Meeting with NRC Code Case N-740-2

Washington, DC

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EPRI

H & A Inc.

Introduction

- **Comment 1 - In the REPLY paragraph, it is stated that all section XI references are to the 2007 edition of the ASME Code, Section XI. The NRC has not endorsed the 2007 edition in Title 10, Code of Federal Regulations, Part 50.55a. The NRC cannot approve a code case that uses an edition of the Code that the NRC has not endorsed in the regulation. The NRC suggests that the reference to the 2007 edition be removed.**
- **Response - This must be a new NRC policy. This comment has never been made before by the NRC, even though numerous ASME Section XI Cases reference later Section XI Editions and Addenda than have been endorsed by the NRC in 10CFR50.55a. The NRC has been allowing use of these Cases, along with use of later Editions and Addenda than are endorsed in 10CFR50.55a, for many years. For example, Case N-532-4 was just endorsed in R.G. 1.147 Rev. 15 with references to the 2005 Addenda of Section XI. It is standard practice for ASME to reference a later edition and addenda than endorsed by the NRC to impose additional programmatic requirements on Owners of older plants, who are using earlier, less-restrictive Editions and Addenda of Section XI. To ensure uniform implementation of the administrative provisions of Case, ASME needs to establish a common basis for such requirements. The best common basis is usually determined to be a more recent edition and addenda of Section XI than has been endorsed by the NRC in 10CFR50.55a.**

Introduction (Con't.)

- **Comment 2 - Mitigation is not defined or addressed in the ASME Code. While an attempt is made in the General Requirements Section, mitigations should be defined when it is first used (in the reply). Ideally, however, this definition should be in the Code. O-24**
- **Response – The types of overlays covered by the code case are defined in the General Requirements, Definitions. The word mitigation is used in the context of what is included in the Definitions section for a mitigative overlay. All overlays in this case are full structural. We believe the definitions are adequate. When ASME uses words in accordance with their common English usage, those words are not redefined in the ASME Code. The word "mitigation" is used in the same sense as in ordinary English usage, as moderating or making less severe.**

Introduction (Con't.)

- **3. In order to perform the evaluation in IWB-3640, the stress terms Pb, Pm, and Pe must be known. What value of "D" or "t" is used in these evaluations (e.g., t = twall, t = twall + toverlay). O-49**
- **Response - Diameter and thickness used for design of weld overlays per IWB-3640 are the updated values that include the weld overlay thickness (t = twall + toverlay). Overlay length requirements are also specified to ensure that the stresses at the crack location are governed by these dimensions. This has been the WOL design philosophy since their inception in the early 1980's, as documented in CC-N504 and Appendix Q.**

Section 1

- **Comment 1. - Under Section 1, General Requirements, the Definition for the Mitigative Weld Overlay should be changed to "…Weld overlay that is applied over material with no inside surface connected flaws or subsurface defects found during an examination performed in accordance with 2(a)(3) prior to the weld overlay being applied…" The "subsurface defects" is added to emphasize that the original weld must contain neither subsurface defects nor inside-surface connected flaws in order to be qualified for being a "Mitigative Weld Overlay". JT**
- **Response – We believe that the change is not needed. All defects are rejectable and require repair. (See Glossary); hence, a Repair Weld Overlay, as defined would be needed. The intent is to preclude the use of a Mitigative Weld Overlay over surface connected flaws whether acceptable or not thereby potentially calling repair of SCC mitigation. Subsurface flaws that are evaluated and found acceptable may be present in the base material or original weld.**

Section 1

- **2. The terminology for these overlays differs from that in NUREG-0313, Revision 2 Standard, Designed, or Limited Service). How do these new terms compare to the terms in NUREG-0313? Should we be using similar terminology? O-52**
- **Response - The definitions in N-740-2 differ from those on NUREG 0313, Rev. 2. NUREG 0313, Rev.2 did not address mitigative overlays. Full Structural Overlay is the same as the NUREG. Mitigative Overlay is new. Repair Weld Overlay is to clarify what is considered a repair.**

Section 1 (Con't.)

- **Comment 3. - In Section 1, for mitigative weld overlay change "preformed" to "performed".**
- **Response – This editorial change will be made.**

- **Comment 3. - Paragraph 1(a) states that "…This Case applies to austenitic nickel alloy and austenitic stainless steel welds between P-No. 8 or P-No. 43 and P-Nos. 1, 3, 12A, 12B, or 12C materials; between P-Nos 1, 3, 12A, 12B, and 12C materials, or between P-No. 8 and P-No. 43 materials…" This sentence is confusing. For clarification, the NRC staff suggests the following format:**
- **This Case applies to austenitic nickel alloy and austenitic stainless steel welds between the following items:**
- **P-No. 8 and P-Nos, 1, 3, 12A, 12B, and 12C.**
- **P-No. 43 and P-Nos, 1, 3, 12A, 12B, and 12C.**
- **P-No. 8 and P-No. 43**
- **Between P-Nos 1, 3, 12A, 12B, and 12C materials. JT, O-27**
- **Response – We believe the wording in 1(a) in the final version is clear. The NRC proposed change is considered editorial.**

Section 1 (Con't.)

- **Comment 4. - Paragraph 1(a) states that "…This Case applies to austenitic nickel alloy and austenitic stainless steel welds between P-No. 8 or P-No. 43 and P-Nos. 1, 3, 12A, 12B, or 12C materials; between P-Nos 1, 3, 12A, 12B, and 12C materials, or between P-No. 8 and P-No. 43 materials…" This sentence is confusing. For clarification, the NRC staff suggests the following format:**
- **This Case applies to austenitic nickel alloy and austenitic stainless steel welds between the following items:**
- **P-No. 8 and P-Nos, 1, 3, 12A, 12B, and 12C.**
- **P-No. 43 and P-Nos, 1, 3, 12A, 12B, and 12C.**
- **P-No. 8 and P-No. 43**
- **Between P-Nos 1, 3, 12A, 12B, and 12C materials. JT, O-27**
- **Response – We believe the wording in 1(a) in the final version is clear. The NRC proposed change is considered editorial and is acceptable. We will consider rewording as suggested.**

Section 1 (Con't.)

- **Comment 5. - Paragraph 1(b) permits the overlay to extend to adjacent welds joining P-No 8 materials. It does not require it to extend to these welds. If the overlay does not cover the adjacent P-8 weld it may increase the ID tensile stresses of the SS to SS weld. Although there has not been any significant cracking of these welds in PWRs, the Code Case should indicate that in the event the overlay does not cover the SS-to-SS weld, the effects of the overlay on the residual stresses on the ID surface of the SS-to-SS weld should be minimal. O-33**
- **Response – Shrinkage stresses are considered in design since they are secondary. The case requires that shrinkage stresses be considered when performing crack growth evaluations. Most SS welds have not been fully annealed following welding. The residual stresses in the welds would be highly tensile from initial welding. Any additional stresses from shrinkage of the overlay would have little or no effect on crack initiation since the original fabrication stresses would be greater than that needed for crack initiation. In addition SCC of SS in a PWR environment has not been a problem. No change is needed.**

Section 1 (Con't.)

- **Comment 6. Paragraph 1(b) permits the overlay to extend to adjacent welds joining P-No 8 materials; however, it is not clear whether the beneficial effects of the overlay apply to this weld also (i.e., it is not clear that the design must assess this condition or whether the overlay can simply be extended). O-50**
- **Response – If an overlay is extended over the SS weld, residual stress and structural reinforcement considerations apply to that weld as-well, if the exam volume for future ISI is revised to be the standard overlay ISI volume. Crack growth analyses must be performed for that weld considering any applicable degradation mechanisms (typically only fatigue for SS welds in PWR applications). The revised residual stresses due to the overlay are considered in the SS weld crack growth analysis. Alternatively, if the original ISI volume is retained for the SS weld, then such considerations are not needed, since the overlay over the SS weld would constitute a code acceptable reinforcement of that weld. In either case, ASME Section III fatigue analyses must be updated to address the potential effects of discontinuities introduced at the ends of the overlays (paragraphs 2(b) (1) and (2)).**

Section 1 (Con't.)

- **Comment7. Given that the definitions are not numbered, it is no longer clear whether 1(a) only applies to repair weld overlays or both repair and mitigative weld overlays. O-61**
- **Response – the definition for a Full Structural Overlay states that it can be either Repair or Mitigative. Para. 1(a) was never intended to be limited to only a Repair Weld Overlay. With removal of the definition numbering during the SC XI editing and review process, this was clarified in N-740-1.**

Section 1 (Con't.)

- **Comment 8. The NRC finds paragraphs 1(c), 1(c)(1), 1(c)(1)(a), 1(c)(1)(b), and 1(c)(2) regarding PWHT exemption unacceptable because the staff does not agree with paragraph 1(c)(1)(a) which defines the nominal weld thickness as the maximum overlay thickness. The NRC staff thinks that the nominal weld thickness should be defined as the maximum base metal (component) thickness. The staff needs to review the white paper. JT, TL**
- **In the event that paragraph 1(c)(1) is retained, a figure that depicts the various definitions/terms would be useful. O-53**
- **The term "nominal weld thickness" is confusing. O-62**
- **Response – These paragraphs are completely consistent with the Section III definition of nominal thickness in NB-4622.3, Definition of Nominal Thickness Governing PWHT, which has been endorsed by the NRC for many years. Additional information on this issue may be found in http://cstools.asme.org/csconnect/PDF/C61651.pdf. A white paper entitled "Technical Justification For Applying the PWHT Exemptions of NB-4620 to Weld Overlays on P-No. 1 Materials" has been given to the NRC previously. An additional copy will be supplied at the meeting if desired.**

Section 1 (Con't.)

- **Comment 9 - 1(c)(2) states that Appendix I may be used for temperbead welding. Since this is a mandatory appendix that must be used when temperbead welding is performed to alleviate the need for PWHT, 1(c)(2) should be reworded to indicate "If ambient-temperature temper bead welding is used, Appendix I shall be used."**
- **Response - We agree. We will re-word to require the use of Appendix 1 if ambient – temperature temper bead welding is used.**

Section 1 (Con't.)

- **Comment 10. - In paragraph 1(d), the surface where the overlay is to be applied must be inspected with PT. Given standard industry practice to inspect at least ½-inch beyond the area of interest and the requirements of 3(a)(2), the inspection extent in 1(d) should be ½-inch beyond the area where the overlay is to be deposited.**
- **Response -The length of the weld overlay is far greater than the areas to be examined for either the acceptance or preservice/inservice examinations. The purpose of the PT prior to deposition of the overlay is to ensure that unacceptable surface flaws are not present where the overlay will be deposited. The examination of an additional ½ in. area surrounding the weld is applicable only after welding – not before.**

Section 1 (Con't.)

- **Comment 11.- In 1(d)(2), the term "initial weld overlay layer" is used. This is confusing since this layer is applied per 1(d)(1) and this layer is not credited in meeting weld reinforcement design thickness requirements. Alternate terminology should be used to avoid confusion since this "layer" is not part of the overlay. TL**
- **Response – We believe the sentence in 1(d)(2) is clear. This clearly applies to a weld overlay layer or local repair. This is used if blow-through or a leak occurs in the original piping. This criteria has been successfully implemented since the first overlay was applied without confusion.**

Section 1 (Con't.)

- **Comment 12. - 1(d)(3) permits the application of an austenitic stainless steel filler material "layer" over stainless steel base metal to reduce the potential for hot cracking. Is there any specific type of austenitic stainless steel filler material that should or should not be used in this application? If so, this should be specified. TL**
- **Response – Austenitic SS filler material used is left to the Repair Organization. The layer must meet the requirements for delta ferrite in 1(e) 1.**

Section 1 (Con't.)

- **13. 1(d)(3) discusses that an austenitic stainless steel filler material may be used to reduce the potential for hot cracking. The paragraph does not state whether this is a single layer or layers. In one sentence, it implies it is a single layer and the next sentence implies it could be layers. If a single layer, the inconsistency between the two sentences should be corrected. How is the amount of SS filler material that is needed to reduce the potential for hot cracking determined? O-5**
- **Response – The second sentence will be changed to "the layer". (Is the correct? Is anything done to determine the thickness of the SS layer to reduce the potential for hot cracking?)**

Section 1 (Con't.)

- **Comment 14. - The justification for the chromium values in 1(e)(2) should be provided. O-54**

- **Response - A White Paper titled "EFFECT OF CHROMIUM CONTENT ON NICKEL-BASE ALLOY SCC RESISTANCE", IS AVAILABLE ON C&S CONNECT SUPPORTING ACTION, RRM-02-05, BC04-1003, "Develop New Code Case to Address Inconel Weld Overlay on Various Materials". The NRC has been provided with this paper on several occasions previously.**

Section 1 (Con't.)

- **Comment 15. - 1(f) discusses the weldability of irradiated materials. Although thermal fluence may be of concern, it is not clear that the fluence levels reported are those associated with fast or thermal neutrons. In fact, some references use the energy levels associated with fast neutrons when discussing the limits on fluence (from a weldability perspective). Please clarify. O-29**
- **Response – The code case states that the limitation is thermal neutron fluence. Overlay repairs performed to date have been on the portion of the nozzles considered piping. The locations are away from the vessel beltline and fluence has not been a concern.**

Section 2a

- 1. 2(a)(2), 2(a)(3) and possibly other paragraphs do not appear to address the situation when the safe end is a PWSCC susceptible material. In these cases, the flaw may grow into the material (or there could be pre-existing flaws in the material). As a result, it is not clear that postulating an axial flaw length of 1.5-inches (or the combined width of the weld plus buttering) is conservative for cases when the safe end is a PWSCC material. In addition, qualified examinations of the safe end material should be performed. This is not addressed in 2(a)(3). TL
- Response - The postulated flaw size is consistent with the flaw sizes used in all overlay analyses to date. The examinations for preservice/inservice inspections extend ½ in. beyond the postulated area. This was done for BWR overlays where the base material is considered susceptible. The highest stressed area and most susceptible material is adjacent to the weldment. Cracking that has been observed is consistent with this and therefore, the postulated flaw size is considered adequate.

Section 2a (Cont'd)

- **Comment 2. Paragraph 2(a)(3) states that "…If an Appendix VIII, Supplement 10, or Supplement 2, as applicable, ultrasonic examination is performed prior to application of the overlay, and no inside-surface connected planar flaws are discovered, initial flaws originated from the inside surface of the weldment equal to 10% of the original wall thickness shall be assumed…". There are four possible outcomes of inspection results from the pre-installation UT of the original weld: (1) a subsurface flaw is detected, but no inner surface-connected flaw is detected, (2) a subsurface flaw is not detected, but an inner surface-connected flaw is detected, (3) both a subsurface flaw and an inner surface-connected flaw are detected, and (4) no flaws are detected. Paragraph 2(a)(3) is only applicable to Case (4) above. Crack growth calculations for Cases (1), (2), and (3) above can be handled by paragraph 2(a) which requires that crack growth be evaluated based on the examination results. Therefore, for clarification, paragraph 2(a)(3) should be revised to read "…If an Appendix VIII, Supplement 10, or Supplement 2, as applicable, ultrasonic examination is performed prior to application of the overlay, and no inside-surface connected planar flaws are discovered, initial flaws originated from the inside surface of the weldment equal to 10% of the original wall thickness shall be assumed…" JT**
- **The basis for the 10% depth assumption in 2(a)(3) should be provided. Include in this information, the probability of detecting flaws between 10% and 75% through-wall, and the potential for flaws to grow (both in depth and length) during application of the weld overlay. TL, O-55**
- **Response – The premise is that no surface connected flaws maybe present in what is considered a mitigative overlay. *Acceptable* subsurface flaws may be present since they are not PWSCC-susceptible and would not be adverse. Subsurface defects require repair and the overlay could not be considered mitigative. This was addressed earlier in our response.**
- **10% was considered to be a reasonable estimate of detection threshold. Any estimates of crack growth of flaws not detected would be frivolous. The premise is that no unacceptable subsurface defects or surface flaws are detected and the overlay is mitigative. Therefore it is reasonable to postulate a 10 % flaw. This assumption is necessary for an Owner to expend resources to perform an inspection prior to weld overlay. If no benefit with regard to postulated flaw size and re-inspection requirements is received from performing an inspection, it is doubtful such inspections would be performed.**

Section 2a (Cont'd)

- **3. Paragraph 2(a)(4) requires that for cast austenitic stainless steel items, a 100% through wall flaw be assumed. Although the 100% through wall flaw assumption is acceptable, it may be impractical or create a hardship in the overlay design or installation. In these cases, an initial flaw with 75% through wall depth may be assumed in the crack growth calculation provided the required inspection volume is examined at a higher frequency than the requirements in paragraph 3(c). The subject weld shall be ultrasonically inspected during the first or second refueling outage following the weld overlay installation. If UT is performed prior to weld overlay installation and after installation without detecting any planar flaws in the original weld and the weld overlay, the first or second refueling outage UT may be eliminated. After the first ISI examination, the required inspection volume shall be ultrasonically inspected every 10 years from the date of the installation until such time when UT is qualified to examine the CASS portion of the required inspection volume in accordance with the performance demonstration requirements of ASME Code, Section XI, Appendix VIII. After the subject weld is examined by qualified UT for the CASS material and no planar flaws are detected, the weld may be placed in the 25 percent sample inspection population per paragraph 3(c)(5). The inspection of the overlaid weld shall not be credited to satisfy the requirement of the twenty-five percent sample inspection every ten years of overlaid welds with non-CASS materials. JT**
- **Response – We consider that it would be prudent to leave the Code Case as written rather than to add this additional complication. The 100% assumption for postulated flaw sizes will be used for the overlay design. If a case is encountered where this can't be accommodated in the design and fabrication, it would be outside of the Code Case and be handled by relief request.**

Section 2a (Cont'd)

- **4. In 2(a)(4), the meaning of the phrase "consistent with the overlay examination volume in Figure 2" should be clarified. TL**

- **Response – "Consistent with the overlay examination in Figure 2" means examine volume A-B-C-D as shown in the figure. The note is also included. We believe this is clear and a change is not needed.**

Section 2a (Cont'd)

- **5. In 2(a)(5), the second sentence is awkward. Suggest rewording. TL, O-15, O-64**
- **Response – The 2nd sentence will be reworded as follows: "For such cases, the initial flaw depths assumed would be the detected depth found by the Appendix VIII, Supplement 11 qualified examination plus the postulated worst-case flaw in the region examined by an ultrasonic examination not qualified in accordance with Appendix VIII.**

Section 2a (Cont'd)

- **6. 2(a)(6) Suggest rewording the 2nd sentence as follows: "…region of the pipe wall thickness which was not examined using an ultrasonic examination procedure meeting Appendix VIII for that region." In general, this sentence is awkward since it could be read that a 100% through-wall flaw (i.e., the "postulated worst-case flaw depth") must be added to the detected depth. Suggest rewording. TL, O-45**
- **Response – The sentence will be revised as suggested.**

Section 2a (Cont'd)

- **7. In 2(a)(6), for clarity instead of just referencing "(3), (4), or (5) above", the paragraph should indicate " 2(a)(3), 2(a)(4), or 2(a)(5) above." In addition, the paragraph numbers in this paragraph (and possibly others) should be in italics (since the Code Case numbering is in italics).**

- **Response – This editorial change will be made. However, formatting of paragraph numbers in the text is done by the ASME staff editors in a manner that is consistent with all other ASME Codes and Standards. This Case will not be made unique in regard to use of italics.**

Section 2a (Cont'd)

- 8. Figure 2 is referred to before Figure 1. O-63

- Response – We will consider renumbering the figures. Although the reference to Figure 2 is made before Figure 1, this is consistent in the Examination Section as written.

Section 2b

- 1. 2(b)(1) does not appear to address the case when there is a PWSCC susceptible safe end. When wouldn't the requirements be satisfied by extending the overlay full thickness length beyond the projected flaw by $0.75\sqrt{Rt}$? Is "t" the overlay wall thickness, the combined thickness of the overlay and the original wall thickness of the pipe or nozzle, or just the nominal wall thickness of the pipe or nozzle?
- Define R and t for the case where you have an overlay on a nozzle-to-pipe weld where Rnoz > Rpipe and tnozzle > tpipe. O-65
- Response - We propose to reword as follows: (1) "The axial length and end slope of the weld overlay shall cover the weld and heat-affected zones on each side of the weld as well as any SCC susceptible base material adjacent to the weld, and provide . . . ."

Section 2b (Cont'd)

- **2. In 2(b)(1), there should be some stipulation on the proximity of the overlay to the safe end weld since the weld residual stress may be affected at the ID. O-16**
- **Response - This is addressed under Section 1, Questions 5 and 6 above.**

Section 2b (Cont'd)

- **3. In 2(b)(2), a figure would help clarify the slope. O-57**
- **Response – We believe this is clear. However, if this is a significant concern to the NRC, a pointer to the end transition slope could be added in one of our existing figures.**

Section 2b (Cont'd)

- **4. It is not clear why both 2(b)(3) and 2(b)(4) are needed. If 2(b)(3) is for a repair overlay and 2(b)(4) is for a mitigative overlay, it is not clear why 2(b)(6) is needed. If paragraph 2(b)(3) was intended to address the length of a repair overlay and 2(b)(4), the depth, 2(b)(4) has a length dimension in it. If not, the flaw of 2(b)(4) will always be larger than the flaw of 2(b)(3). Paragraphs 2(b)(3), 2(b)(4), and 2(b)(6) should be clarified. TL, O-12, O-8, O-35**
- **Response - Paragraph 2(b)(3) is a carry-over from N-504, in which we permitted designed overlays based on the detected length of the flaw (or group of flaws). Since we are restricting this CC to FSWOLs, it is not needed.**

Section 2b (Cont'd)

- **5. The phrase "for the entire circumference" in 2(b)(5) and 2(b)(6) should be clarified. Does this mean that the axial flaw can be anywhere around the circumference and it should be assumed to be at the worst possible location, or is it trying to express the view that the flaw affects the entire welded area and the overlay can credit none of the original material? TL, O-11, O-9, O-36**
- **Response – This means that the axial flaw can be anywhere around the circumference and must be assumed to be at the worst possible location. The wording will be revised accordingly.**

Section 2b (Cont'd)

- **6. In 2(b)(6), the assumption of 1.5-inch or the combined width of the weld plus buttering does not account for configurations involving a safe end made of PWSCC susceptible material such as Alloy 600. See comment 1 in Section 2a. TL**
- **Response – Wording of 2(b)(6)(b), will be revised to state: "100% through-wall for 1.5 in. (38 mm) or the combined width of the weld plus buttering plus any SCC susceptible base material, whichever is greater, in the axial direction at the worst location around the circumference"**

Section 2b (Cont'd)

- 7. 2(b)(6) should specify what is considered limiting. Is it the thickest overlay? O-10
- Response - Opening paragraph of 2(b)(6) will be revised as follows: "For mitigative full structural overlays, the assumed flaw in the underlying base material or weld shall be based on the limiting case of the two below that results in the larger required overlay thickness."

Section 2b (Cont'd)

- 8. 2(b)(8) discusses the effects that weld shrinkage could have on the piping system and that it should be assessed. However, the code case does not discuss whether these stresses should be considered in the design of the overlay (i.e., axial tension will also be a loading on the overlay and should be considered as an increase in the axial membrane tensile stresses. This stress should be classified as a secondary stress). In addition, guidance should be provided on how to determine these stresses since a simple mockup would not necessarily match all of the restraint that may be provided by the connected piping systems. O-38
- Response – Axial membrane secondary stresses do not enter into overlay design. Since the overlay material is high toughness, overlay sizing in accordance with IWB-3640 is governed by primary loads only. Secondary stresses due to weld shrinkage do not cycle, so they are not required to be considered in Section III fatigue analysis, and their potential effect on the crack growth analyses is considered to be bounded by the weld residual stress computation.

Section 2b (Cont'd)

- 9. 2(b) references IWA-4311 and IWB-3640, IWC-3640, and IWD-3640; however, none of these sections really describes how to design a weld overlay. For example, what material properties are used (i.e., the base material properties for the weld material – Alloy 690 for Alloy 52/152 weld metal). This should be clarified. O-6, O-32, O-39, O-44
- More generally, guidance should be added on how to perform analyses in support of overlays. For example, what material properties are used, what crack growth rates are used for the overlay material, what are the important parameters in determining the weld residual stresses (e.g., weld sequencing, with or without water in the pipe, effects on adjacent pipes, etc).

- **Response – The ASME Code and Code Cases are not intended to be "cook books" for analysis. The rules for required flaw evaluations are in IWX-3640 and the design rules are in the code case. Overlays have been designed, installed and have performed acceptably in service for well over 20 years.**
- **Extensive details on these topics are provided in MRP-69 which had been submitted to NRC for review and approval. It provides detailed guidance on how to perform analyses in support of overlays, which are beyond the typical level of detail contained in a code case.**

Section 3

- **1. The NRC does not accept achieving less than 100% coverage for a preservice examination. Conversely, if 100% coverage can be obtained on a preservice examination, then 100% coverage should be able to be achieved during an inservice inspection examination. When the weld involves cast austenitic stainless steel, less than 100% coverage can be accepted provided the crack growth analysis is based on an assumption of a 100% through wall flaw as outlined in 2(a)(4). Alternatively, another option may be to assume a 75% through wall flaw if the overlay is inspected at a frequency of once per interval (i.e. the welds cannot be placed into a 25% sample). See comment above. TL**

- **Response – The position regarding examination coverage is given in the first paragraph. Paragraph 3 (b) (*1*) defines the volume to be examined. The examinations will be as complete as possible within the limits of the technology.**

Section 3 (Cont'd)

- **2. In paragraphs 3(a)(2) and 3(a)(3) it is not clear whether "at least 48 hrs following completion" is a minimum or maximum time value. O-67**
- **Response – "At least 48 hrs" always means not less than 48 hrs. This is very clear. The 48 hour hold time is a minimum time value. It has been included to address concerns regarding delayed hydrogen cracking.**

Section 3 (Cont'd)

- 3. Paragraph 3(a)(3) introduces a dimension of "t3". The NRC staff has the following concerns with application of "t3" when applying the acceptance standards of IWB-3514-2: (a) The"t3"dimension is difficult to measure accurately because it is based on the locations of the flaw in the base metal and in the weld overlay. There could be substantial errors in this measurement. (b) The "t3" dimension is calculated based, in part, on the location of the inner surface connected flaw; however, the current UT method is not qualified to examine the inner 75% of the base metal. Therefore, it is not clear that "t3" can be implemented. The NRC staff suggests this dimension be eliminated. JT
- The application of t1. t2, and t3 is complicated. It should be simplified. The weld overlay transmits loads to and from the nozzle and pipe system (generally if the overlay extends beyond any flaw (postulated or actual) by $0.75\sqrt{Rt}$). As a result, the t1 thickness should be used for flaw evaluations within this region, and outside this region, the t2 thickness may be used. It is not clear if the area E-F-G-H includes the $0.75\sqrt{Rt}$ additional length for the overlay. It should. Lastly, it is not clear that the examination volume would cover and PWSCC susceptible material beyond the weld (e.g., an Alloy 600 safe end) and that it is appropriate to use thicknesses other than t1 for such materials. TL
- Figure 1 does not address the case where the flaw crosses two boundaries (e.g., flaw resides in JEHI and EFGH). In these cases, the code case should specify that the smaller thickness should be used. O-17
- **Response - A technical basis document has been submitted that confirms that the load transfer from the overlay to the pipe system is complete at distance of one pipe thickness (not $0.75\sqrt{Rt}$) from the end of the susceptible material, i.e. the "b" dimension. For simplicity, we will eliminate the t3 term, and specify t1 for flaws up to and including "b", and t2 for flaws beyond that distance. When the dimension "b" is based on an ID surface flaw, the location of that flaw is based on the pre-overlay inspection which is qualified to inspect the inner 1/3 of the pipe, not the post overlay inspection. Lastly, the figure will be modified to specify that any length of SCC susceptible base metal will be included in the exam volume EFGH, and thus subject to the t1 dimension for application of the IWB-3500 acceptance standards. We will also specify that if a flaw in the overlay crosses the boundary, the more conservative of the two dimensions (t1 or t2) shall be used.**

Section 3 (Cont'd)

- **4. The examination volume A-B-C-D in Fig 1(a) (referenced in 3(a)(3)) depicts a portion of the overlay that is not examined due to encroachment on a curved surface that limits the ultrasonic transducer positioning in this area. How is it ensured that this area is not required to transmit loads back to the original piping system and nozzle (0.75√Rt)? A similar comment applies to area E-F-G-H defined in Fig 1(b). Does E-F-G-H include all portions of the structural weld overlay necessary to transmit loads from the piping system to the nozzle and vice versa (0.75√Rt)? If not, this area should be expanded to include this transition zone. TL**
- **Response - When determining the overlay length required to transmit loads back to the piping system and nozzle, (per 2(b)(2)), this length refers to the full thickness portion of the overlay, without the end tapers or nozzle radius region. Thus ABCD in Fig. 1(a) encompasses this entire length. In addition, PT examination is required of the ed taper and nozzle radius region of the overlay + ½ inch beyond it. The area E-F-G-H defined in Fig 1(b) is not intended to cover this length. It is for future ISI looking for potential cracks in the PWSCC susceptible material, not inspection of the overlay material itself.**

Section 3 (Cont'd)

- **5. Paragraph 3(c)(2) should be revised to read: "Alternatively, for mitigative weld overlay, in which pre-overlay examination are performed in accordance with 2(a)(3), post-overlay examinations are performed in accordance with 3(a) and 3(b), and no inside surface connected planar flaws are discovered, the overlay may be placed immediately into the population to be examined in accordance with 3(c)(5)…" This is to emphasize that if the weld overlay and base metal/original weld has no planar flaws (either subsurface or inside surface connected) then it is allowed to be placed in the sample inspection population. If a subsurface flaw exists in the base metal/original weld (even if no inside surface connected flaws are detected), the weld needs to be examined during the first or second refueling outage to confirm that that the subsurface flaw has not grown due to the weld overlay installation or some other mechanism. JT**
- **Response – The requested change is unreasonable and not technically justifiable.**
- **The concern is surface-connected flaws that are identified, regardless of size. Subsurface flaws that are evaluated as prescribed and found acceptable have no safety implications and should not affect the examination frequency.**

Section 3 (Cont'd)

- **6. Paragraph 3(c)(4) states that "…Any indication characterized as stress corrosion cracking in the weld overlay material is unacceptable…". In the context of the rest of Paragraph 3(c)(4), the above requirement could be interpreted to be that stress corrosion cracking is unacceptable to IWB-3514-2 or unacceptable to IWB-3600. For clarity, the NRC staff suggests the above requirement be revised to read "…Any indication characterized as stress corrosion cracking in the weld overlay material is unacceptable and shall be removed…" JT**
- **Response – The suggested change reduces the conservatism of the requirements. The use of a second overlay over an existing overlay is prohibited. Specifying the indication shall be removed could lead to an interpretation that a local weld repair is an acceptable repair for stress corrosion cracking (SCC) in an overlay made with filler material considered to be resistant to SCC. It is quite clear that SCC in the overlay is unacceptable. The suggested change could result in an unacceptable repair.**

Section 3 (Cont'd)

- **7. The requirements for additional examinations in 3(d) are inconsistent with IWB-2430 and with the Code Case drafted by the Task Group on Alloy 600. The requirements should be consistent with the Alloy 600 task group's recommendations. O-31**
- **Response – Subcommittee XI has been developing a resolution to this issue. Our current plan is to remove all such requirements from this Case and to reference the provisions of the Alloy 600 Examination Case in the same action as the approval of the Alloy 600 Examination Case. We plan to cross-references both Cases. To do this, we need to obtain permission from the ASME B&PVC to allow us to reference one Case within the text of another. In the mean time, because the Alloy 600 Case has not even been submitted to SC XI for review, we are not in a position to incorporate the Alloy 600 Task Group's recommendations into Case N-740 at this time.**

Appendix

- **Paragraph I-1(c) is confusing. O-68**
- **Response – This means if the buttering is 1/8 in. or less left on the wall of a "V" groove weld after excavation, the Appendix may be used. If the weld buttering or residual initial weld such as Ni or SS austenitic was greater than 1/8 in., temper bead welding or post weld heat treatment would not be required for the repair activity. This is consistent with the provisions of IWA-4631(b).**

Appendix (Cont'd)

- **Paragraph 1-1(d). Is the 3/8-inch criterion independent of the wall thickness. O-69**
- **Response – Yes**

Appendix (Cont'd)

- **Appendix I, paragraph I-3(e) states that "…Temperature measurement (e.g. pyrometers, temperature indicating crayons, thermocouples) during welding…". As currently written, the code case would require the use of all 3 methods listed in this section. This is acceptable. If this was not the intent, the code case should be clarified to indicate that 1-3(e)(1) should be used except when it is impractical due to situations where the weldment area is not accessible, such as internal bore welding or when there are extenuating radiological concerns. In which case, the interpass temperature shall be determined by performing paragraphs I-3(e)(2) and 1-3(e)(3). JT**
- **Response – The first sentence will be changed as follows: "The interpass temperature shall be determined by one of the following three methods."**
- **All three of the methods listed in *(1)(2) or (3)* are technically adequate and can be used without restriction.**