

**Remediation for Unit 3 Containment Vessel
Unistrut Welding
ASME Section III Code Alternative Request
VEGP 3&4-ALT-16**

April 22, 2021

Overview

- Background
- Overview of Alternative Request
- Applicable ASME Section III Code
- Summary



Background

- The Unit 3 Containment Vessel (CV) is an ASME Section III, Class MC pressure vessel
- Design and construction were completed as indicated by the application of the N-Certificate Holder's certification stamp
- Subsequent to completion of design and construction of Unit 3 Containment Vessel (CV):
 - 6 pieces of Unistrut were welded to the CV inside diameter across 3 locations
 - Welding was performed by a contractor that is not an N-Certificate holder



Background

- The welds used are $\frac{1}{4}$ " to $\frac{3}{8}$ " fillet welds, 4" long
- The proposed process of removing the Unistrut welds is analogous to similar activities performed for temporary attachments used throughout the CV construction



Alternative Request

- SNC plans to request an alternative to the applicable portions of Section III
- Remediation of Unistrut welding would be performed by the CV N-Certificate Holder, CB&I, according to their Section III program
 - » Mechanical methods will be used to cut the Unistrut from the welds
 - » Weld material will be ground flush with CV shell, with trace amounts of weld material remaining for the life of the plant
 - » Ultrasonic digital thickness measurements of CV shell will be taken to confirm thickness before and after removal of weld material
 - » Surface exams of the CV shell will be conducted to identify any discontinuities
 - » Supplemental vacuum box testing of remediated areas will be performed to verify no leak paths were created in the CV shell



Alternative Request

- Documentation of activities will be reported on an N-10A Data Report
- SNC will request an alternative to the following Section III Code Paragraphs:
 - NCA-3131, NE-4411, NE-4435(a)(1) which invokes NE-4321, NE-4435(a)(4), NE-4610



- **Requirement:** All field welding is done or subcontracted by a Certificate Holder
- **Challenge:** Six sections of Unistrut were welded to the CV by a contractor that is not a Certificate Holder or subcontracted by a Certificate Holder.
- **Alternative Action:**
 - The CV N-Certificate Holder has developed a plan for performing remediation activities in accordance with their ASME III QA program.



NE-2300

- **The requirements of NE-2300 are met.**
- **Requirement:** Pressure retaining material shall be impact tested. For the specific plates, the average fracture toughness shall be ≥ 40 ft-lb at -48.5°F
- **Basis for Acceptability:**
 - The average fracture toughness test results for SA-738 Gr. B, CV shell plates to which the Unistrut channels were attached are 221.25 ft-lb at -58.5°F or >5 times the minimum required value.
 - The fracture toughness for the SA-738 Gr.B, Rings S2 - S11 test plates was achieved using a qualified welding procedure specification from the CV N-Certificate Holder with 1/8" diameter electrode and a maximum heat input of 68.4 kJ/in.
 - The average fracture toughness test result for the weld filler material used to attach the Unistrut is 133 ft-lb at -20°F .



NE-2300 (Continued)

- **Basis for Acceptability (Continued):**

- The Unistrut attachment welds are 4” long, 1/4” to 3/8” fillet welds made on 1-3/4” CV shell plates with a 3/32” E7018 electrode. Therefore, it is reasonable to conclude that the heat input from the Unistrut attachment welds could not have exceeded the qualified weld maximum heat input.
- The heat affected zone in the CV shell material created by welding the Unistrut is only slightly below the surface and is not significantly different from any other attachment weld on the vessel.
- Based on the relative heat input, it is reasonable to conclude that the fracture toughness in the heat affected zone would not be adversely impacted.



NE-4125 / NE-2400

- The requirements of NE-4125 and NE-2400 are met.
- **Requirement:** All welding material shall meet the requirements of NE-2400.
- **Basis for Acceptability:**
 - Weld filler metal conforms to NB-2400 and NCA – 3860.
 - The weld filler metal was procured under Stone & Webster's ASME III QA program and is compliant with Subsection NE requirements.
 - The CV N-Certificate Holder has reviewed the CMTRs for the weld filler metal and confirmed that the material is compatible with the CV shell.



- **Requirement:** Each Certificate Holder is responsible for control of the welding electrodes and other material which is used in the fabrication and installation of components (NE-4120). Suitable identification, storage, and handling of electrodes, flux, and other welding material shall be maintained. Precautions shall be taken to minimize absorption of moisture by electrodes and flux.
- **Challenge:** The CV N-Certificate Holder did not control the weld material used in the attachment welds. However, it was under the control of another ASME Certificate Holder until it was issued to the Contractor.
- **Alternative Actions:**
 - The weld material was procured under Stone & Webster's ASME III QA program and maintained under the S&W ASME III QA program until it was issued to the Contractor and checked out by the welder.
 - The CV N-Certificate Holder has reviewed the CMTRs for the weld metal and confirmed that the material is compatible with the CV shell.



NE-4435(a)(1) / NE-4321

- **Requirement:** Welding procedures and welders have been qualified in accordance with NE-4321.
- **Challenge:** Six sections of Unistrut were welded to the CV using welding procedures and welders which were not qualified by a Certificate Holder.
- **Alternative Actions:**
 - The CV N-Certificate Holder has reviewed the CMTRs for the weld metal and confirmed that the material is compatible with the CV shell.
 - The CV N-Certificate Holder has developed a plan for performing remediation activities in accordance with their ASME III QA program.
 - The remediation plan includes surface examination to confirm the absence of surface defects that could have been introduced by the welding performed by welders using a welding procedure that was not qualified by a Certificate Holder and vacuum box testing to verify that no through-wall indications were introduced into the CV shell.



NE-4435(a)(2) / NE-4435(a)(3)

- The requirements in NE-4435(a)(2) are met.
 - **NE-4435(a)(2) Requirement:** The material is identified and is compatible with the material to which it is attached
 - **Basis for Acceptability:** The CV N-Certificate Holder has reviewed the material data for the Unistrut and confirmed that the material is compatible with the CV shell.
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- The requirements in NE-4435(a)(3) are met.
 - **NE-4435(a)(3) Requirement:** The welding material is identified and compatible with the materials joined
 - **Basis for Acceptability:** The CV N-Certificate Holder has reviewed the CMTRs for the weld filler metal and confirmed that the material is compatible with the CV shell.



NE-4435(a)(4)

- **Requirement:** The welds are postweld heat treated when required by NE-4620
- **Challenge:** Based on the base material thickness and weld size, postweld heat treatment (PWHT) would not be required by NE-4620 provided that a preheat of 200°F is achieved.
- **Alternative Actions:**
 - Based on the base material thickness of 1-3/4” and the weld size of 1/4” to 3/8”, the material would be exempt from PWHT by NE-4622.7 provided that a preheat of 200°F is achieved.
 - The utilized welding procedure specification calls for a preheat of 150°F. While this preheat temperature is not the full 200°F required by the Code for the PWHT exemption, it does reduce the temperature differential present during the welding process and the potential for adverse effects as a result of no preheat.
 - Based on the size of the Unistrut attachment welds, localized PWHT would have a negligible effect on relieving any residual stresses in the remaining material.



NE-4435(b)(1)

- **The requirements in NE-4435(b)(1) are met.**
- **Requirement:** The temporary attachment is completely removed in accordance with the procedures of NE-4211.
- **Basis for Acceptability:**
 - The CV N-Certificate Holder's remediation plan includes provisions to remove the Unistrut attachment in accordance with NE-4211.



NE-4610

- **Requirement:** Materials are preheated prior to welding if not exempted by Table NE-4622.7(b)-1 and required by the qualified welding procedure specification. For the specific plate, a preheat of 200°F is required to exempt postweld heat treatment.
- **Challenge:** The achieved preheat does not allow for the exemption of postweld heat treatment.
- **Alternative Actions:**
 - The utilized welding procedure specification calls for a preheat of 150°F. While this preheat temperature is not the full 200°F required by the Code for the PWHT exemption, it does reduce the temperature differential present during the welding process and the potential for adverse effects as a result of no preheat.
 - The attachment welds are 4" long, 1/4" to 3/8" fillet welds made on 1-3/4" CV shell plates.
 - The CV N-Certificate Holder has developed a plan for performing remediation activities in accordance with their ASME III QA program.
 - The remediation plan includes surface examination to confirm the absence of surface defects that could have been introduced by inadequate preheat and vacuum box testing to verify that no through-wall indications were introduced into the CV shell.



NE-4613

- **The requirements in NE-4613 were met.**
- **Requirements:**
 - Consideration shall be given to the limitations of interpass temperatures for quenched and tempered material to avoid detrimental effects on the mechanical properties.
 - The Certificate Holder's welding procedure specification limits interpass temperature to 500°F.
- **Basis for Acceptability:**
 - The utilized welding procedure specification calls for a maximum interpass temperature of 450°F.



NE-6000

- **The requirements in NE-6000 are met.**
- **Requirement:** All pressure retaining vessels shall be pressure tested prior to N-Certification.
- **Basis for Acceptability:**
 - The CV was successfully pressure tested and N-Certified by the CV N-Certificate Holder in compliance with Section III.
 - There is no explicit Code requirement to reperform pressure test after removal of temporary attachments in NE-4435.



Summary

- Welding was performed on the CV shell by a non-Certificate Holder, after receiving the N-Certificate Stamp and after SIT had been performed
- Alternative Request ALT-16 is being prepared
- Remediation will be performed by CB&I, the N-Certificate Holder for the CV, in accordance with their ASME Section III Program
- The proposed alternative along with the plan of remediation, based on evaluations performed by CB&I, provide an acceptable level of quality and safety in accordance with 10 CFR 50.55a



Questions

