ASME Reviewer Comments Form

Document: ASME Code Section III, Division3 through July 2009 Addenda)			Reviewer: Staff Member A	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB-1132.2	Jurisdictional boundary descriptions, (a) thru (g), are hard to follow. Suggest to include sketches or pointers to Figures NB-1132.2-1 thru -3 to provide visual clarity	Yes	Response: Section III will consider the addition of sketches in Subsections WB/WC, similar to WD-1000. Addition of sketches would enable ASME to note features that are specific to Division 3 (e.g., flat head with closure weld).	
WB-3112.4	Sub-subparagraph WB-3112.4(b) is redundant and should be removed or rewritten, given that the pointers, WB-3220 and WB-3230, identified in WB-3114, "Stress Limits," would direct the user to appropriate Code text.	Yes	Response: Section III will consider the deletion of WB-3112.4(b) and delete the existing designator (a) only and make (1) and (2) a new (a) and (b).	
WB-3221.3 WB-3222.5 WB-3222.8	Out of sequence, where are they?	Yes	Response: The number sequencing results from efforts to maintain consistency with existing Division 1 numbering. No change.	
Table WB-3217-1	How would the Note No. 4 provision of Subparagraph WB-3222.7, "Expansion Stress Intensity," apply to the puncture related local membrane and local bending stress evaluation? What are the bases for the design stress intensity values?	Yes	Response: In Table WB-3217-1, Note 4 refers to the special stress limits of WB-3227, not WB-3222.7. However, WB-3222.7 was deleted from the 2015 Edition. No change.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB-6120	This subsubarticle is out of synch with the current U.S. design standard for meeting the 10 CFR Part 71 requirements in that (1) A transportable dual-purpose canister is now considered an "enclosure vessel," which is not required by regulation to have pressure-retaining function, and (2) The same enclosure vessel is designed for confinement (containment) function with redundant sealing, thus, also there is a need for leakage test for the "inner" or redundant closure sealing, of storage cask systems to which Subsection WC provisions may apply. Suggest to review subsubarticle WC-6120 and to rewrite both to harmonize test protocols for the intended use and function.	Yes	Response: This paragraph was revised for the 2013 Edition. Also note that Division 3 does not require containments to be pressure-retaining. Division 3 does require appropriate loading to be considered. However, Section III will consider revisions to WB/WC-6000 to achieve more clarification and consistency where appropriate. See comment below.	
WB-6222(a)	The subsubparagraph, as written, is misleading in that (1) It exceeds a similar NB-6221(a) provision, which prescribes to test the containment not less than 1.25, in lieu of 1.50, times the lowest Design Pressure, and (2) The multiplier 1.5 appears to be associated with the U.S. 10 CFR Part 71.85(b) provision for which the containment system, for first time use, is required to be tested at a pressure equal or greater than 1.5 times the maximum normal operating pressure (MNOP). This subsubparagraph should be rewritten, recognizing that the MNOP could be substantially less than the Design Pressure, and, therefore, the hydrostatic test pressure specified as 1.25 times the Design Pressure should be sufficient to serve the purpose of demonstrating structural integrity of the containment system.	Yes	Response: For clarification, this comment actually refers to WB-6221(a), not WB-6222(a). Section III will consider appropriate revisions to WB/WC-6000. There is a future effort planned to generate a new nonmandatory appendix addressing Division 3 Design Specification development that might help clarify these issues.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB-6321	Revise the "1.5 times" test pressure requirement of the first sentence to read, "The containment shall be pneumatically tested at no less than 1.25 times Design Pressure." See also comments on WB-6222(a) above.	Yes	Response: See previous response above.	
WB-6700	The entire subarticle, WB-6700, "Leak Testing," should be removed or rewritten for clarity. The helium leak test, as a unique type of operability testing, needs not be addressed here. ANSI N14.5, as referenced, should be the standard to which a Design Specification can refer directly.	Yes	Response: WB-6710 was revised for clarity in the 2010 Edition. However, Section III will consider additional revisions to WB/WC-6000 to achieve more clarification and consistency where appropriate.	
WC-2130 WB-2130	Both subsubarticles address same concerns. It's unclear why different NCA paragraphs and/or subsubarticles are cited	No	Response: Section III will consider revisions to WC-2130 to read identical to WB-2130.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-3112.4	This subparagraph should be revised to use precise stress allowable terminologies as recognized also by other companion Subsections for intended use. Specifically, (1) The subparagraph title should be revised to be identical to that of NC-3112.4 to read, "Design Allowable Stress Values," in that Design Stress Intensity Values and Maximum Allowable Stress Values are considered in the respective subsubparagraphs WC-3112.4(a) and WC-3112.4(b) and (2) All "**allowable** stress intensity values" citations should be revised to read "**design** stress intensity values" to be consistent with the Section II, Part D, Tables 2A, 2B, and 4 terminologies. The above clarifications are imperative in opting for a design-by-analysis evaluation approach based on design stress intensity values	Yes	Response: WC-3112.4 was revised for clarity in the 2010 Edition and that revision is believed to address this concern. "Allowable stress intensity" is an acceptable term to use when used appropriately (e.g., when referring to stress limits for Level D event, this would include the multiplier for Level D). However, the header title still contains the word "Allowable". Therefore, will consider the following potential changes: 1. Delete "Allowable" from WC-3112.4 header. 2. Search Division 3 for certain phrases like: a. Good: "allowable value of stress intensity" is clear. b. Bad: "allowable stress intensity", especially when referring to Tables 2A & 2B. c. Also look in Section III Appendices.	
WC-3211.1	In subsubparagraph WC-3211.1(c), revise "impulsive loads" to read "impact loads." In WC-3211.1(d), revise "WC-3350" to read "WCA-3350."	Yes	Response: Section III will consider changing "impulsive" to "impact" throughout Division 3. WC-3350 should be WA-3350, and was previously corrected in the 2010 Edition.	

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ASME Reviewer Comments Form

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-6700	He leakage test must be mandatory for all containment/confinement boundaries, NOT optional, as presently worded in WB and WC. Continued use (or not) of pneumatic or hydro test should be considered as a separate issue and not connected to or contingent upon He leakage test. IF a pneumatic or hydro test is required, it should be substantially improved by requiring much higher pressures that generate stresses that approach yield in the structure. Such a "proof test" (for lack of better term, and to differentiate from the "systems leakage test" aspect of the presently used pressure tests) would be far more appropriate in demonstrating the structural capability of the canister, given transportation hypothetical accident conditions. If this concept is adopted, a pneumatic test must be prohibited for safety reasons. Application of this proof test after canister loading needs to be explored for possible adverse effects on the payload. Such proof testing would be applied twice. Shop proof testing of the canister shell, using a temporary lid would be required regardless. A second proof test after loading and lid welding should be considered after evaluating possible deleterious effects on the fuel.	Y	Response: Section III will consider revisions to both WB/WC-6000 addressing comment as appropriate. NRC has indicated a willingness to clarify and expand further on potential "proof testing" needs to support future rule changes. Also see responses to Staff Member A comments. Note that there is nothing that prevents the user to combine a pneumatic and leak test by using helium as the pressurization gas. If the pneumatic pressure is low such that (a) would apply, then the pressure testing requirements would be easy to achieve. Pressure testing insights could be discussed in a planned nonmandatory appendix addressing the development of Division 3 Design Specifications.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-6700	He leakage test should be mandatory, in addition to, not in lieu of hydro. If a "proof test" type hydro is NOT adopted, I could support using the He leakage test alone as I feel that a conventional hydro is meaningless. Furthermore, based upon comments from the field practitioners, execution of a hydro test before a He leakage test may only serve to hide very small leaks because of temporary leakage path blockage by residual adsorbed water molecules, leading to a false negative He leakage test result. This is NON-conservative.	Y	Response: Section III will consider revisions to WB/WC-6000 as appropriate, including test sequencing to not have masking of results by residual water from hydrostatic testing. Also, see comments in response above.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-6700	There is controversy regarding the necessity of performing the He leakage test over the entire boundary or just the welds. The ANSI B14.5 committee has taken the position that the entire boundary must be tested. This is conservative, but possibly unnecessary and burdensome, depending on the test procedure (e.g. enclosing entire vessel in test chamber versus using a vacuum box type device). The materials engineers do not support the need to test the entire boundary when rolled plate is the base material. The fear, on the part of the materials engineers, is that the consensus national standard is being incorrectly "informed" based on unverified reports about He leakage occurring in various types of pressure vessels/pipe systems. Some of the anecdotal evidence which is used by the N14.5 committee as the justification for comprehensive testing evidently involved CAST material, which WOULD be very likely to have He leakage paths. Converse to this "evidence," materials engineers view wrought (e.g. forged or rolled) material as being immune to this problem. However, the committee does not differentiate between material production methods (cast versus wrought) and concludes that any base material may be susceptible to leakage. When asked, the N14.5 committee cannot produce any supporting failure analysis reports which provide a root cause determination. (continued below)	Y	Response: Section III will consider revisions to WB/WC-6000 as appropriate, including considerations as to what we should or should not address when Division 3 references ANSI N14.5, especially if future revisions of N14.5 make unanticipated changes. Also, see comments in both responses above.	

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	(continued) Hence the materials and conditions which experienced the He leakage are subject to speculation or misinformation. What is missing then is guidance regarding what types of base materials need/do not need He leakage testing. The ASME could choose to include a basis for performing/not performing a full leakage test, provided suitable materials guidance is included.			
General	Rules need to be developed to require DYNAMIC fracture mechanics design/evaluation of the Part 71 containment boundary and gamma shield overpack, (when involving ferritic steels). Of course anything fabricated from stainless is exempt. We need to decide if dynamic fracture toughness should be extended to Part WC (storage) confinement boundaries (non-stainless). It needs to be extended to the fuel basket (non-stainless) under WB/WD, at least, and also considered for WC/WD baskets. This would cover materials such as Metamic HT.	Y	Response: The goal of Section III construction (the gamma shield overpack is not in Division 3 scope) is no cracks. Cracks found after loading is an inservice issue. This is an extensive effort that is better addressed by Section XI, which is currently developing a Code Case for storage containments.	
General	Use of CMTR values for material properties must be specifically prohibited. This is a long-standing NRC/NRR position, for good reason. Stick with using Code minimums. There are too many ways to play games with CMTR values and we should not permit creative analyses which employ possibly questionable material properties.	Y	Response: Division 3 does not specify the use of CMTRs for allowable stress intensity values or material properties for typical detailed stress analyses. The new strain-based acceptance criteria introduced in the 2013 Edition refers to CMTR data only to validate the material properties obtained from Code mandated material testing. Division 3 WB/WC Articles 2000 have been written to establish clear material requirements.	

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General	The draft Code title, definitions, and text do not recognize the terminology difference between Part 71 “containment” and Part 72 “confinement.” Everything in WB and WC is called “containment.” Is this an issue?	Y	Response: No. ASME Section III, Division 3 purposely uses the term “containment” throughout for both transportation and storage systems. Containment is viewed as an enclosure that provides a higher degree of barrier assurance than that of a confinement. The Design Specification is used to specify the required leak rate, which influences and controls the design and testing of the containment.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB and WC 4600	Alternative, lower-temperature-longer-time PWHT is NOT acceptable. DELETE tables WB-4622.4(c)-1 and WC-4622.4(c)-1. This is a widely recognized (among materials engineers) mistake in the existing ASME Code. For a design which MUST survive severe shock loadings, the impaired ductility which results from the lower temperature PWHT schedule is totally unacceptable. Preheat, if used, must clearly delineated and made mandatory when employed and NEVER made optional as per WC-4611, and other places. Adopt the Mandatory Minimum Preheat table from the old ANSI B31.1, Power Piping Code. The B31.1 Code treated the materials with better consistency and respect. Again, this potentially adversely affects ductility, as per the previous PWHT comment.	Y	Response: A sound technical basis exists for performing PWHT at a lower temperature for an extended period of time – this is born out of decades of research and performance history. It is understood that the alternative temperature-time PWHT rules were incorporated to accommodate a component configuration that could not be brought to the “normal” PWHT temperature. This occurred many years ago and PWHT equipment and technology have improved considerably since then. It is believed that all steel structures and components requiring “normal” PWHT can be performed with today’s equipment and technology. Hence, Section III will consider revisions to remove the alternate PWHT rules from Subsections WB/WC. Preheating in accordance with the rules specified in WC-4611 has been successfully applied for many years. The WC-4611 approach is one where an informed engineering decision is made based on the materials being welded and the recommended Appendix D preheat values. This, coupled with WPS qualification/confirmation by test, provides confidence that the WPS-specified preheat values are appropriate for the welding application. Hence, no change will be considered.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB and WC 4600	Further comment on preheat and PWHT: If real dynamic fracture toughness (e.g. J-integral, not drop-weight) is required for (non-stainless) containment/shielding/basket materials, then a WPS/PQR, with dynamic fracture toughness measurements required of coupons, would suffice to verify a deviation from mandatory preheat/PWHT requirements. Fracture toughness testing would absolutely determine whether or not a given preheat/PWHT regimen was adequate for a given application. Such testing could thus better inform the conventionally imposed mandatory times/temperatures for preheat and PWHT. Presently, there is scant (if any) objective fracture mechanics-based data that can be related to the effect a particular pre-heat/PWHT has on the fracture toughness (not just ductility) of the material. Fracture toughness, first and foremost, is THE material parameter of concern for transportation. Everything about the welding procedure must support enhancing this property. Extending this concept to storage should be encouraged. In order to accomplish any of this, objective (numerical) data is needed. This area needs large amounts of work. Of course, pre-heat and PWHT would remain as essential variables for any WPS.		Response: The ASME BPV Code is always interested and willing to consider Code revisions based on solid technical evidence and experience. If the stated concerns can be more fully addressed by more research in the future, ASME can then more appropriately consider this issue on more depth. No change at this time.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-4265	Note the acceptable weld joint designs of sketch WC-4265-2 for closures. This MUCH better practice, but in conflict with existing designs. Although I would like to see the existing weld joint design eliminated (even prohibited), I doubt if past practice can be changed. There is real difficulty in trying to produce the proposed joint geometry because of the poor "roundness" of rolled-and-welded-plate canister shells. This is a significant fabrication difficulty. Industry will likely lobby against this.	Y	Response: Section III will consider a proposed revision to Figure WC-4265-2 where the optional cover plate was left off of the (a) sketch. However, these are indicated as only typical Category C partial penetration welds. Other closure welds, including full penetration welds, are not prohibited if the component design can accommodate such a weld.	
WB & WC	WB-5245, WC-5245, WC-5250, table WC-3262-1, and likely other places I missed, are NOT acceptable for progressive PT. This is because it simply states a "mid-layer" and is not flaw tolerance informed as per ISG15/18.	Y	Response: WB/WC-5245 address Category D welds that have very limited imposed loadings and other controls. These are not containment shell welds like Category A and Category B, which have full volumetric and surface PT examination requirements. WC-5250 and WC-3262 do address closure welds for storage canisters, which can be (but are not required to be) partial penetration welds. These requirements reflect those found in Code Case N-595. If additional requirements are believed needed, specific identified details would be helpful in order to allow the appropriate committees to consider such potential revisions.	

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WC	WC-2530/1 discusses UT of closure weld but fails to specify any kind of performance demonstration requirement, which is really mandatory for this. Is this beyond the Code?	Y	Response: WC-2530 addresses examination and repair of plate (or shell), looking for laminations in the material, not in the welds. See WC-5250 for closure weld examination requirements. However, it was noticed that the reference in WC-2531 should be to Figure WC-4265-2. This correction is being currently addressed.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB & WC 3000	There are three types of loading events: 1) Force Limited (Load Controlled) Events, 2) Energy Limited (Energy Controlled) Events, and 3) Displacement Limited (Displacement Controlled) Events. The Code should explain these three types of events and the acceptance criteria that have been established to evaluate each. The Code should state that stress-based criteria are to be used to evaluate Force Limited Events, such as internal pressure, dead load, etc. All Energy Limited Events, such as the 30 foot drop, puncture drop, non-mechanistic tip-over, aircraft impact, etc. should be evaluated using strain-based criteria.	Y	Response: Section III will consider clarifying that that there are three types of loadings events: (1) Force Limited (Load Controlled) Events, (2) Energy Limited (Energy Controlled) Events, and (3) Displacement Limited (Displacement Controlled) Events. Options include explaining these in WX-3111.2 (Loading Events) with existing WX-3111 becoming WX-3111.1 (Loading Conditions) and the title of WX-3111 becoming "Loading Conditions and Events". WX-3211.2 may be used to point to other paragraph revisions as needed.	
WB & WC 3000	The stress based criteria separates stress components at a given location into stress categories, such as primary membrane, primary bending, secondary, etc. The definitions of these stress categories were constructed for and apply to Force Limited Events (see for example WB-3213.8 and WB-3213.9). These definitions make no sense when applied to Energy Limited Events. Trying to apply stress criteria to Energy Limited events creates uncertainty among applicants and reviewers as to what stress limits apply to various locations on the containment boundary.	Y	Response: Resolution of the above comment is expected to also address this review comment, with clarification of loading types with analysis approaches.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-3217.1	WC-3217.1 states that "Secondary stresses need be evaluated only for Level A Service Limits." Secondary stresses, as currently defined in WB-3213.9 (They are not defined in WC.) would typically occur at the junction of the cylindrical shell and closure lid flange in a non-mechanistic tip-over (a Level D event) and would likely yield the highest stresses on the containment boundary. Yet the Code would eliminate these stresses from evaluation. This needs to be revised to not exclude Level D events. If stress based criteria are used to evaluate Level D events, as they would be required to for carbon steels, all locations on the containment boundary, regardless of stress category, must be evaluated.	Y	Response: Section III will consider revisions to WC-3217.1 as appropriate, including addressing this issue of concern identified. Secondary stresses must be considered as appropriate. Remember that WC-3200 points to Appendix XIII where definitions of terms do exist as well as classification of stress intensities. This concern must also be addressed in Subsection WB where there is also the hypothetical fire evaluation.	
Level D Events	All Level D Energy Limited events should employ plastic analysis methods. For stainless steel containments strain-based criteria should be used, and for ferritic steel containments the acceptance criteria of Appendix F-1340 should be used. When using F-1340 all normal stresses (membrane and bending) not classified as general primary membrane stresses should be evaluated as primary stresses in accordance with F-1341.2(b).	Y	Response: Section III will consider proposed revisions to Division 3 to address the stated issue. Resolution of this review comment is expected to be supported by the resolution of the above review comment for WB & WC-3000.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB and WC 3000	Strain -based criteria needs to be developed for ferritic steels.	Y	Response: This may be future work for the Committee. However, additional information needs to be considered such as the types of ferritic steels of interest (limiting?) or concerns over initiation of cracking at what strain levels. Division 1 is currently working on their own strain-based acceptance criteria, from which additional insights may be gained.	
General	To enhance understanding of the Code rules, more commentary needs to be added to the Code.	Y	Response: Many BPV III committee members do not want non-Code requirements inserted into the Code. However, ASME does publish other documents, such as the “Companion Guide” that offer many insights into the deeper understanding of Section III rules. In addition, a planned nonmandatory appendix that will address the preparation of Division 3 Design Specifications could be a means to insert pertinent clarifications directly into the Code.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WB-6700, Leak Test	Leak testing shall be performed on the entire containment boundary which meets the guidance of ANSI-14.5, the international consensus standard on leak testing of radioactive transportation packages, as well as the regulations 72.236(j) & (l).	Y	Response: Section III will consider revisions to WB/WC-6000 as appropriate, addressing this concern and similar concerns mentioned by Staff Member Reviewers A and B. Consistency between certain aspects in WB-6000 and WC-6000 will also be considered. Finally, revisions made in later editions than the one reviewed by the NRC also need to be factored into this comment.	
WC-6700, Leak Test	Helium leak testing is NOT a substitute for the Code required pressure test. These are two separate tests with two separate purposes. The NRC has accepted the results from a helium leak test as meeting the pressure test acceptance criteria of no leakage from the containment, for those vessels that were not shop pressure tested and whose shell and bottom are inaccessible for inspection during the field pressure test.	Y	Response: Section III will consider revisions to WB/WC-6000 as appropriate, addressing this concern and similar concerns mentioned by Staff Member Reviewers A and B. Consistency between certain aspects in WB-6000 and WC-6000 will also be considered. Finally, revisions made in later editions than the one reviewed by the NRC also need to be factored into this comment.	
WC-6700, Leak Test	No correlation should be made between design stress values and the elimination of/substitution for the Code pressure test. The Code pressure test is not performed to verify the design, but is performed to insure that fabrication was proper. A weld can be properly designed with low design stress, but if not fabricated properly, could still fail (i.e. leak) when subjected to the pressure test. Design stress values can be used to increase the pressure test value, but not to lower nor eliminate the pressure test.	Y	Response: The helium leak test is a pressure test (typically one atmosphere differential pressure) so standardized leak rate values will provide meaningful insight regarding weld acceptability. The concern was that low Design Pressure values (based on MNOP/MNIP) simply would not challenge the base material or welds in any significant fashion so why perform such testing. The NRC has indicated a willingness to clarify and expand further on potential “proof testing” needs to support future rule changes.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
WC-6700, Leak Test	Leak testing shall be performed on the entire containment boundary except for the redundant closure weld. This is needed to meet the guidance of ANSI-14.5 for fabrication leak testing, the guidance of NUREG-1536, Rev.1 and, the requirements of 10CFR72.236 (j) & (l).	Y	Response: Section III is willing to consider revisions to Subsection Articles WB/WC-6000. Please see responses to Staff Member Reviewers A and B for further details in this area.	
WA-8000	If vendors choose not to fully embrace Division 3, by not stamping and consequently not using an ANI, what other compensating effects would need to be made to Division 3? In other words, what considerations are inherent in the Code requirements that would be different if an inspection agreement is not required? Some suggestions would be to increase the hydro test pressure, reduce allowables, etc.	Y	Response: At this time, ASME BPV Code requirements do not address “compensating effects”. A Code requirement is a Code requirement. Future Code revisions may address such issues but such decisions need to be made by other higher committees.	
WC-6120	There should be no exclusion from pressure testing the closure welds of the containment boundary.	Y	Response: Section III is willing to consider revisions to Subsection Articles WB/WC-6000. Please see responses to Staff Member Reviewers A and B for further details in this area.	
WC-6000, Testing	It should be made clear that pressure testing of the containment boundary be done before the fuel is loaded. The only exception is pressure testing of the closure weld of the canister after the fuel is loaded.	Y	Response: Section III is willing to consider revisions to Subsection Articles WB/WC-6000. Please see responses to Staff Member Reviewers A and B for further details in this area.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
Foreword, 2nd Paragraph	Change the Committee's function to include structural integrity of containments for transportation and storage of spent fuel and high-level radioactive materials and waste.	Y	Response: Efforts are currently underway to revise the Foreword for the 2019 Edition.	
Foreword, 2nd Paragraph	Change the following: In formulating the rule, The Committee considers the needs of the users,.... and inspectors of the pressure vessels and the containments for transportation and storage of spent fuel and high-level radioactive materials and waste.	Y	Response: Efforts are currently underway to revise the Foreword for the 2019 Edition.	
Foreword, 6th Paragraph	Change the Boiler and Pressure Vessel Committee deals with the design, fabrication, maintenance and inspection of boilers, pressure vessels and containments for transportation and storage of spent fuel and high-level radioactive materials and waste.	Y	Response: This paragraph no longer exists in the "Foreword".	
Subsection WA, General Requirements, Scope of Division 3, WA-1200 General Requirements	After WA-1223 add - "Equivalent Materials may be used provided they meet or exceed the form, fit and function of the original specified materials".	Y	Response: Division 3 wording to remain as is since WA-1223 addresses both AWS and ASME specifications and being "identical" is required.	
Article WA-3000, Responsibilities and Duties, WA-3130	Change title from "Welding and Subcontracting of Welding" to Subcontracting of Welding and remove WA-3131" Welding under Construction"	Y	Response: Based on a clarification comment (wanting WA-3111 revised to add NRC licensees and certificate holders) received from the NRC, Division 3 has only 3 entities responsible for Code activities (N3 Certificate Holder, NPT Certificate Holder, and the Owner) and hence no change is proposed.	

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
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Article WA-3000, Responsibilities and Duties, WA-3130	Add Paragraph "WA -3132, Subcontracting of Nondestructive Testing Services".	Y	Response: The 2017 Edition of Division 3 has added a new WA-3124 titled "Subcontracted Testing Services".	
Article WA-4000,Quality Assurance, WA-4100 Scope and Applicability	Add a paragraph (c) "As minimum containments for storage of spent fuel and high level radioactive materials and waste shall have quality assurance program .that meets the requirements of 10CFR Part 72 Subpart G".	Y	Response: It is believed that NQA-1 via WA-4000 satisfies this need. In addition, due to international needs, references to specific single country regulatory requirements are being deleted from the ASME BPV Code.	
Article WA-4000,Quality Assurance, WA-4100 Scope and Applicability	Add a paragraph (d) "As minimum containments for transportation of spent fuel and high level radioactive materials and waste shall have quality assurance program .that meets the requirements of 10CFR Part 72 Subpart G".	Y	Response: It is believed that NQA-1 via WA-4000 satisfies this need. In addition, due to international needs, references to specific single country regulatory requirements are being deleted from the ASME BPV Code.	
2007 Section III-Division 3	Delete – "WB-5273,WB-5274, And WB-5275.	Y	Response: Based on input from industry representatives, Division 3 has already deleted three paragraphs (WB-5274, -5275, -5276) in the 2008 Addenda but not WB-5273 – "Hard Surfacing".	
2007 Section III-Division 3	**WB-5279 Special Exceptions- Add – "**When the large, multi-pass weld* joining the canister shell to the structural lid of an austenitic stainless steel spent fuel canister is executed and examined consistent with the guidance provided in ISG-15 (Ref. 3), the staff has reasonable assurance that no flaws of significant size will exist such that they could impair the structural strength or confinement capability of this weld. For a spent nuclear fuel	Y	Response: Keeping in mind the identified scope for Division 3, the specific mention of "multi-pass weld …. to the structural lid" and "closure weld" is believed to refer to the closure welds on storage containments whereas this WB-5279 addresses requirements for transportation containments. Hence, no change is anticipated.	

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	canister, such a flaw would be the result of improper fabrication or welding technique, as service-induced flaws under normal and off-normal conditions of storage are not credible. Any such fabrication flaws would be reasonably detectable during the in-process and post-weld examination techniques described by ISG-15. Based on flaw size evaluation, the described techniques of ISG-15 should detect any such flaw which could lead to a failure or credible leakage of radioactive material. Therefore, the staff believes that there is reasonable assurance that no credible leakage of radioactive material would occur through the structural lid to canister shell weld of an austenitic stainless steel canister, and that helium leakage testing of this specific multi-pass weld is unnecessary provided the weld is executed and examined in accordance with ISG-15. Conversely, it is the staff position that other welds associated with the lid assemblies of spent fuel canisters must be subject to the helium leakage test of ANSI N14.5, in addition to the ASME Code Section III (Ref. 4) required pressure test and surface NDE which would demonstrate compliance with 10 CFR 72.236. This revision to ISG-18 expands the guidance to address all welds associated with the redundant closures of a spent fuel canister and describes how each individual closure weld must be considered from the overall design and testing standpoint. Revision 1 adds discussion and staff review guidance for the: 1. Helium leakage test for closure welds. 2. Design and examination criteria to be met before			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
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	any closure weld may be exempted from the helium leakage test. 3. Criteria for helium leakage testing of any closure weld which may be pressurized during the welding process. 4. ASME Code, Section III, hydrostatic test requirement. 5. ASME Code Case N-595. 6. Criteria for limiting root pass thickness. **Technical Review Guidance:** General Guidance The staff should verify that the cask design under review is in compliance with the guidance of this document. 1. This guidance only applies to canisters of all-welded construction, fabricated from austenitic stainless steel, employing redundant welds for the confinement closure.] 2. The welded canister (i.e., the confinement boundary) must be helium leakage tested in accordance with ANSI N14.5 and ISG-15, except as specified by this guidance. 3. Closure welds must conform with the guidance of ISG-15, and/or the guidance of this instruction, as appropriate. 4. “Structures, systems, and components important to safety must be designed… to withstand postulated accidents.” [10 CFR 72.122(b)]. 5. Records documenting the lid welds shall comply with the provisions of 10 CFR Part 72.174, “Quality Assurance Records,” and ISG-15. Records storage should comply with ANSI N45.2.9, “Requirements for Collection, Storage, and Maintenance of Quality			

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	Assurance Records for Nuclear Power Plants" (Ref. 5). 6. Activities related to inspection, evaluation, documentation of fabrication, and lid welding shall be performed in accordance with an NRC-approved quality assurance program as required in 10 CFR Part 72, Subpart G, "Quality Assurance." Specific Guidance The use of helium leakage testing for dry cask storage was established to provide assurance that: 1. No leakage occurred after the closure welds of the cask system were executed. This was viewed as necessary since no active or passive methods are employed to confirm or monitor the presence of helium within an all-welded spent fuel canister over its licensed lifetime. "No leakage" in this case means measured leakage rate performed per ANSI N14.5, at a predetermined sensitivity that shows hypothetical doses would not exceed 10 CFR Part 72 limits. 2. If the weld(s) meets the criteria of ANSI N14.5, the staff has assurance that radio-nuclide leakage would not exceed the regulatory dose limits in 10 CFR Parts 72.104 and 72.106. 3. No oxygen in-leakage could occur, assuring the presence of the inert helium atmosphere which prevents oxidation and corrosion induced degradation of the spent fuel assemblies and enhances cooling of the spent fuel. Helium Leakage Test - Large Weld Exception Criteria In order for any closure weld to be exempt from the helium leakage testing to demonstrate compliance with 10 CFR 72.236, the staff should verify that all of the following conditions are satisfied: 1. The weld must be multi-pass, with a minimum weld			

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	depth comprised of at least 3 distinct weld layers. 2. Each layer of weld may be composed of one or more adjacent weld beads. 3. The layer must be complete across the width of the weld joint. 4. If only three weld layers comprise the full thickness of the weld, each layer must be PT examined. 5. For more than three weld layers, not all weld layers need to be PT examined. The maximum weld deposit depth allowed before a PT examination is necessary is based upon flaw-tolerance calculations in accordance with ISG-15. Note: This criteria does not supersede the flaw acceptance criteria of any construction code. Instead, this criteria is used to establish the maximum allowable weld deposit depth before an in-process PT examination is necessary. 6. Regardless of conditions (4) or (5) above, at least three different weld layers must be examined, e.g., the root pass, a mid-layer, and the cover pass. 7. The weld cannot have been executed under conditions where the root pass might have been subjected to pressurization from the helium fill in the canister itself. When executing vent and drain connection cover plate welds, it should not be assumed that the fill and drain closure valves, quick-disconnects, or similar, are leak tight. It is assumed that mechanical closure devices (e.g. a valve or quick-disconnect) permit helium leaks. Field experience has shown that such leaks occur and have been responsible for causing leak paths through the weld. Consequently, welds potentially subjected to helium pressure (by way of leakage through a mechanical closure device) during the welding process must be			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	subsequently helium leakage tested. Helium Leakage-Testing of the Confinement Boundary The redundant weld requirement for the confinement system closure creates two closure boundaries. The staff should verify that at least one of the redundant boundaries is helium leakage tested, or, some closure welds leakage tested and the remaining closure welds of the same boundary designed so that the “large weld” exemption criteria of the preceding section are met. Only a boundary which is testable or meets the large weld exemption criteria, per this guidance, should be considered the confinement boundary of the redundant closures. Refer to sketches A and B and the following narrative for application of this criteria to two currently approved designs. Leakage Testing a Single Lid With Cover Plate Design - Sketch A In sketch A, the dotted line marked (1) defines one closure boundary. Starting on the left side of the sketch, the closure boundary can be traced from the canister wall, up through the large, multi-pass weld joining the canister wall to the heavy section, combined shield and structural lid. The boundary continues through the lid to the small weld joining the heavy lid to the vent-and drain port cover plate, and back to the heavy lid. The remainder of this boundary (and sketch) is assumed to be symmetrical with or similar to the half-sketch portion that is shown, for all cases. The large, canister-shell-to-lid weld is exempted from the helium leakage test. This is because the canister-shell-to-lid weld is a large, multi-pass weld meeting the flaw tolerance and other guidance of ISG-15 and the appropriate portions of this guidance. Note that this			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	weld is executed prior to filling the canister with helium (use of purge or backing gas for welding operations is not considered filling or pressurizing). Before the remaining welds of this first closure boundary are executed, the canister is drained, dried, purged, and filled with helium to the design operating pressure. The helium line connection is closed off and the vent and drain port cover plates fitted and welded into place. Since the vent-and-drain port cover plate weld may have potentially been pressurized from underneath due to assumed leakage from the closure valve, it must be helium leakage tested in accordance with the methods described in ANSI N14.5. If there are other cover plates and welds, they shall also be helium leakage tested. This first closure boundary maintains confinement integrity because one weld meets the large weld exemption criteria and the other weld was leakage tested. Thus, this first closure boundary meets the staff guidance by ensuring at least one of the two redundant closure boundaries is leakage tested or conforms to the large weld exemption criteria. The second boundary, delineated by the dotted line 2 in Sketch A, can be traced from the canister wall on the left side of the sketch up through the cover plate fillet weld joining the canister wall to the structural lid cover plate. The boundary continues through the cover plate to the fillet weld joining the cover plate to the canister lid. The weld joining the cover plate to the canister wall and lid cannot be helium leakage tested since there is no feasible means to do so. Since this second boundary does not meet all the criteria for a confinement boundary, it may not be designated as the confinement boundary. The first			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	closure boundary is thereby designated the confinement boundary in this design, as it meets all the applicable criteria for a confinement boundary. Leakage Testing a Dual Lid Design - Sketch B In sketch B, the dotted line marked (1) defines one of the redundant closure boundaries. It may be traced from the canister wall on the left side of the sketch. The boundary proceeds through the weld joining the canister wall to the shield lid, then through the shield lid. It continues through the small weld joining the vent-and-drain port cover plate back to the shield lid again. This closure boundary may satisfy the leakage test guidance by several methods, depending on the details of the weld design. The canister shell to shield lid weld may be designed several ways. The weld may be a small seal weld which would necessitate subsequent helium leakage testing. Conversely, it could be a large, multi-pass weld consistent with the guidance of ISG-15. In that case, the weld would qualify for the leakage test exemption. Either way, note that this weld (canister to shield lid weld) is executed prior to filling and pressurizing the canister with helium (use of purge or backing gas for welding operations is not considered filling or pressurizing). Next, the canister is drained, dried, purged, and filled with helium to the design operating pressure. The helium line connection is closed off. The vent-and-drain port cover plates are fitted and welded into place. Since the vent-and-drain port cover plate weld may have potentially been pressurized from underneath due to assumed leakage through the closure valve, it must be helium leakage tested with the methods described in ANSI N14.5. The vent and-drain-port			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
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	cover plate welds may be tested either individually or in combination with the helium leakage test of another weld. This first closure boundary maintains confinement integrity because one weld was either tested, or, meets the large weld exemption criteria. The other weld was leakage tested. Thus, this closure boundary demonstrates compliance with regulatory requirements and is consistent with staff guidance by ensuring at least one of the two redundant closures is leakage tested or exempted by conformance to the exemption guidance of ISG-15. This cover may therefore be designated as the confinement boundary. The secondary boundary, delineated by dotted line 2 in sketch B, can be traced from the canister wall on the left side of the sketch up through the canister wall-to-structural lid weld and into the structural lid. This large canister shell-to-lid weld is exempted from the helium leakage test, because the canister shell-to-lid weld is a large, multi-pass weld meeting the flaw tolerance and other guidance of ISG-15, and the appropriate portions of this guidance. For this lid design, the second closure also qualifies for designation as the confinement boundary, because it meets the large weld exemption criteria of this guidance and the guidance in ISG-15. In this case, the designer has the freedom to designate either of the redundant closures as the confinement boundary. However, only one of the two closures is credited as the confinement boundary. Hydrostatic Testing Closure welds must be hydrostatically or pneumatically tested in accordance with ASME Code Section III requirements to the extent practicable. ASME Code Case N-595-4			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
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	ASME Code Case N-595-4 (and all earlier versions) (Ref. 6) is not endorsed by the NRC staff, per Regulatory Guide (RG) 1.193 (Ref. 7), and consequently is not permitted as an alternative to the Code requirements. Criteria for Limiting Root Pass Thickness Cask lid welding is governed in part by the limiting flaw size analysis, per the guidance in ISG- 15. The method prescribed in ISG-15 controls the depth of weld deposit for the intermediate passes before the required PT examination is performed. However, the root pass thickness is not addressed by the guidance of ISG-15, as a single layer root pass was assumed. Occasionally, multi-layer root passes are employed to smooth the weld surface to avoid false positives from the PT. A multi-layer root pass is acceptable provided a flaw size analysis is used to limit the weld deposit depth. Stress analysts should note that the intermediate layer critical flaw size calculation assumes an internal flaw, not a surface connected flaw. For the root pass calculation, a surface connected flaw must be assumed. Surface connected flaws have a higher stress intensity factor than internal flaws. This will result in a smaller critical flaw size. Consequently, the permissible weld deposit thickness will also be smaller than for the intermediate weld pass case. The staff should verify that if the licensee desires to use a thicker root pass, they must limit the amount of weld deposit to the ratio of the fracture toughness K values (or, J values) for the different flaw types (buried K divided by surface K) multiplied by the maximum weld deposit depth allowed by the ISG-15 calculation			

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	method. This will limit the depth of the root pass to the critical flaw size for a surface connected flaw. Thus, if a licensee desires to use a thicker weld deposit for the root pass, then a limiting flaw size analysis establishes a structural basis that is consistent with the intent of ISG-15. Alternative approaches may be proposed. Any alternative approach must consider the flaw tolerance of the weld and limit weld deposit depth to less than the critical flaw depth so that a PT may be performed before proceeding with additional weld deposit depth. The staff recognizes that for stainless steel, K, or even J, is not entirely correct for evaluating failure in austenitic stainless steel due to the large capacity for plastic deformation. Generally, the result is failure due to net section stress, not fracture. However, the stress intensity ratio suggested above is acceptable for this purpose. **Regulatory Basis:** The systems, structures, and components (SSCs) important to safety must be designed, fabricated, erected, and tested to quality standards commensurate with the importance to safety of the function to be performed [10 CFR 72.122(a)]. The high-level radioactive waste.....must be packaged.....without the release of radioactive materials to the environment or radiation exposures in excess of [10 CFR] part 20 limits. The package must be designed to confine the high-level radioactive waste for the duration of the license [10 CFR 72.122(h)(5)]. Radiation shielding and confinement features must be provided sufficient to meet the requirements in parts 72.104 and 72.106 [10 CFR 72.236(d)]. The spent fuel storage cask must be designed to			

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	provide sealing of confinements systems [10 CFR 72.236(e)]. The spent fuel storage cask must be inspected to ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce its confinement effectiveness [10 CFR 72.236(j)]. The spent fuel storage cask and its systems important to safety must be evaluated, by appropriate tests or by other means acceptable to the NRC, to demonstrate that they will reasonably maintain confinement of radioactive material under normal, off-normal, and credible accident conditions [10 CFR 72.236(l)]. The independent spent fuel storage installation must be designed to provide conformance to Parts 72.104 and 72.106 which define criteria for radioactive material in effluents and direct radiation limits. **Applicability:** This guidance applied to dry cask storage system reviews conducted in accordance with NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems" (January 1997); and NUREG-1567, "Standard Review Plan for Spent Fuel Storage Facilities" (March 2000).			
2007 Section III-Division 3	WB-5279 – Special Exceptions – Add **"**For designs employing austenitic lid materials and welds, either volumetric or multi-pass PT inspection methods are acceptable. For either UT or PT examination, the minimum detectable flaw size must be demonstrated to be less than the critical flaw size. The critical flaw size should be calculated in accordance with ASME Section XI methodology; however, net section stress may be governing for austenitic stainless steels, and must not violate ASME		Response: Keeping in mind the identified scope for Division 3, the specific mention of "lid materials and welds" is believed to refer to the closure welds on storage containments whereas this WB-2300 addresses requirements for transportation containments (where partial penetration containment welds are not permitted). Also, PT alone is not permitted for containment welds, volumetric plus PT is the requirement. Hence, no change is anticipated.	

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	Section III requirements. Flaws in austenitic stainless steels shall not exceed the thickness of one weld bead. If using UT, the UT acceptance criteria are the same as those of NB-5332 for pre-service examination. In accordance with Code practice for supplementing volumetric examinations with a surface examination, UT examination must be performed in conjunction with a root pass and cover pass PT examination. If PT is specified in lieu of volumetric inspection, a stress reduction factor of 0.8 must be applied to the weld design.			
2007 Section III-Division 3	Delete – "WB-5360, VISUAL ACCEPTANCE FOR BRAZED JOINTS" Delete – "WB-5380, BUBBLE FROMATION TESTING"		Response: These paragraphs have already been deleted.	
2008a Section III-Division 3, Table WA7100-2 Standards and Specifications referenced in text	After SNT-TC-1A Add: ANSI/ASNT CP-189-2006, ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel	Y	Response: Section III will consider adding ANSI/ASNT CP-189 as an alternative to SNT-TC-1A.	
2009b Section III, Division 3, Article WA-9000, Glossary	WA-9000 Definitions, add: Equivalent Materials – "Materials that can be used in lieu if the original source material provided these material physical and chemical requirements meet or exceed the original source materials."	Y	Response: In light of the response to the fourth comment on page 1, this term will not be added to the glossary without further justification.	

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Nonmandatory Appendix A, A5- ASNT STANDARD	Add the ASNT CP-189 as an alternate guideline for Qualification and Certification of Nondestructive Personnel	Y	Response: The nonmandatory appendix referred to by the reviewer was added by the ASME Editors and subsequently deleted by the BPV III Committee. See related response to comment on previous page.	
2008a Section III-Division 3, WB-2300 Facture Toughness	Add a new topic to identify Fracture Toughness for Lid to Shell Weld joints using ISG-15 verbiage.	Y	Response: Keeping in mind the identified scope for Division 3, the Article WB-2000 already addresses a variety of material considerations for transportation containments, The specific mention of "lid to shell weld joints" is believed to refer to the closure welds on storage containments whereas this WB-2300 addresses requirements for transportation containments (where partial penetration containment welds are not permitted). Hence, no change is anticipated by this review comment.	
2009b Section III-Division 3	Delete – WB-2344 Tubular Products and Fittings	Y	Response: Division 3 needs to permit a variety of potential designs of components under its stated scope. Division 3 rules should not be restricted to just U.S. needs or just commercial power needs but be able to address all needs.	
2009b Section III-Division 3	Delete – "And Brazing"	Y	Response: If referring to WB-2400, the wording has already been deleted.	
2008a Section III-Division 3, Subsection WB Class TC Transportation	**IWA-2300 QUALIFICATIONS OF NONDESTRUCTIVE EXAMINATION PERSONNEL** **IWA-2310 GENERAL** *(a)* Personnel performing nondestructive examinations (NDE) shall be qualified and certified using a written practice prepared in accordance with ANSI/ASNT CP-189, Standard for Qualification and Certification of Nondestructive Testing Personnel, as amended		Response: Section III will consider adding ANSI/ASNT CP-189 as an alternative to SNT-TC-1A.	

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Containments	by the requirements of this Division. Certifications based on SNT-TC-1A, ANSI N45.2.6, or earlier editions of ANSI/ASNT CP-189 are valid until recertification is required. Recertification shall be in accordance with the edition of ANSI/ASNT CP-189 referenced in IWA-1600 as amended by the requirements of this Division. Outside agencies, as defined in Appendix VII, may be used to qualify NDE personnel; however, the Employer shall be solely responsible for the certification of Levels I, II, and III personnel. Nondestructive and visual examination personnel qualified and certified in accordance with the requirements of this Division are qualified and certified to perform examinations in accordance with the requirements of previous Editions and Addenda. *(b)* As an alternative to a personnel qualification program based on CP-189, the ASNT Central Certification Program (ACCP) may be used. The supplemental requirements of this Division shall apply to qualification of personnel in accordance with the ACCP. **IWA-2311 Written Practice** *(a)* The Employer shall prepare a written practice in accordance with ANSI/ASNT CP-189. *(b)* The written practice shall specify the duties and responsibilities of the Principal Level III. **IWA-2312 NDE Methods Listed in ANSI/ASNT CP-189** *(a)* Qualifications shall be based on the methods, techniques, procedures, and equipment used for the NDE required by this Division. *(b)* Training, qualification, and certification of ultrasonic examination personnel shall also comply with the requirements of Appendix VII. *(c)* Training, qualification, and certification of visual examination personnel shall comply with the requirements of Appendix VI. *(d)* The visual examination training and experience hours specified in ANSI/ASNT CP-189 shall be applied to the combined certification of an individual for VT-1, VT-2, and VT-3 visual examination. Certification in only one of the VT techniques is a limited certification, and the requirements of IWA-2350 apply. *(e)* Personnel certified in an NDE method, and whose training and			

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Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	experience in that method met the requirements of an edition of ASNT SNT-TC-1A or ANSI/ASNT CP-189 referenced by a previous edition or addenda of this Division, do not require additional training or experience hours when being certified or recertified to the same level by an employer, except as specified in IWA-2312(b). **IWA-2313 NDE Methods Not Listed in ANSI/ASNT CP-189** Personnel using NDE methods not addressed in ANSI/ASNT CP-189 shall be qualified as defined in ANSI/ASNT CP-189 or the ACCP and the Employer's written practice. **IWA-2314 Certification and Recertification** *(a)* Personnel shall be qualified by examination and shall be certified in accordance with ANSI/ASNT CP-189, except that the ASNT Level III certificate is not required. Level I, II, and III personnel shall be recertified by qualification examinations every 5 years. *(b)* Personnel qualified in accordance with the ACCP shall be recertified by examination every 5 years. *(c)* An ACCP certificate with current endorsements obtained by examination satisfies the General and Practical Examination requirements for Levels I and II NDE personnel. *(d)* Level I, II, and III NDE personnel may be certified or recertified without additional training or experience hours when *(1)* certification or recertification is to the same level, and *(2)* the candidate's training and experience in the NDE method met the requirements of an edition of ASNT SNT-TC-1A or ANSI/ASNT CP-189 referenced by a previous edition or addenda of this Division. **IWA-2315 Personnel Requirements for Eddy Current Examination of Steam Generator Tubing** Personnel performing analysis or evaluation of data shall be qualified by examination to perform analysis of multifrequency data and to use multiparameter signal combination techniques. The qualification shall include a practical examination that includes techniques used and the types of flaws that may be found during examination of steam generator tubing.			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	IWA-2316 Alternative Qualifications of VT-2 Visual Examination Personnel *(a)* For system leakage tests and hydrostatic tests performed in accordance with IWA-5211(a) and (b), in lieu of the requirements of IWA-2310 through IWA-2314, VT-2 visual examination personnel may be qualified by satisfying the following requirements: *(1)* at least 40 hr plant walkdown experience, such as that gained by licensed and nonlicensed operators, local leak rate personnel, system engineers, quality control personnel, and nondestructive examination personnel *(2)* at least 4 hr of training in the Section XI requirements and plant-specific procedures for VT-2 visual examination *(3)* the vision test requirements of IWA-2321 *(b)* Personnel qualified in accordance with these alternative requirements shall not perform VT-2 functions other than examinations (e.g., verifying adequacy of procedures, training VT-2 personnel). *(c)* These alternative qualification requirements shall be described in the Employer's written practice. **IWA-2317 Alternative Qualifications of VT-3 Visual Examination Personnel** *(a)* In lieu of the requirements of IWA-2310 through IWA-2314, VT-3 visual examination personnel may be qualified by satisfying the following requirements: *(1)* at least 40 hours plant experience, such as that gained by plant personnel involved in installation, maintenance, or examination of pumps, valves, and supports, quality control personnel, and nondestructive examination personnel *(2)* at least 8 hr of training in the Section XI requirements and plant-specific procedures for VT-3 visual examination *(3)* the vision test requirements of IWA-2321 *(4)* for initial qualification, and at least every 3 years thereafter, pass a written examination of at least 30 questions covering VT-3 examination attributes, VT-3 examination requirements, and plant-specific VT-3 procedures.			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	TABLE IWA-2322-1 **NEAR-DISTANCE ACUITY TEST DISTANCES AND CHARACTER HEIGHTS** **Maximum Lower Case** **Test Distance, Character Height,** **in. (mm) in. (mm)** 12 (300) 0.022 (0.56) 13 (330) 0.024 (0.61) 14 (350) 0.025 (0.64) 15 (380) 0.027 (0.69) 16 (400) 0.029 (0.74) GENERAL NOTE: The test distances (eye to chart) and corresponding character heights provide a visual angle of 6.25 minutes, which is equivalent to a Snellen fraction of 20/25. *(b)* The alternative qualification requirements shall be described in the Employer's written practice. **IWA-2320 QUALIFICATION EXAMINATIONS** **IWA-2321 Vision Tests** The following tests shall be administered annually to NDE personnel: *(a)* Personnel shall demonstrate natural or corrected near-distance acuity of 20/25 or greater Snellen fraction, with at least one eye, by reading words or identifying characters on a near-distance test chart, such as a Jaeger chart, that meets the requirements of IWA-2322. Equivalent measures of near-distance acuity may be used. In addition, personnel performing VT-2 or VT-3 visual examinations shall demonstrate natural or corrected far-distance acuity of 20/30 or greater Snellen fraction or equivalent with at least one eye. *(b)* As an alternative to the visual acuity demonstration requirements of (a), any vision test administered by an optometrist, ophthalmologist, or other healthcare professional who administers vision tests and documents compliance with the acuity requirements of (a) is acceptable. *(c)* Personnel shall demonstrate the capability to distinguish the colors applicable to the NDE methods for which certified and to differentiate contrast between these colors. **IWA-2322 Near-Distance Test Chart Qualification** A measurement of one of the near-distance test chart characters			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	shall be made once before initial use, with an optical comparator (10X or greater) or other suitable instrument, to verify that the height of a representative lower case character, without an ascender or descender (e.g., a, c, e, o), for the selected type size, meets the requirements of Table IWA-2322-1. This measurement shall be documented and traceable to the test chart. **IWA-2323 Level III Personnel** The qualifications of Level III NDE personnel shall be evaluated using written examinations and a Demonstration Examination. The written examinations shall cover the Basic, Method, Specific, and Practical areas of knowledge as defined in IWA-2323(a), (b), (c), and (d). The Demonstration Examination shall be in accordance with ANSI/ASNT CP-189, Level II Practical Examination rules. *(a)* The Basic Examination shall consist of at least 65 questions (required only once if certification is sought in more than one method). *(1)* at least twenty questions related to understanding of ANSI/ASNT CP-189 *(2)* at least thirty questions related to applicable materials, fabrication, and product technology *(3)* at least fifteen questions that are similar to published Level II questions for other NDT methods *(b)* The Method Examination shall consist of at least 65 questions. *(1)* at least thirty questions related to fundamentals and principles that are similar to published ASNT Level III questions for each method *(2)* at least fifteen questions related to application and establishment of procedures and techniques that are similar to published ASNT Level III questions for each method *(3)* at least twenty questions related to capability for interpreting codes, standards, and specifications related to the method *(c)* The Specific Examination shall contain at least 30 questions covering equipment, techniques, procedures, and administration of the Employer's written practice. The Specific Examination shall also cover the NDE requirements of this Division, including acceptance standards and referenced codes and standards.			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	(d) The Practical Examination shall be in accordance with ANSI/ASNT CP-189 requirements. *(e)* An ASNT Level III certificate with current endorsements obtained by examination for the applicable method satisfies the Basic and Method Examination requirements. *(f)* When an outside agency administers the examination and only a pass or fail grade is issued, the Employer shall assign a grade of 80% for a pass grade. *(g)* Level III personnel shall be recertified using the written Method, Specific, and Practical Examinations and the Demonstration Examination. Alternatively, Level III personnel may be recertified using only the written Method and Specific Examinations, provided the following conditions are met. *(1)* The Level III candidate was previously certified or recertified using all the written examinations and the Demonstration Examination. *(2)* The Level III candidate is not being recertified due to interrupted service as defined in the Employer's written practice. *(3)* The Level III candidate is not being certified by a new Employer. *(h)* For initial certification, the grades for the Basic, Method, Specific, Practical, and Demonstration Examinations shall be averaged to determine the overall grade. For recertification, the grades of applicable examinations administered in accordance with IWA-2323(g) shall be averaged to determine the overall grade. *(i)* An ACCP certificate with current endorsements obtained by examination satisfies the Basic, Method, Practical, and Demonstration examination requirements for Level III NDE personnel. **IWA-2330 LEVEL I RESPONSIBILITIES** Level I personnel shall use written procedures when performing specific setups, calibrations, and examinations and when recording data. These activities shall be conducted under the guidance of Level II or Level III personnel. Level I personnel shall not evaluate or accept the results of a nondestructive examination. **IWA-2340 LEVEL III EDUCATION**			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	Level III candidates shall have high school or equivalent education. **IWA-2350 LIMITED CERTIFICATION** Limited certification in a method is permitted for personnel who are restricted to performing examinations of limited scope, i.e., limited operations or limited techniques within the method. Topics that are not relevant to the limited certification may be deleted from the ANSI/ASNT CP-189, Appendix VI, or Appendix VII training outline and may be accompanied by a corresponding reduction in training hours, examination content, and number of examination questions. Only questions related to the limited training are required. In addition, the required experience may be reduced by a corresponding amount. The specific methods and techniques covered by limited certification and the training, examination, and experience requirements for limited certification shall be defined in the written practice and documented in the individual's certification records. **IWA-2360 LEVEL I AND LEVEL II TRAINING AND EXPERIENCE** *(a)* A candidate may be qualified directly to Level II with no time as a Level I provided the required training and experience consists of the sum of the hours required for Level I and Level II certification. *(b)* NDE training course outlines and materials shall be approved by a Level III. Previous training and experience may be accepted if verified by a Level III. The method of verification shall be documented in the candidate's certification records. **IWA-2370 LEVEL III EXPERIENCE** Candidates for Level III certification shall meet one of the following criteria: *(a)* Graduate of a 4-year accredited engineering or science college or university with a degree in engineering or science, plus 1 year experience in NDE in an assignment comparable to that of a Level II in the examination method. *(b)* Completion with a passing grade of at least the equivalent of 2 full years of engineering or science study at a university, college,			

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Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	or technical school, plus 2 years experience in an assignment comparable to that of a Level II in the examination method. *(c)* Four years experience in an assignment comparable to that of a Level II in the examination method. **IWA-2380 NDE INSTRUCTOR** In lieu of the requirements of CP-189, a candidate being considered for qualification as an NDE Instructor shall satisfy the Level III Basic and Method Examination requirements of IWA-2323 and shall meet one of the following requirements: *(a)* maintain a current teacher or vocational instruction certificate issued by a state, municipal, provincial, or federal authority; or *(b)* complete a minimum of 40 hr instruction in training and teaching techniques. **IWA-2400 INSPECTION PROGRAM** **IWA-2410 APPLICATION OF CODE EDITION AND ADDENDA** The Code Edition and Addenda for preservice inspection and for initial and successive inservice inspection intervals shall be as required by the regulatory authority having jurisdiction at the plant site. **IWA-2300 QUALIFICATIONS OF NONDESTRUCTIVE EXAMINATION PERSONNEL** **IWA-2310 GENERAL** *(a)* Personnel performing nondestructive examinations (NDE) shall be qualified and certified using a written practice prepared in accordance with ANSI/ASNT CP-189, Standard for Qualification and Certification of Nondestructive Testing Personnel, as amended by the requirements of this Division. Certifications based on SNT-TC-1A, ANSI N45.2.6, or earlier editions of ANSI/ASNT CP-189 are valid until recertification is required. Recertification shall be in accordance with the edition of ANSI/ASNT CP-189 referenced in IWA-1600 as amended by the requirements of this Division. Outside agencies, as defined in Appendix VII, may be used to qualify NDE personnel; however, the Employer shall be solely responsible for the certification of Levels I, II, and III personnel. Nondestructive and visual examination personnel qualified and			

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ASME Reviewer Comments Form

Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	certified in accordance with the requirements of this Division are qualified and certified to perform examinations in accordance with the requirements of previous Editions and Addenda. *(b)* As an alternative to a personnel qualification program based on CP-189, the ASNT Central Certification Program (ACCP) may be used. The supplemental requirements of this Division shall apply to qualification of personnel in accordance with the ACCP. **IWA-2311 Written Practice** *(a)* The Employer shall prepare a written practice in accordance with ANSI/ASNT CP-189. *(b)* The written practice shall specify the duties and responsibilities of the Principal Level III. **IWA-2312 NDE Methods Listed in ANSI/ASNT CP-189** *(a)* Qualifications shall be based on the methods, techniques, procedures, and equipment used for the NDE required by this Division. *(b)* Training, qualification, and certification of ultrasonic examination personnel shall also comply with the requirements of Appendix VII. *(c)* Training, qualification, and certification of visual examination personnel shall comply with the requirements of Appendix VI. *(d)* The visual examination training and experience hours specified in ANSI/ASNT CP-189 shall be applied to the combined certification of an individual for VT-1, VT-2, and VT-3 visual examination. Certification in only one of the VT techniques is a limited certification, and the requirements of IWA-2350 apply. *(e)* Personnel certified in an NDE method, and whose training and experience in that method met the requirements of an edition of ASNT SNT-TC-1A or ANSI/ASNT CP-189 referenced by a previous edition or addenda of this Division, do not require additional training or experience hours when being certified or recertified to the same level by an employer, except as specified in IWA-2312(b). **IWA-2313 NDE Methods Not Listed in ANSI/ASNT CP-189** Personnel using NDE methods not addressed in ANSI/ASNT CP-189 shall be qualified as defined in ANSI/ASNT CP-189 or the			

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Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	ACCP and the Employer's written practice. **IWA-2314 Certification and Recertification** *(a)* Personnel shall be qualified by examination and shall be certified in accordance with ANSI/ASNT CP-189, except that the ASNT Level III certificate is not required. Level I, II, and III personnel shall be recertified by qualification examinations every 5 years. *(b)* Personnel qualified in accordance with the ACCP shall be recertified by examination every 5 years. *(c)* An ACCP certificate with current endorsements obtained by examination satisfies the General and Practical Examination requirements for Levels I and II NDE personnel. *(d)* Level I, II, and III NDE personnel may be certified or recertified without additional training or experience hours when *(1)* certification or recertification is to the same level, and *(2)* the candidate's training and experience in the NDE method met the requirements of an edition of ASNT SNT-TC-1A or ANSI/ASNT CP-189 referenced by a previous edition or addenda of this Division. **IWA-2315 Personnel Requirements for Eddy Current Examination of Steam Generator Tubing** Personnel performing analysis or evaluation of data shall be qualified by examination to perform analysis of multifrequency data and to use multiparameter signal combination techniques. The qualification shall include a practical examination that includes techniques used and the types of flaws that may be found during examination of steam generator tubing. **IWA-2316 Alternative Qualifications of VT-2 Visual Examination Personnel** *(a)* For system leakage tests and hydrostatic tests performed in accordance with IWA-5211(a) and (b), in lieu of the requirements of IWA-2310 through IWA-2314, VT-2 visual examination personnel may be qualified by satisfying the following requirements: *(1)* at least 40 hr plant walkdown experience, such as that gained by licensed and nonlicensed operators, local leak rate personnel,			

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Document: Section III Division 3 through July 2009 Addenda			Reviewer: Staff Member E	
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	system engineers, quality control personnel, and nondestructive examination personnel *(2)* at least 4 hr of training in the Section XI requirements and plant-specific procedures for VT-2 visual examination *(3)* the vision test requirements of IWA-2321 *(b)* Personnel qualified in accordance with these alternative requirements shall not perform VT-2 functions other than examinations (e.g., verifying adequacy of procedures, training VT-2 personnel). *(c)* These alternative qualification requirements shall be described in the Employer's written practice. **IWA-2317 Alternative Qualifications of VT-3 Visual Examination Personnel** *(a)* In lieu of the requirements of IWA-2310 through IWA-2314, VT-3 visual examination personnel may be qualified by satisfying the following requirements: *(1)* at least 40 hours plant experience, such as that gained by plant personnel involved in installation, maintenance, or examination of pumps, valves, and supports, quality control personnel, and nondestructive examination personnel *(2)* at least 8 hr of training in the Section XI requirements and plant-specific procedures for VT-3 visual examination *(3)* the vision test requirements of IWA-2321 *(4)* for initial qualification, and at least every 3 years thereafter, pass a written examination of at least 30 questions covering VT-3 examination attributes, VT-3 examination requirements, and plant-specific VT-3 procedures. **TABLE IWA-2322-1** **NEAR-DISTANCE ACUITY TEST DISTANCES AND CHARACTER HEIGHTS** **Maximum Lower Case Test Distance, Character Height, in. (mm) in. (mm)** 12 (300) 0.022 (0.56) 13 (330) 0.024 (0.61) 14 (350) 0.025 (0.64) 15 (380) 0.027 (0.69) 16 (400) 0.029 (0.74)			

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	GENERAL NOTE: The test distances (eye to chart) and corresponding character heights provide a visual angle of 6.25 minutes, which is equivalent to a Snellen fraction of 20/25. *(b)* The alternative qualification requirements shall be described in the Employer's written practice. **IWA-2320 QUALIFICATION EXAMINATIONS** **IWA-2321 Vision Tests** The following tests shall be administered annually to NDE personnel: *(a)* Personnel shall demonstrate natural or corrected near-distance acuity of 20/25 or greater Snellen fraction, with at least one eye, by reading words or identifying characters on a near-distance test chart, such as a Jaeger chart, that meets the requirements of IWA-2322. Equivalent measures of near-distance acuity may be used. In addition, personnel performing VT-2 or VT-3 visual examinations shall demonstrate natural or corrected far-distance acuity of 20/30 or greater Snellen fraction or equivalent with at least one eye. *(b)* As an alternative to the visual acuity demonstration requirements of (a), any vision test administered by an optometrist, ophthalmologist, or other healthcare professional who administers vision tests and documents compliance with the acuity requirements of (a) is acceptable. *(c)* Personnel shall demonstrate the capability to distinguish the colors applicable to the NDE methods for which certified and to differentiate contrast between these colors. **IWA-2322 Near-Distance Test Chart Qualification** A measurement of one of the near-distance test chart characters shall be made once before initial use, with an optical comparator (10X or greater) or other suitable instrument, to verify that the height of a representative lower case character, without an ascender or descender (e.g., a, c, e, o), for the selected type size, meets the requirements of Table IWA-2322-1. This measurement shall be documented and traceable to the test chart. **IWA-2323 Level III Personnel** The qualifications of Level III NDE personnel shall be evaluated using written examinations and a Demonstration Examination. The			

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	written examinations shall cover the Basic, Method, Specific, and Practical areas of knowledge as defined in IWA-2323(a), (b), (c), and (d). The Demonstration Examination shall be in accordance with ANSI/ASNT CP-189, Level II Practical Examination rules. *(a)* The Basic Examination shall consist of at least 65 questions (required only once if certification is sought in more than one method). *(1)* at least twenty questions related to understanding of ANSI/ASNT CP-189 *(2)* at least thirty questions related to applicable materials, fabrication, and product technology *(3)* at least fifteen questions that are similar to published Level II questions for other NDT methods *(b)* The Method Examination shall consist of at least 65 questions. *(1)* at least thirty questions related to fundamentals and principles that are similar to published ASNT Level III questions for each method *(2)* at least fifteen questions related to application and establishment of procedures and techniques that are similar to published ASNT Level III questions for each method *(3)* at least twenty questions related to capability for interpreting codes, standards, and specifications related to the method *(c)* The Specific Examination shall contain at least 30 questions covering equipment, techniques, procedures, and administration of the Employer's written practice. The Specific Examination shall also cover the NDE requirements of this Division, including acceptance standards and referenced codes and standards. *(d)* The Practical Examination shall be in accordance with ANSI/ASNT CP-189 requirements. *(e)* An ASNT Level III certificate with current endorsements obtained by examination for the applicable method satisfies the Basic and Method Examination requirements. *(f)* When an outside agency administers the examination and only a pass or fail grade is issued, the Employer shall assign a grade of 80% for a pass grade. *(g)* Level III personnel shall be recertified using the written			

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	Method, Specific, and Practical Examinations and the Demonstration Examination. Alternatively, Level III personnel may be recertified using only the written Method and Specific Examinations, provided the following conditions are met. *(1)* The Level III candidate was previously certified or recertified using all the written examinations and the Demonstration Examination. *(2)* The Level III candidate is not being recertified due to interrupted service as defined in the Employer's written practice. *(3)* The Level III candidate is not being certified by a new Employer. *(h)* For initial certification, the grades for the Basic, Method, Specific, Practical, and Demonstration Examinations shall be averaged to determine the overall grade. For recertification, the grades of applicable examinations administered in accordance with IWA-2323(g) shall be averaged to determine the overall grade. *(i)* An ACCP certificate with current endorsements obtained by examination satisfies the Basic, Method, Practical, and Demonstration examination requirements for Level III NDE personnel. **IWA-2330 LEVEL I RESPONSIBILITIES** Level I personnel shall use written procedures when performing specific setups, calibrations, and examinations and when recording data. These activities shall be conducted under the guidance of Level II or Level III personnel. Level I personnel shall not evaluate or accept the results of a nondestructive examination. **IWA-2340 LEVEL III EDUCATION** Level III candidates shall have high school or equivalent education. **IWA-2350 LIMITED CERTIFICATION** Limited certification in a method is permitted for personnel who are restricted to performing examinations of limited scope, i.e., limited operations or limited techniques within the method. Topics that are not relevant to the limited certification may be deleted from the ANSI/ASNT CP-189, Appendix VI, or Appendix VII			

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ASME Reviewer Comments Form

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	training outline and may be accompanied by a corresponding reduction in training hours, examination content, and number of examination questions. Only questions related to the limited training are required. In addition, the required experience may be reduced by a corresponding amount. The specific methods and techniques covered by limited certification and the training, examination, and experience requirements for limited certification shall be defined in the written practice and documented in the individual's certification records. **IWA-2360 LEVEL I AND LEVEL II TRAINING AND EXPERIENCE** *(a)* A candidate may be qualified directly to Level II with no time as a Level I provided the required training and experience consists of the sum of the hours required for Level I and Level II certification. *(b)* NDE training course outlines and materials shall be approved by a Level III. Previous training and experience may be accepted if verified by a Level III. The method of verification shall be documented in the candidate's certification records. **IWA-2370 LEVEL III EXPERIENCE** Candidates for Level III certification shall meet one of the following criteria: *(a)* Graduate of a 4-year accredited engineering or science college or university with a degree in engineering or science, plus 1 year experience in NDE in an assignment comparable to that of a Level II in the examination method. *(b)* Completion with a passing grade of at least the equivalent of 2 full years of engineering or science study at a university, college, or technical school, plus 2 years experience in an assignment comparable to that of a Level II in the examination method. *(c)* Four years experience in an assignment comparable to that of a Level II in the examination method. **IWA-2380 NDE INSTRUCTOR** In lieu of the requirements of CP-189, a candidate being considered for qualification as an NDE Instructor shall satisfy the Level III Basic and Method Examination requirements of IWA-			

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ASME Reviewer Comments Form

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Article Section	**NRC Reviewer's Comment**	**ASME Response Required (Y/N)?**	**Comment Clarification**	**Response Accepted by NRC? (Y/N)(1)**
	2323 and shall meet one of the following requirements: *(a)* maintain a current teacher or vocational instruction certificate issued by a state, municipal, provincial, or federal authority; or *(b)* complete a minimum of 40 hr instruction in training and teaching techniques. **IWA-2400 INSPECTION PROGRAM** **IWA-2410 APPLICATION OF CODE EDITION AND ADDENDA** The Code Edition and Addenda for preservice inspection and for initial and successive inservice inspection intervals shall be as required by the regulatory authority having jurisdiction at the plant site.			
	critical flaw size: the flaw size that will cause failure under a specified load calculated using fracture mechanics. The minimum critical flaw size for normal or upset conditions (Service Level A and B) is a_c; the minimum critical initiation flaw size for emergency and faulted conditions is a_i.		Response: The goal of Division 3 construction is no cracks. Therefore, this term is not applicable to Division 3. Future Section XI efforts may address critical flaw size for inservice inspections.	

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