atmospheric and 0-15 psi Storage Tanks, Section III, Division 1
N-520-1 [S8/9]	Reaffirmed	Alternative Rules for Renewal of N-type Certificates for Plants Not in Active Construction, Section III, Division 1
N-539 [S12]	Reaffirmed	UNS N08367 in Class 2 and 3 Valves, Section III, Division 1

N-564-2 [S7]	Reaffirmed	UNS J93380, Alloy DC3MWCuN, Class 2 and 3 Construction, Section III, Division 1
N-579 [S7]	Reaffirmed	Use of Nonstandard Nuts, Class 1, 2, and 3, MC, CS Components and Supports Construction, Section III, Division 1
N-607 [S1]	Reaffirmed	Transfer of Welder, Welding Operator, Brazer, and Brazing Operator Qualifications Between Owners, Section XI, Division 1
N-610 [S1]	Reaffirmed	Alternative Reference Stress Intensity Factor (K_{1R}) Curve for Class Components, Section III, Division 1
N-611 [S12]	Reaffirmed	Use of Stress Limits as an Alternate to Pressure Limits Subsection NC/ND-3500, Section III, Division 1
N-620 [S1]	Reaffirmed	Rules for Class 1 Type M Pumps, Section III, Division 1
N-621 [S1]	Reaffirmed	Ni-Cr-Mo Alloy (UNS N06022) Welded Construction to 800°F, Section III, Division 1
N-625-1 [S12]	Reaffirmed	Ni-Cr-Mo Alloy (UNS N06059) Welded Construction to 800°F, Section III, Division 1
N-632 [S7]	Reaffirmed	Use of ASTM A572, Grades 50 and 65 for Structural Attachments to Class CC Containment Liners, Section III, Division 1
N-635-1 [S8/9]	Revised	Use of 22Cr-5Ni-3Mo-N (Alloy UNS S31803) Forgings, Plate, Bar, Welded and Seamless Pipe, and/or Tube, Fittings, and Fusion Welded Pipe With Addition of Filler Metal, Classes 2 and 3, Section III, Division 1

N-642 [S7]	Reaffirmed	Alternative Rules for Progressive Liquid Penetrant Examination of Groove Welds in P-No. 8 Materials 3/16 in. (5mm) Thick and Less Made by Autogenous Machine or Automatic Welding, Section III, Division 1
N-644-1 [S8/9]	Revised	Weld Procedure Qualification for Procedures Exempt From PWHT in Classes 1, 2, and 3 Construction, Section III, Division 1
N-646 [S10/12]	Reaffirmed	Alternative Stress Intensification Factors in Circumferential Fillet Welded or Socket Welded Joints for Class 2 or 3 Piping, Section III, Division 1
N-650 [S12]	Reaffirmed	Use of SA-537, Class 2 Plate Material in Non-pressure Boundary Application Service 700°F to 850°F, Class 1 or CS, Section III, Division 1
N-692 [S10]	New	Use of Standard Welding Procedures, Section III, Divisions 1 and 2
N-698 [S11]	New	Design Stress Intensities and Yield Strength for UNS N06690 With a Minimum Specified Yield Strength of 35 ksi (240Mpa), Class 1 Components, Section III, Division 1
N-703 [S1]	New	Use of Strain Hardened Austenitic Material at Lower Design Stress Values for Class 1 Valves, Section III, Division 1
N-710 [S1]	New	Use of Zirconium Alloy UNS R60702, Bars, Forgings, Plate, Seamless and Welded Fittings, Seamless and Welded Tubing, and Seamless and Welded Pipe, for Class 3 Construction, Section III, Division 1

4.3 Section XI Code Cases

CODE CASE NUMBER	TYPE	TITLE
N-307-3 [S1]	Reaffirmed	Revised Ultrasonic Examination Volume for Class 1 Bolting, Table IWB-2500-1, Examination Category B-G-1, When the Examinations Are Conducted from the End of the Bolt or Stud or from the Center-Drilled Hole, Section XI, Division 1
N-334 [S8/9]	Reaffirmed	Examination Requirements for Integrally Welded or Forged Attachments to Class 2 Piping at Containment Penetrations, Section XI, Division 1
N-416-3 [S1]	Reaffirmed	Alternative Pressure Test Requirement for Welded Repairs or Installation of Replacement Items by Welding, Class 1, 2, and 3, Section XI, Division 1
N-432-1 [S1]	Reaffirmed	Repair Welding Using Automatic or Machine Gas Tungsten-Arc Welding (GTAW) Temper Bead Technique, Section XI, Division 1
N-460 [S8/9]	Reaffirmed	Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1
N-491-2 [S8/9]	Reaffirmed	Rules for Examination of Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power Plants, Section XI, Division 1
N-508-3 [S11]	Revised	Rotation of Serviced Snubbers and Pressure Relief Valves for the Purpose of Testing, Section XI, Division 1

N-513-2 [S1]	Revised	Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1
N-534 [S8/9]	Reaffirmed	Alternative Requirements for Pneumatic Pressure Testing, Section XI, Division 1
N-537 [S1]	Reaffirmed	Location of Ultrasonic Depth-Sizing Flaws, Section XI, Division 1
N-545 [S1]	Reaffirmed	Alternative Requirements for Conduct of Performance Demonstration Detection Test of Reactor Vessel, Section XI, Division 1
N-553-1 [S1]	Reaffirmed	Inservice Eddy Current Surface Examination of Pressure Retaining Pipe Welds and Nozzle-to-Safe End Welds, Section XI, Division 1
N-566-2 [S1]	Reaffirmed	Corrective Action for Leakage Identified at Bolted Connections, Section XI, Division 1
N-573 [S8/9]	Reaffirmed	Transfer of Procedure Qualification Records Between Owners, Section XI, Division 1
N-586-1 [S1]	Revised	Alternative Additional Examination Requirements for Classes 1, 2, and 3 Piping, Components, and Supports, Section XI, Division 1
N-600 [S1]	Reaffirmed	Transfer of Welder, Welding Operator, Brazer, and Brazing Operator Qualifications Between Owners, Section XI, Division 1
N-609 [S1]	Reaffirmed	Alternative Requirements to Stress-Based Selection Criteria for Category B-J Welds, Section XI, Division 1

N-641 [S7]	Reaffirmed	Alternative Pressure-Temperature Relationship and Low Temperature Overpressure Protection System Requirements, Section XI, Division 1
N-643-2 [S1]	Revised	Fatigue Crack Growth Rate Curves for Ferritic Steels in PWR Water Environment, Section XI, Division 1
N-649 [S1]	Reaffirmed	Alternative Requirements for IWE-5240 Visual Examination, Section XI, Division 1
N-651 [S1]	Reaffirmed	Ferritic and Dissimilar Metal Welding Using SMAW Temper Bead Technique Without Removing the Weld Bead Crown for the First Layer, Section XI, Division 1
N-652-1 [S12]	Revised	Alternative Requirements to Categorize B-G-1, B-G-2, and C-D Bolting Examination Methods and Selection Criteria, Section XI, Division 1
N-665 [S8/9]	New	Alternative Requirements for Beam Angle Measurements Using Refracted Longitudinal Wave Search Units, Section XI, Division 1
N-683 [S8/9]	New	Method for Determining Maximum Allowable False Calls When Performing Single-Sided Access Performance Demonstration in Accordance With, Appendix VIII, Supplements 4 and 6, Section XI, Division 1
N-685 [S8/9]	New	Lighting Requirements for Surface Examination, Section XI, Division 1
N-686 [S8/9]	New	Alternative Requirements for Visual Examinations, VT-1, VT-2, and VT-3, Section XI, Division 1

N-695 [S10]	New	Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1 (Note: N-695 was approved in Revision 14 to Regulatory Guide 1.147)
N-696 [S10]	New	Qualification Requirements for Appendix VIII Piping Examinations Conducted From the Inside Surface, Section XI, Division 1
N-697 [S11]	New	Pressurized Water Reactor (PWR) Examination and Alternative Examination Requirements for Pressure Retaining Welds in Control Rod Drive and Instrument Nozzle Housings, Section XI, Division 1
N-700 [S11]	New	Alternative Rules for Selection of Classes 1, 2, and 3 Vessel Welded Attachments for Examination, Section XI, Division 1

4.4 Conditionally Acceptable Code Cases: The Code Cases listed below are acceptable to the NRC subject to the limitations and modifications listed. Notations have been made to indicate the conditions duplicated from previous versions of the regulatory guides.

4.5 Section III

- Code Case N-62-7 [S7]

  Type: Reaffirmed

  Title: Internal and External Valve Items, Section III, Division 1, Classes 1, 2, and 3

  Code Case N-62-7 was conditionally approved in Revisions 32 and 33 to RG 1.84. This Code Case was reaffirmed by the ASME. No changes have been made to the conditions in proposed Revision 34 to the guide.

- Code Case N-71-18 [S8/9]

  Type: Reaffirmed

  Title: Additional Materials for Subsection NF, Class 1, 2, 3, and MC Component Supports Fabricated by Welding, Section III, Division 1

  Code Case N-71-18 was conditionally approved in Revision 33 to RG 1.84. This Code Case was reaffirmed by the ASME. No changes have been made to the conditions in proposed Revision 34 to the guide.

- Code Case N-155-2 [S7]

  Type: Reaffirmed

  Title: Fiberglass Reinforced Thermosetting Resin Pipe, Section III, Division 1

  Code Case N-155-2 was conditionally approved in Revisions 32 and 33 to RG 1.84. This Code Case was reaffirmed by the ASME. No changes have been made to the conditions in proposed Revision 34 to the guide.

- Code Case N-249-14 [S10/12]]

  Type: Reaffirmed

  Title: Additional Materials for Subsection NF, Class 1, 2, 3, and MC Component Supports Fabricated Without Welding, Section III, Division 1

  Code Case N-249-14 was conditionally approved in Revision 33 to RG 1.84. This Code Case was reaffirmed by the ASME. No changes have been made to the conditions in proposed Revision 34 to the guide.

4.6 <u>Section XI</u>

- Code Case N-504-2 [S8/9]

  Type: Reaffirmed

Title: Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1

Section XI, Nonmandatory Appendix Q, “Weld Overlay Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Weldments,” addresses the repair of Class 1, 2, and 3 austenitic stainless steel pipe weldments that have experienced stress corrosion cracking through the deposition of weld overlay reinforcements on the outside of the pipe, and provides examination requirements for such overlays. Comments provided by NRC staff representatives to the ASME Code were incorporated into Nonmandatory Appendix Q, and the NRC committee representatives ultimately approved this appendix. Code Case N-504 has a similar scope to that of nonmandatory Appendix Q, i.e., reducing a flaw to an acceptable size by increasing the pipe wall thickness through the deposition of a weld overlay on the outside of the pipe. Nonmandatory Appendix Q specifies the NDE methods and acceptance criteria to be used when making such weld overlays. Additionally, requirements have been specified for the extent and frequency of ISI, and for sample expansion. These requirements have been adopted in Code Case –504-3 (to be considered in the next RG revision). Thus, the same requirements should be used for the use of Code Case N-504-2. Thus, Code Case N-504-2 has been conditioned to require that the provisions in the nonmandatory appendix also be met. The appendix is available on the ASME web site at http://cstools.asme.org/csconnect/CommitteePages.cfm?Committee=O10000000.

- Code Case N-517-1 [S1]

  Type: Reaffirmed

  Title: Quality Assurance Program Requirements for Owners, Section XI, Division 1

Code Case N-517-1 was conditionally approved in Revisions 13 and 14 to RG 1.147. This Code Case was reaffirmed by the ASME. No changes to the conditions have been made in proposed Revision 15 to the guide.

- Code Case N-532-3 [S12]

  Type: Revised

  Title: Alternative Requirements to Repair and Replacement Documentation Requirements and Inservice Summary Report Preparation and Submission as Required by IWA-4000 and IWA-6000, Section XI, Division 1

  Code Case N-532-1 was conditionally approved in Revisions 13 and 14 of Regulatory Guide 1.147. Revision 2 of the Code Case was not approved for use, however, because of a publishing error and the need for a clarification. Revision 3 of the Code Case corrects the error. The publishing error was that the Code Case referenced new ASME Code Paragraph IWA-6350 which was not yet in print when the Code Case was published. The clarification reconciled Footnote 1 and Table 4 of the Code Case regarding the applicable edition and addenda. The revisions are acceptable to the NRC staff.

  The NRC's concern with N-532-1 regarding the timeliness of submittal of inspection findings to the regulatory authority is applicable to subsequent revisions of the Code Case and is being considered by the ASME. The ASME Code requires that inspection findings be submitted to the regulatory authority within 90 calendar days of the completion of each refueling outage. The Code Case relaxes this requirement, potentially up to 3 years. The Code Case time frame for submittal should be the same as that for the ASME Code, especially since the burden associated with generating the report would be much less under the Code Case. The NRC supports the reduction in

report size but cannot support the time frame relaxation. Thus, the condition for N-532-1 in Revisions 13 and 14 of the guide is retained for N-532-3 in proposed Revision 15.

- Code Case N-554-3 [S8/9]

  Type: Revised

  Title: Alternative Requirements for Reconciliation of Replacement Items and Addition of New Systems, Section XI, Division 1

  Code Case N-554-2 was conditionally approved in Revisions 13 and 14 to RG 1.147. The NRC staff was concerned that the Code Case would permit licensees to purchase material for use in safety-related applications that did not meet the requirements of Appendix B to 10 CFR Part 50. The NRC staff had similar concerns with the provisions of Section XI, Paragraph IWA-4200. The ASME made changes to IWA-4200 that the NRC staff initially determined to be acceptable. The ASME then modified Code Case N-554-2 (resulting in Revision 3) to make it consistent with IWA-4200 in the belief that this would satisfy the NRC's concerns. During the NRC staff review of the revised Code Case (N-554-3) relative to the NRC's previous concerns, questions were raised whether the new language of IWA-4200 and hence N-554-3, adequately addressed the NRC's concerns. The NRC staff and the cognizant ASME committees are actively engaged to resolve the questions. Thus for this revision to the guide, N-554-3 is approved subject to the same condition as that for N-554-2.

- Code Case N-583 [S8/9]

  Type: Reaffirmed

  Title: Annual Training Alternative, Section XI, Division 1

  Code Case N-583 was conditionally approved in Revisions 13 and 14 to RG 1.147. This Code Case was reaffirmed by the ASME. No changes to the conditions have been made in proposed Revision 15 to the guide.

- Code Case N-593 [S8/9]

  Type: Reaffirmed

  Title: Alternative Examination Requirements for Steam Generator Nozzle to Vessel Welds, Section XI, Division 1

  Code Case N-593 was conditionally approved in Revisions 13 and 14 to RG 1.147. This Code Case was reaffirmed by the ASME. No changes to the conditions have been made in proposed Revision 15 to the guide.

- Code Case N-597-2 [S11]

  Type: Revised

  Title: Requirements for Analytical Evaluation of Pipe Wall Thinning, Section XI, Division 1

  Code Case N-597-1 was conditionally approved in Revision 13 to RG 1.147. Users of the Code Case discovered several errors in the formulas. It was determined that the errors resulted from formatting/publishing difficulties. Revision 2 to the Code Case corrects these publishing errors, but the cognizant ASME working group is still considering the NRC's concerns that resulted in the conditional acceptance of N-597-1.

  These concerns are: (1) the Electric Power Research Institute (EPRI) developed Report 202L-R2, April 1999, "Recommendations for an Effective Flow Accelerated Corrosion Program," for developing the inspection requirements, the method of predicting the rate of wall thickness loss, and the value of the predicted remaining wall thickness. The Code Case which should contain such guidance/requirements does not; (2) the Code Case is not clear relative to the allowable minimum wall thickness; (3) the Code Case lacks adequate evaluation criteria for Class 1 piping that does not meet the ASME Code; and (4) the Code Case lacks adequate criteria addressing the rate of wall thickness loss to be used to determine a suitable inspection frequency when immediate repair or replacement

is not required so that repair or replacement occurs prior to reaching allowable minimum wall thickness, t_{min}.

The cognizant ASME working group is still considering these concerns. Hence, no changes have been made to the particular Code Case provisions in question in Code Case N-597-2. Thus, the conditions will be retained in proposed Revision 15.

- Code Case N-638-1 [S8/9]

  Type: Revised

  Title: Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1

- Code Case N-647 [S11]

  Type: Reaffirmed

  Title: Alternative to Augmented Examination Requirements of IWE-2500, Section XI, Division 1

  Code Case N-647 was conditionally approved in Revisions 13 and 14 to RG 1.147. This Code Case was reaffirmed by the ASME. No changes to the conditions have been made in proposed Revision 15 to the guide.

- Code Case N-648-1 [S1]

  Type: Reaffirmed

  Title: Alternative Requirements for Inner Radius Examination of Class 1 Reactor Vessel Nozzles, Section XI Division 1

- Code Case N-659 [S7]

  Type: New

  Title: Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination, Section III, Division 1

The Code Case requires demonstration of the ultrasonic examination procedure on a qualification block or specimen. For piping, if material of the same product form and specification is not available, the Code Case permits the use of a calibration block of similar chemical analysis, tensile properties, and metallurgical structure. Additional guidance is not provided, however, to fully define “similar chemical analysis.” This raises a concern that the calibration block material may not be truly representative of the material to be ultrasonically examined; the calibration block material could be easier to examine. Hence, two conditions would be added to ensure that the calibration block material is within the range of chemical composition of the component and has similar insonification and examination characteristics to the component to be examined. These conditions are being added to ensure that the procedure qualification is adequately demonstrated.

- Code Case N-694-1 [S1]

  Type: Revised

  Title: Evaluation Procedure and Acceptance Criteria for PWR Reactor Vessel Upper Head Penetration, Section XI, Division 1

  Code Case N-694-1 provides acceptance criteria and fracture evaluation methods (crack-growth rate calculations) to disposition flaws in PWR reactor pressure vessel Alloy 600 control rod drive mechanism (CRDM) nozzles and bottom mounted instrumentation penetrations (BMIs). Because of the safety significance of cracking in these penetrations, the NRC had an independent review of the Code Case performed. The review, which was performed by Engineering Mechanics Corporation of Columbus (Emc^2), and documented in its report dated April 30, 2004, "Predicting Axial Crack Growth in Control Rod Drive Mechanism Tubes," [ML060060548], determined that the crack-growth rates calculations specified in the Code Case were not conservative

enough and underpredict crack growth. The report states that, "Credible crack-growth predictions rely highly on an accurate determination of the crack-driving force." To develop the data needed for its review of the Code Case, Emc^2 performed parametric finite element studies on axial cracks in CRDM J-groove weld residual stress fields and determined that under certain applications, published K-solutions, used in Code Case N-694-1, would under predict crack growth, so much so, that cracks could grow through-wall prior to the performance of the next inspection.

The cognizant ASME working group is currently reviewing the report. On the basis of the report, the NRC proposes to condition Code Case N-694-1 to require more accurate crack-growth rate calculations to ensure that the frequency of examination is appropriate for these penetrations.

Availability of Documents

The NRC is making the documents identified below available to interested persons through one or more of the following means:

The NRC Public Document Room (PDR) is located at 11555 Rockville Pike, Public File Area O-1 F21, Rockville, Maryland.

The NRC's interactive rulemaking Web site is located at http://ruleforum.llnl.gov. Selected documents may be viewed and downloaded electronically via this Web site.

The NRC's Public Electronic Reading Room is located at www.nrc.gov/reading-rm.html.

Document	PDR	Web	e-Reading Room
Proposed Regulatory Guide 1.84, Rev. 34 (DG-1133)	**x**	**x**	ML061210377
Proposed Regulatory Guide 1.147, Rev. 15 (DG-1134)	**x**	**x**	ML061210404

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Dated at Rockville, Maryland, this 30th day of June, 2006.

For the U.S. Nuclear Regulatory Commission.

/RA

Brian W. Sheron, Director
Office of Nuclear Regulatory Research