April Rice
Manager
Nuclear Licensing

October 27, 2016
NND-16-0455
10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3
Combined License Nos. NPF-93 and NPF-94
Docket Nos. 52-027 & 52-028

Subject: VCSNS Units 2 & 3 LAR 16-18 License Amendment: Request for Nondestructive Examination for Welds of Couplers to Carbon Steel Embedment Plates

In accordance with the provisions of 10 CFR 50.90, South Carolina Electric & Gas Company (SCE&G), acting on behalf of itself and the South Carolina Public Service Authority (Santee Cooper), requests an amendment to the Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 combined licenses (COLs) numbers NPF-93 and NPF-94, respectively. The requested amendment requires changes to the Updated Final Safety Analysis Report (UFSAR) in the form of departures from the incorporated plant-specific Design Control Document (DCD) Tier 2* information.

The proposed departure consist of changes to Tier 2* information in the UFSAR (which includes the plant-specific DCD information) to clarify how the quality and strength of a specific set of couplers welded to Carbon Steel embedment plates, already installed and embedded in concrete, is demonstrated through visual examination, static tension testing, and magnetic particle examination, in lieu of the nondestructive examination requirements of American Institute of Steel Construction (AISC) N690.

Enclosure 1 provides the description, technical evaluation, regulatory evaluation (including the Significant Hazards Consideration Determination) and environmental considerations for the proposed changes.

Enclosure 2 provides proprietary text excerpts that are redacted from the License Amendment Request text in Enclosure 1. **The text excerpts in Enclosure 2 provide information that is considered to be proprietary; therefore, Enclosure 2 is requested to be withheld from disclosure to the public under 10 CFR 2.390.**

Enclosure 3 provides markups depicting the requested changes to the VCSNS Units 2 and 3 UFSAR.

An affidavit from SCE&G supporting withholding under 10 CFR 2.390 is provided as Enclosure 4. Enclosure 5 is Westinghouse's Proprietary Information Notice, Copyright Notice and CAW-16-4482 Application for Withholding Proprietary Information from Public Disclosure and Affidavit. The affidavit sets forth the basis upon which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in

paragraph (b)(4) of Section 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information that is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-16-4482 and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066. Correspondence with respect to proprietary aspects of this letter and its enclosures should also be addressed to April Rice at the contact information within this letter.

This letter contains no regulatory commitments.

SCE&G requests staff approval of this license amendment by October 18, 2017, to support timely closure of the corrective actions surrounding the couplers welded to Carbon Steel embedment plates. Approval of this LAR will not affect construction activities or the Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) closure schedule for VCSNS Units 2 and 3. SCE&G expects to implement this proposed amendment (through incorporation into the licensing basis documents) within 30 days of approval of the requested changes. This is a plant-specific LAR, which is not directly tied to the NRC review schedule of any LARs associated with construction of the AP1000 plants at Southern Nuclear Operating Company (SNC) Vogtle Electric Generating Plant (VEGP) Unit 3 and 4.

In accordance with 10 CFR 50.91, SCE&G is notifying the State of South Carolina of this LAR by transmitting a copy of this letter and publicly-available enclosures to the designated State Official.

Should you have any questions, please contact Mrs. April Rice by telephone at (803) 941-9858, or by email at arice@scana.com.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 27th day of October, 2016.

Sincerely,

April Rice
Manager
Nuclear Licensing

MMD/ARR/mmd

Enclosure 1: Virgil C. Summer Nuclear Station Units 2 and 3 – Request for License Amendment Regarding Nondestructive Examination for Welds of Couplers to Carbon Steel Embedment Plates (LAR 16-18)

Enclosure 2: Virgil C. Summer Nuclear Station Units 2 and 3 – Proprietary Information for Request for License Amendment Regarding Nondestructive Examination for Welds of Couplers to Carbon Steel Embedment Plates (LAR 16-18) **(Withheld Information)**

Enclosure 3: Virgil C. Summer Nuclear Station Units 2 and 3 – Proposed Changes to Licensing Basis Documents (LAR 16-18)

Enclosure 4: Virgil C. Summer Nuclear Station Units 2 and 3 – Affidavit from South Carolina Electric and Gas Company for Withholding Under 10 CFR 2.390 (LAR 16-18)

Enclosure 5: Virgil C. Summer Nuclear Station Units 2 and 3 – Westinghouse Authorization Letter CAW-16-4482, Affidavit, Proprietary Information Notice and Copyright Notice (LAR 16-18)

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South Carolina Electric and Gas Company

Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3

NND-16-0455

Enclosure 1

Request for License Amendment Regarding

Nondestructive Examination for

Welds of Couplers to Carbon Steel Embedment Plates

(LAR 16-18)

(This Enclosure consists of 34 pages, including this cover page)

Table of Contents

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, South Carolina Electric and Gas Company (SCE&G), acting on behalf of itself and the South Carolina Public Service Authority (Santee Cooper), Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, requests an amendment to Combined License (COL) Numbers NPF-93 and NPF-94, for VCSNS Units 2 and 3, respectively.

1.0 SUMMARY DESCRIPTION

As specified in DCD/UFSAR Tier 2* Section 3.8.4.5, "*Structural Criteria*," the analysis and design of concrete and structural steel conform to American Concrete Institute (ACI), "Code Requirements for Nuclear Safety Related Structures," (ACI 349-01) and American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Steel Safety Related Structures for Nuclear Facilities," (AISC N690-1994), respectively. Supplemental requirements for structural steel are provided in UFSAR Section 3.8.4.5.2, "*Supplemental Requirements for Steel Structures*."

The proposed change as part of this activity is to demonstrate weld quality and strength of embedded #9 sized and #11 sized C3J partial joint penetration (PJP) coupler welds with fillet welds on carbon steel embedment plates that are installed in concrete are capable of performing their intended design function and remain acceptable for use-as-is using visual examination (VT), magnetic particle examination (MT), and static tension testing in lieu of NDE. Specifically, nonconformance with AISC N690-1994, Section Q1.26.2.2 code requirements to perform the requisite 10 percent NDE on PJP welds (i.e., not performing MT on coupler welds across the carbon steel coupler weld manufacturer loads), is addressed in this License Amendment Request (LAR). Demonstration of the strength and quality of these coupler welds on Cives carbon steel embedment plates is satisfied through a combination of satisfactory VT on the installed population of coupler welds, and through satisfactory MT and static tension testing on portions of the uninstalled population of welded couplers representing the installed population. The proposed change incorporates supplemental requirements to UFSAR Section 3.8.4.5.2 for AISC N690-1994, Section Q1.26.2.2, "*Partial-Penetration Welds*." These supplemental requirements will allow for the demonstration of the strength and quality of the coupler welds to be credited as justification for the installed coupler welds being capable of performing their intended design function in lieu of the existing AISC N690-1994, Section Q1.26.2.2 requirement for PJP welds to be 10 percent inspected. Because the Cives carbon steel embedment plates with C3J PJP coupler welds with fillet welds were manufactured at the same fabrication facility during the same time frame, the coupler weld populations for Vogtle and V.C. Summer are combined into a single population for the aforementioned demonstration of weld strength.

AISC N690-1994, Section Q1.26.2.2 provides no specific requirement regarding when the 10 percent NDE examination must be performed to in-process PJP welds with reinforcing fillet welds (i.e., no requirement to perform NDE on PJP welds prior to completing the fillet weld reinforcement). As such, the PJP portion of the welds and the fillet portion of the welds were designed as a system and may be inspected as a system. That is, performing NDE (10 percent

MT) after the reinforcing fillet weld is completed along with 100 percent VT meets the requirements of AISC N690-1994, Section Q1.26.2.

2.0 DETAILED DESCRIPTION

Embedment plates are fabricated in accordance with AISC N690-1994. While all welds are subjected to VT, the design specifications and AISC N690-1994 require additional NDE of PJP welds. AISC N690-1994, Section Q1.26.2.2 states,

> "*Partial penetration welds shall be 10 percent inspected by magnetic particle examination or liquid penetrant examination. The examination may be 10 percent of each weld or 100 percent of one weld in ten.*"

Contrary to this requirement, a total of 444 carbon steel embedment plates with a total of 1951 C3J Lenton® weldable couplers attached via PJP welds with reinforcing fillet welds were fabricated by Cives Steel Company (Cives) and shipped to V.C. Summer Units 2 and 3, and accepted without the requisite NDE having been performed.

Subsequent to receipt and acceptance of the 444 Cives carbon steel embedment plates at V.C. Summer Units 2 and 3, 415 embedment plates with a total of 1748 welded couplers were installed (embedded in concrete) under the V.C. Summer Units 2 & 3 CA20 modules and under the V.C. Summer Unit 2 CA01 module. The remaining 29 carbon steel embedment plates with a total of 203 welded couplers have not been installed and are accessible for NDE. The entire population of 1748 welded couplers installed (embedded in concrete) consist of 1688 #9 sized and 60 #11 sized C3J weldable couplers.

A sampling inspection plan was developed to perform NDE on coupler welds in accordance with AISC N690-1994, Section Q1.26.2.2 on 10 percent of the total population of the welds on carbon steel embedment plates. A sample set of 200 welded couplers was pooled to perform the requisite magnetic particle examination from the population of 203 welded couplers that were not embedded in concrete as this sample size is sufficient in magnitude to signify 10 percent of the total population of 1951 coupler welds received from Cives.

Ultimately, the requisite NDE on the Cives sample set of 200 welded couplers was performed and demonstrated 100% satisfactory results via magnetic particle examination. However, it is recognized that the sample set of 200 NDE tested coupler welds is not entirely representative of the total installed population of couplers welded to Cives carbon steel embedment plates. Specifically, the 200 NDE tested coupler welds were pooled from only 4 of 11 total Cives shop fabrication loads. Moreover, review of the Cives shop fabrication loads' visual examination (VT) dates confirm that the 200 coupler welds tested do not overlap with the VT dates from welded couplers in other Cives shop loads which have been installed in their entirety, thereby not allowing for any NDE to be performed on those subsets of fully installed Cives welded coupler loads. As such, it is determined that the sample set of Cives welded couplers which underwent magnetic particle examination (MT) is not entirely representative of the total installed population of welded couplers.

AISC N690-1994, Section Q1.26.2.2 requires that PJP welds shall be 10 percent inspected by magnetic particle examination (MT) or liquid penetrant examination (PT). Because the selected 10 percent sample set MT inspections were determined to be not entirely representative of the total installed populations of Cives welded couplers on carbon steel embedment plates, a License Amendment Request (LAR) is needed to request a change to the Tier 2* portion of UFSAR Section 3.8.4.5.2 to allow demonstration of weld quality and strength of embedded #9 and #11 C3J coupler manufacturer welds using VT, MT, and static tension testing in lieu of NDE for use-as-is.

Description of any Changes to Current Licensing Basis Documents

Tier 2* portions of UFSAR Section 3.8.4.5.2 are revised to supplement the requirements of AISC N690-1994 by specifying that the quality and strength of welds is demonstrated through satisfactory VT on the installed population of coupler welds, and through satisfactory MT and static tension testing of an uninstalled representative population of welded couplers in lieu of the requirements of AISC N690-1994, Section Q1.26.2.2 for PJP 10 percent weld inspection for #9 sized and #11 sized C3J coupler welds on carbon steel embedment plates already installed and embedded in concrete.

3.0 TECHNICAL EVALUATION

As specified in UFSAR Section 3.8.4.5, the analysis and design of concrete and structural steel conform to ACI 349-01 and AISC N690-1994, respectively. Supplemental requirements for structural steel are provided in UFSAR Section 3.8.4.5.2.

The change proposed by this activity demonstrates weld quality and strength to show that the embedded #9 sized and #11 sized C3J PJP coupler welds with fillet welds on carbon steel embedment plates already installed in concrete are capable of performing their intended design function and remain acceptable for use-as-is using VT, MT, and static tension testing in lieu of NDE. Demonstration of the strength and quality of these coupler welds associated with the carbon steel embedment plates as being capable of performing their intended design function is satisfied through a combination of satisfactory VT on the installed population, and through satisfactory static tension testing and MT of uninstalled weld samples representing portions of the installed population of welded couplers.

Demonstration of Satisfactory AISC N690-1994 Visual Inspection

AISC N690-1994 is the governing code for weld design. AISC N690-1994, Section Q1.26.2, "*Minimum Examination of Welds*," outlines the requirements for weld visual examination. Section Q1.26.2 states,

> "*All welds shall be visually examined in accordance with Section Q1.26.1.5 for 100 percent of their length.*"

Together with AISC N690-1994, Q1.26.2.2, "*Partial-Penetration Welds*," the combination of satisfactory requisite visual examination and magnetic particle examination of the PJP welds provides reasonable assurance that the PJP welds, and their welded structural elements that are parts of the nuclear safety-related system, would not impair the ability of these systems or components to perform their safety-related functions. The following discussions pertain to the records of visual examinations in accordance with AISC N690-1994, Section Q1.26.2 for the populations of carbon steel embedment plates with welded couplers at V.C. Summer Units 2 & 3.

Population of Carbon Steel Embedment Plates with Welded Couplers at V.C. Summer Units 2 & 3

As part of the Cives manufacturing process, the carbon steel embedment plates and their associated welded couplers undergo visual examination in accordance with the AISC N690-1994 code requirements. These visual examinations are documented in inspection reports for each embedment plate piece mark (i.e., component tag number/unique plate identifier) and transmitted to the site Owner with each carbon steel embedment plate load package shipment. A total of 444 Cives carbon steel embedment plates with 1951 welded couplers was provided to V.C. Summer Units 2 & 3 via eleven separate load packages. Each of the eleven load packages were reviewed and their corresponding inspection reports were confirmed to contain record of dates of satisfactory visual examination for each carbon steel embedment plate piece mark with welded couplers. Because the carbon steel embedment plates and their associated welded couplers did not undergo visual examination on the same day, Table 3-1 tabulates the Cives carbon steel embedment plates' shop load number along with the total number of carbon steel embedment plates and welded couplers for each load and also tabulates the range of earliest to latest documented satisfactory manufacturer visual examination dates for each load referenced from the respective load package inspection reports.

Table 3-1: Cives Record of Satisfactory Weld Visual Examinations

Shop Load Number	Earliest VT Inspection Date of CS Embeds with Couplers in Load	Latest VT Inspection Date of CS Embeds with Couplers in Load	CS Embeds in Load	Welded Couplers in Load
L#5	3/14/2012	4/19/2012	85	340
L#4	3/19/2012	4/16/2012	117	468
L#9	8/5/2013	8/8/2013	117	468
L#10	8/8/2013	8/12/2013	84	336
L#19	8/22/2013	8/22/2013	1	4
L#2043	3/25/2014	3/26/2014	18	71
L#2052	5/6/2014	5/14/2014	6	56
L#2054	5/6/2014	5/14/2014	5	76
L#3052	5/7/2014	5/19/2014	8	100
L#3053	5/15/2014	5/19/2014	2	16
L#3064	8/6/2014	8/6/2014	1	16
Total			444	1951

Review of the records containing the information reported in Table 3-1 confirms that the welded couplers on each of the 444 carbon steel embedment plates manufactured by Cives and provided to V.C. Summer Units 2 & 3 underwent satisfactory visual examination in accordance with AISC N690-1994, Section Q1.26.2. Documentation of these satisfactory visual examinations supports the demonstration of the quality of the Cives carbon steel embedment plates' coupler welds and their supporting welded structural elements as being capable of performing their intended design function.

<u>Demonstration of Coupler Weld Strength via Static Tension Testing</u>

The demonstration of coupler weld strength is performed via static tension testing and subsequent statistical analysis of carbon steel embedment plates with welded couplers. The issue regarding lack of requisite AISC N690-1994 NDE on carbon steel embedment plates with welded couplers is common to both Vogtle Units 3 & 4 and V.C. Summer Units 2 & 3. Despite differences between the sites' individual populations of carbon steel embedment plates coupler welds (i.e., two different manufacturers at Vogtle – one vendor at V.C. Summer; Vogtle installed #9 sized couplers – V.C. Summer installed #9 sized and #11 sized couplers) these coupler populations were combined into a single population for the static tension testing statistical analysis for the following reasons:

1. Both embedment plate coupler weld manufacturers used the same weld process and a qualified Welding Procedure Specification (WPS)
2. Variability associated with welders who performed the welds is minimized through the standard qualification process
3. Both manufacturers used weld qualification processes in accordance with AWS D1.1 requirements.
4. Inclusion of both #9 sized and #11 sized coupler welds provides a more robust conclusion of the actual margins of the entire population, as this represents the inclusion of an additional variable present in the combined sample set population for the statistical analysis

Therefore, the following discussion in this Technical Evaluation related to the static tension testing and statistical analysis was developed considering the populations of carbon steel embedment plates with C3J PJP welded couplers with fillet welds from Vogtle Units 3 & 4 and V.C. Summer Units 2 & 3 as a single population.

Recognizing that the requisite NDE was not performed on a representative sample of the installed population of carbon steel embedment plates with welded couplers, a demonstration of sufficient weld strength is necessary to justify the capability of the installed populations of carbon steel embedment plate coupler welds and their associated structural elements to perform their intended design function. Though demonstration of weld strength is not a specific requirement of AISC N690-1994, such a demonstration supports the justification that the installed populations of carbon steel embedment plates with welded couplers are capable of performing their intended design function and are acceptable for use-as-is.

For the population of carbon steel embedment plates with welded couplers, a static tension testing method and test sample populations were determined such that the samples tested are representative of the installed population of welded couplers. As a consideration to the static tension testing method development and in order to credit the statically tested coupler welds as having sufficient strength to perform their intended design function, it was first necessary to establish a reasonable acceptance criterion for the required tensile strength of the coupler welds. A reasonable acceptance criterion for establishing a sufficient demonstration of such weld strength is referenced from ACI 349-01. The acceptance criterion for these tests is aligned with the ACI 349-01 requirement for mechanical anchorage of reinforcing steel. As applicable to the coupler-rebar splice system, a splice made by full mechanical connection must develop 125% of the specified yield strength of the reinforcing steel as required by ACI 349-01, Section 12.14.3.4. ACI 349-01, Section 12.14.3.4 requires that:

> *"A full mechanical connection shall develop in tension or compression, as required, at least 125% of specified yield strength f_y of the bar."*

The Commentary to ACI 349-01, Section 12.14.3 (by reference to ACI 318-95) states that:

> *"The maximum reinforcement stress used in design under the Code is the specified yield strength. To ensure sufficient strength in splices so that yielding can be achieved in a member and thus brittle failure avoided, the 25 percent increase above the specified yield strength was selected as both an adequate minimum for safety and a practicable maximum for economy."*

The coupler strength requirement is extended to the weld to demonstrate that the coupler weld is stronger than the reinforcing bar. The ACI-349-01 requirement for the mechanical connection to meet 125% of the specified strength of the reinforcing bar has been applied to the coupler body, and by extension, the coupler weld to demonstrate that the coupler weld is stronger than the reinforcing bar. The scope of AISC N690-1994, Section Q1.22 includes requirements for design of anchorage of items embedded in concrete that are in tension. AISC N690-1994, Section Q1.22.2.2.2 states:

> *"Design of welded joints shall be in accordance with the requirements of the applicable provisions of this specification."*

The weld strength required to meet the 125% of the specified yield strength of the reinforcing bar exceeds the AISC N690-1994 weld stress limits for design loads. Because the requirement to provide 125% of the specified yield strength of the reinforcing bar is not directly included in AISC N690-1994 Table Q1.5.7.1, the additional AISC N690-1994 Section Q1.0.1 provisions for demonstrating the adequacy of a system of design by analysis or test are followed.

AISC N690-1994, Section Q1.0.1 states that:

> *"The engineers of any system of design or construction within the scope of this specification, the adequacy of which has been shown by successful use or by analysis of test, but which does not conform to or is not covered by this Specification, shall have the right to present the data on which their design is based to the Regulatory Authority for review and approval."*

To ensure that the investigated installed population of #9 sized and #11 sized C3J couplers are adequate in their ability to perform safety function and demonstrate that the weld strength exceeds 125% of the specified yield strength of the reinforcing bar, a representative population was evaluated experimentally in two phases. Details of the two phases of testing and the corresponding results of the statistical evaluations are detailed in statistical analysis calculation developed in support of this LAR and are discussed below.

Phase I: System Testing

Testing was performed for #9 and #11 C3J coupler sizes by the vendors as part of initial qualification tests required in accordance with the test specification. The tests consisted of each coupler size including the reinforcing bar, coupler, and coupler weld. The tension force was applied in compliance with ASTM A370, "*Standard Test Methods and Definitions for Mechanical Testing of Steel Products*."

Testing was performed on a total of four #9 sized couplers and a total of two #11 sized couplers. The static tension tests were performed until either the rebar or the mechanical connection of the rebar to the coupler failed. The static tension test results were evaluated to obtain 90/95% confidence interval break strength for each coupler size per ACI 349-01, Section B.4.2. The Phase I test results demonstrate that the 90/95% confidence interval break strength exceeds 125% of the specified yield strength of the reinforcing bar and demonstrate that the rebar or thread fail before the coupler weld fails in the connection system. Additional detail regarding the results and analysis of Phase I testing is provided later in this Technical Evaluation.

It is noted that ACI 349-01, Section 12.14.3.4.1(b), "*Cyclic Tests*," requires that three specimens of the bar-to-bar connection for each reinforcing bar size and grade shall be subjected to 100 cycles of tensile stress variations from 5% to 90% of the specified minimum yield strength of the reinforcing bar. The specimens shall withstand the cyclic test without loss of static tension strength capacity when compared with like static test specimens. The cyclic testing in ACI 349-01, Section 12.14.3.4.1(b) addresses the mechanical connection, and is a low-cycle elastic load used to demonstrate that the mechanical connection is robust and not subject to disruption under elastic design loads prior to being tested to its static limit. The statistical analysis developed in support of this LAR demonstrates that load cycling does not influence the static break strength for various sizes of C3J couplers. Additional tests (Phase II) were performed by pulling the C3J coupler/weld in tension to failure. The tests were performed statically. Seismic loads are not considered high-cycle events, and are evaluated to static stress limits. The purpose of the weld test is to derive the margin between the proposed static stress limits and the static ultimate strength of the coupler/weld.

Phase II: Coupler Weld Testing

Testing was performed by pulling the #9 and #11 coupler system in tension to failure. The tests were performed by sampling the population of the uninstalled couplers that is representative of those that are installed that did not meet the NDE requirements of AISC N690-1994, Section Q1.26.2. Test samples provide a random sampling of the total population.

Test fixtures were welded onto the coupler/embedment plate sample taken from production run embedment plates to aid in fit-up to the tensile testing machine. A schematic representation of the test assembly is shown in Figure 3-1. The tests were performed at a qualified laboratory using a formal quality assurance (QA) program. Qualified welders performed the welding of fixtures to test samples, following WPS. The tension force was applied in compliance with ASTM A370. A total of thirty #9 samples and three #11 samples were tested in Phase II.

Consideration of the fixture welding potentially impacting the coupler PJP weld to the carbon steel embedment plate was evaluated. According to the statistical analysis developed in support of this LAR, the fixture welding performed as part of the test assembly has no evident affect upon the fabrication weld as depicted by the resulting hardness traverses being similar to the original fabrication sample.

a, c

(See Enclosure 2, Proprietary INSERT 1)

Figure 3-1: Test Assembly

The following items were considered during selection of the sample population. To appropriately represent both vendors, 15 samples were taken from Joseph Oat and 18 samples from Cives. Because these embedment plates were manufactured using the same qualification standards, weld process, weld procedure specifications, and that the failure plane was the same for all samples, the two vendor coupler populations for V.C. Summer and Vogtle were treated as one population for analysis purposes in this Technical Evaluation.

- **Sample Size**
  Thirty test specimens of the #9 coupler size and three test specimens of the #11 coupler size were tested. The sample size was chosen based upon the performance of two proof-of-concept tests for each coupler size which demonstrated that a relatively small sample size would provide the desired confidence. Additionally, a further practical need was introduced by the necessity to demonstrate the samples selected were representative of those installed. To accomplish this, the potential variability of the production runs needed to be captured within the selected sample set.

- **Weld Process**
  The same qualified weld process was used for production welding of both the installed and uninstalled coupler populations. Gas Metal Arc Welding (GMAW) was used in all of the production welds for the root and cap pass on the fillet and PJP weld. This was confirmed through review of the vendors' qualified WPS for each process. This process is American Welding Society (AWS) code approved and the WPS requires qualification by test. Macro samples are required as part of the procedure qualification. The macro sample is required to show full fusion to the root of groove per Section 6.2.6.2 of American Welding Society, "Structural Welding Code – Reinforcing Steel," D1.4-1998 (AWS D1.4-1998). Therefore, the process used demonstrates full root fusion, resulting in equivalence in theoretical effective throat area for a given weld size.

- **Semi-Automatic Process**
  The production welds of both the installed and uninstalled coupler populations were performed with the same process. The GMAW welds were performed using a semi-automatic process in the horizontal position. This is referenced through a review of the vendors' qualified WPS for each process.

- **Human Performance Factors**
  The welders who performed the production welds were required to meet qualification requirements. Referencing the statistical analysis developed in support of this LAR, 92 percent of the work performed by listed Cives welders on production welds for both the installed and uninstalled coupler populations is captured in the selected sample. The same material specifications, design, weld procedures, and to the extent possible the same welders who had performed the original PJP and fillet production welds for the installed coupler population would be representative. All of the Joseph Oat samples that were used for static tension testing were fabricated specifically for this purpose (i.e., supplemental population) because Vogtle had installed all plates that were previously produced (i.e., original production population). All of the Cives carbon steel test samples at both sites (i.e., Vogtle and V.C. Summer) came from embedment plates that were intended to be installed and were performed as part of production welding.

- **Welding Procedure Specification (WPS)**
  The welding procedures used to perform the production welds reflect AWS D1.1 requirements. The same welding procedures were used for both the installed and uninstalled populations. Applicable manufacturer documents/procedures for embedment plates with #9 and #11 sized C3J weldable couplers are referenced in the statistical analysis developed in support of this LAR.

- **Nondestructive Examination (NDE)**
  For a limited number of couplers welded to carbon steel plates, examination in accordance with Section Q1.26.2 of AISC N690-1994 was not performed for the final surface condition. A sample of uninstalled production plates with coupler welds representative of those installed was subsequently examined by MT at the site. A

limited number of coupler welds at Vogtle underwent VT per Section Q1.26.2 of AISC N690-1994 and did not receive a satisfactory rating. These couplers were not tested further with other NDE (i.e., MT) due to their failed VT. The V. C. Summer coupler welds underwent VT with satisfactory results. The sample set selected for static tension testing contains the possible NDE outcomes. The following conditions are referenced in Table 3-6 to identify the NDE condition represented by each static tension test performed in Phase II:

i. Coupler welds which received a satisfactory VT and MT rating per Section Q1.26.2 of AISC N690-1994 with the welds in the original production welded condition. No localized conditioning was performed. This condition is represented in six of the selected samples as shown in Table 3-6.

ii. Coupler welds which received a satisfactory VT rating, but the welds did not undergo any form of MT per Section Q1.26.2 of AISC N690-1994 with the welds in the original production welded condition. No localized conditioning was performed. This condition is represented in ten of the selected samples as shown in Table 3-6.

iii. Coupler welds which received an unsatisfactory VT rating (Vogtle only, i.e., Vogtle on-site VT), but the welds did not undergo any form of MT per Section Q1.26.2 of AISC N690-1994 with the welds in the original production welded condition. No localized conditioning was performed. This condition is represented in two of the selected samples as shown in Table 3-6.

iv. Coupler welds which received a satisfactory VT and MT rating per Section Q1.26.2 of AISC N690-1994 with the welds in the fabricated for static tension testing welded condition. No localized conditioning was performed. This condition is represented in two of the selected samples as shown in Table 3-6.

v. Coupler welds which received a satisfactory VT rating and did not undergo any form of MT per Section Q1.26.2 of AISC N690-1994 with the welds in the fabricated for static tension testing welded condition. No localized conditioning was performed. This condition is represented in nine of the selected samples as shown in Table 3-6.

vi. Coupler welds which received an unsatisfactory VT rating (Vogtle only, i.e., Vogtle on-site VT) and did not undergo any form of MT per Section Q1.26.2 of AISC N690-1994 with the welds in the fabricated for static tension testing welded condition. No localized conditioning was performed. This condition is represented in four of the selected samples as shown in Table 3-6.

- **Filler Metal**

The filler metal was procured in accordance with the applicable specification, as documented in the statistical analysis developed in support of this LAR, for both installed and uninstalled embedment plates. Certified Material Test Reports (CMTR) for the material includes yield, tensile, % elongation, and Charpy impact results. The filler metal meets the requirements of AWS A5.18 for the GMAW process. The weld metal mechanical properties are summarized in Table 3-2 for the GMAW process. The filler metal properties are taken from the work packages as documented in the statistical analysis developed in support of this LAR.

Table 3-2: Weld Filler Metal Mechanical Properties for GMAW

Property	GMAW Filler Metal	
	Specified Minimum per AWS A5.18	CMTR*
Yield Strength, ksi	58	60.31
Tensile Strength, ksi	72.5**	75.23
Elongation, %	22	25
Charpy V-Notch Toughness, ft-lb	20 @ -20°F	38 @ -20°F

* Reported as-welded values from entire population provided by both vendors.
** Specification specifies a minimum of 72.5 ksi. AWS A5.18 minimum is 70 ksi.

- **Coupler Material**

C3J couplers are procured to the requirements of the applicable specification, as documented in the statistical analysis developed in support of this LAR, for both the installed and uninstalled embedment plates. Minimum material properties are referenced in the statistical analysis developed in support of this LAR. CMTRs for the couplers identify the yield and tensile strength of the coupler material. The mechanical properties are taken from the work packages referenced in the statistical analysis developed in support of this LAR. The C3J coupler mechanical properties are detailed in Table 3-3.

Table 3-3: C3J Coupler Mechanical Properties

Vendor Load #	Coupler Diameter [in]	CMTR Yield Strength [ksi]	CMTR Tensile Strength [ksi]	Minimum Yield Strength [ksi]	Minimum Tensile Strength [ksi]
J-2721-A1/A55	1.56 (#9)	97.9	100.4	64	90
4063	1.56 (#9)	97.9	100.4		
2043	1.56 (#9)	97.9	100.4		
4091	2.00 (#11)	95.3	100.7	64	90

- **Fabrication Schedule**

  The dates at which production began and welding/inspection ended at the fabrication facility are identified in the work packages as documented in the statistical analysis developed in support of this LAR. Because the remaining embedment plates available for static tension testing were fabricated toward the end of production for both vendors, a representative population for the entire fabrication duration could not be achieved. To maximize the testing sample, one of the two vendors was contracted to duplicate fabrication efforts to simulate the original installed embedment plates (i.e., Joseph Oat supplemental population). Therefore, production time was not considered, and common characteristics, as previously defined, for installed C3J couplers needed to be demonstrated within the selected testing sample in order to be representative.

<u>Phase I Test Results and Analysis</u>

a, c

(See Enclosure 2, Proprietary INSERT 2)

The sample numbers, break loads, and calculated 90/95% confidence strengths are provided in Table 3-4. Test break forces are referenced from their respective vendor load packages.

a, c

Table 3-4: Weld Failure Test Data and Analysis for Phase I

(See Enclosure 2, Proprietary INSERT 3)

A review of the data reported in Table 3-4 confirms that the 90/95% confidence interval upper bound strength exceeds 125% of the specified yield strength of the reinforcing bar and exceeds the specified tensile strength of the reinforcing bar. In each case, either the rebar or rebar/coupler thread fails prior to weld failure in the connection system. It is noted that the vendor static tests are not associated with a specific Load number shipment, but are applicable to any coupler weld that was constructed to its specific WPS criteria. The vendors used the same approved quality plans in execution of AWS specifications for welding, and qualifications of welders, and inspection of the processes and welds was performed to confirm adherence to the requirements for each coupler size. A summary of the results of Phase I testing and analysis is provided in Table 3-5.

Table 3-5: Comparison of 125% of Specified Yield Strength of Reinforcing Bar to Static Tension Test Results for #9 and #11 Coupler Welds (Phase I Testing)

a, c

(See Enclosure 2, Proprietary INSERT 4)

Phase II Test Results

#9 Coupler Test Results

For all test samples, the failure location was within the C3J coupler body. The minimum code-predicted tensile strength of the filled-in coupler body was calculated to be approximately 172.7 kips, which is higher than the minimum code-predicted tensile strength of the weld (approximately 121.4 kips). The NDE condition of the production weld had no influence on the tested failure strength of the coupler system because all samples failed within the coupler body. In the tests, the welds developed the minimum code-predicted weld strength before failure. The average break load was 193.42 kips. Table 3-6 summarizes the test results, and provides the sample number and NDE condition as previously discussed in this Technical Evaluation.

#11 Coupler Test Results

For all test samples, the failure location was within the C3J coupler body. The minimum code-predicted tensile strength of the filled-in coupler body was calculated to be approximately 282.7 kips, which is higher than the minimum code-predicted tensile strength of the weld (approximately 197.7 kips). The NDE condition of the production weld had no influence on the tested failure strength of the coupler system because all samples failed within the coupler body.

In the tests, the welds developed the minimum code-predicted strength before failure. The average break load was 347.42 kips. Table 3-6 summarizes the test results, and provides the sample number and NDE condition as previously discussed in this Technical Evaluation.

Table 3-6: Test Results for #9 and #11 Test Samples (Phase II)

a, c

(See Enclosure 2, Proprietary INSERT 5)

.

Phase II Test Results Analysis and Calculation of Safety Margin

Phase II testing was performed to investigate the strength of the coupler weld. As previously discussed, each sample failed within the coupler body, which demonstrates that the production PJP with fillet weld is stronger than the filled-in coupler body. Due to the nature of the test set-up and the tensile strengths of each component, it was not possible to drive the failure point to the production weld group. Therefore, the test data demonstrates that the NDE condition of the production weld did not have any influence on the lower bound strength of the coupler system. The tested 33 samples, the sample numbers, break loads and calculated tensile strength of the couplers are identified in Table 3-7 for the two populations. The tensile strength of the filled-in couplers was calculated using the CMTR tensile strength from Table 3-3. The break loads were normalized with the calculated strengths of a filled-in coupler sample, due to that being the location of sample failure. Statistical analysis was performed on the normalized value to derive a "test coefficient (*c*)" for the C3J coupler/welds.

The test data measured for the sample population follows a normal distribution. The one-sided tolerance limit approach can be applied to obtain a coefficient that allows 90/95% confidence interval.

Test Data

a, c

(See Enclosure 2, Proprietary INSERT 6)

The test coefficient (*c*) means the following equation can be used to calculate the coupler body tensile strength with a 90/95% confidence interval. The strength of the coupler weld is greater than this calculated value, but because the failure location for all test samples was within the coupler body, the strength of the system is considered as of that of the coupler body.

a, c

(See Enclosure 2, Proprietary INSERT 7)

Table 3-7: Tensile Test Failure Data and Analysis

(See Enclosure 2, Proprietary INSERT 8)

Safety Margin

Safety margin was calculated using the nominal tensile strength and the test coefficient calculated based on all test data. This coefficient is penalized by lower bound failure modes and a finite sample size. The safety margin (or Factor of Safety, FoS) against the 125% yield strength of the rebar can be defined as:

a, c

(See Enclosure 2, Proprietary INSERT 9)

The minimum safety margin with respect to the 125% yield strength of the rebar and to the system strength was calculated in Table 3-8 and Table 3-9, respectively. Graphical representations of the safety margin with respect to 125% yield strength of the rebar and to the system for #9 and #11 size samples is provided in Figure 3-2 and Figure 3-3, respectively.

Table 3-8: Minimum Safety Margin Compared to 125% Yield Strength of Rebar

(See Enclosure 2, Proprietary INSERT 10)

Table 3-9: Minimum Safety Margin Compared to System Strength

(See Enclosure 2, Proprietary INSERT 11)

a, c

(See Enclosure 2, Proprietary INSERT 12)

Figure 3-2: Minimum Safety Margin of #9 Coupler Weld

a, c

(See Enclosure 2, Proprietary INSERT 13)

Figure 3-3: Minimum Safety Margin of #11 Coupler Weld

Upon review of the analytical results of Phase I and Phase II testing reported in Table 3-5, Table 3-8, and Table 3-9, it is (1) demonstrated that the weakest link in the connection system is the rebar or the threads fail prior to failure of the fillet-reinforced PJP weld; and (2) static tension test results demonstrated sufficient safety margin at the 90/95% confidence level per ACI 349-01 Section B.4.2 beyond the AISC N690-1994 and ACI 349-01 125% yield strength of the reinforcing bar and the weak link (system strength) capacity of the connection system. As such, the aforementioned static tension test results and corresponding statistical analyses are sufficient to demonstrate that the strength of the coupler welds installed at V.C. Summer Units 2 and 3 are capable of performing their intended design function and are acceptable for use-as-is.

<u>Demonstration of Satisfactory AISC N690-1994 Magnetic Particle Examination</u>

AISC N690-1994 is the governing code for weld design. AISC N690-1994, Section Q1.26.2.2, "*Partial-Penetration Welds*," outlines the requirements for weld magnetic particle examination. Section Q1.26.2.2 states,

> "*Partial-penetration welds shall be 10 percent inspected by magnetic particle examination or liquid penetrant examination. The examination may be 10 percent of each weld or 100 percent of one weld in ten.*"

Together with AISC N690-1994, Section Q1.26.2, "*Minimum Examination of Welds*," the combination of satisfactory requisite visual examination and magnetic particle examination of the PJP welds provides reasonable assurance that the PJP welds, and their welded structural elements which are parts of the nuclear safety-related system, would not impair the safety-related functions of these systems or components. The following discussions pertain to the records of magnetic particle examinations in accordance with AISC N690-1994, Section Q1.26.2.2 for the population of carbon steel embedment plates with welded couplers at V.C. Summer Units 2 & 3.

<u>Population of Carbon Steel Embedment Plates with Welded Couplers at V.C. Summer Units 2 & 3</u>

A total of 444 carbon steel embedment plates with a total of 1951 #9 sized and #11 sized C3J Lenton® weldable couplers attached via PJP welds were fabricated by Cives, shipped to V.C. Summer Units 2 and 3, and accepted without the requisite NDE having been performed. Subsequent to receipt and acceptance of the 444 Cives carbon steel embedment plates at V.C. Summer Units 2 and 3, 415 embedment plates with a total of 1748 welded couplers were installed (embedded in concrete) under the V.C. Summer Units 2 & 3 CA20 modules and under the V.C. Summer Unit 2 CA01 module. The remaining 29 carbon steel embedment plates with a total of 203 welded couplers have not been installed and are accessible for NDE.
A sampling inspection plan was developed to perform NDE in accordance with AISC N690-1994 on 10 percent of the total population of the welds on carbon steel embedment plates. A sample set of 200 welded couplers was pooled to perform the requisite magnetic particle examination

from the population of 203 welded couplers that were not embedded in concrete as this sample size is sufficient in magnitude to be representative of 10 percent of the total population of 1951 coupler welds received from Cives. Table 3-10 tabulates the results of the magnetic particle examination performed on-site for the 10 percent sample of Cives coupler welds on carbon steel embedment plates in accordance with AISC N690-1994.

Table 3-10: AISC N690-1994 MT Results on Cives Carbon Steel Embedment Plate Coupler Welds

Shop Load Number	Embedment Plate Tag Number	# of Welds Tested	Pass/Fail
2043	11209-CE-PF036	2	Pass
2043	11209-CE-PF037	4	Pass
2043	11209-CE-PF038	4	Pass
2043	11209-CE-PF039	4	Pass
2043	11209-CE-PF040	4	Pass
2043	11209-CE-PF041	4	Pass
2043	11209-CE-PF042	4	Pass
2043	11209-CE-PF043	4	Pass
2043	11209-CE-PF044	4	Pass
2043	11209-CE-PF045	4	Pass
2043	11209-CE-PF046	4	Pass
2043	11209-CE-PF047	2	Pass
2043	11209-CE-PF048	4	Pass
2043	11209-CE-PF049	3	Pass
2043	11209-CE-PF050	4	Pass
2043	11209-CE-PF051	5	Pass
2043	11209-CE-PF052	4	Pass
2043	11209-CE-PF053	4	Pass
3052	11201-CE-PF349	44	Pass
3052	11201-CE-PF350	8	Pass
3052	11201-CE-PF351	8	Pass
3052	11201-CE-PF352	8	Pass
3052	11201-CE-PF353	8	Pass
3053	11201-CE-PF354	8	Pass
3052	11201-CE-PF355	8	Pass
3052	11201-CE-PF356	8	Pass
3053	11201-CE-PF357	8	Pass
3052	11201-CE-PF358	8	Pass
3064	11201-CE-PF359	16	Pass

A review of the MT results tabulated in Table 3-10 indicates that the NDE performed on the Cives sample set of 200 welded couplers demonstrated 100% satisfactory results. However, it is recognized that the sample set of 200 NDE tested coupler welds is not entirely representative of the total installed population of couplers welded to Cives carbon steel embedment plates, because the 200 NDE tested coupler welds were pooled from only 4 of 11 total Cives shop fabrication loads. Despite the limited number of pooled loads, similarities exist between loads tested and loads untested such as being manufactured by the same fabricator, and using the same WPS and weld processes. Though it is determined that the sample set of Cives welded couplers that underwent MT is not entirely representative of the total installed population of welded couplers, documentation of these satisfactory magnetic particle examinations supports the demonstration of the quality of the Cives carbon steel embedment plates' coupler welds and their supporting welded structural elements as being capable of performing their intended design function.

<u>Conclusion</u>

Based upon the evaluation of the coupler welds, the following conclusions are drawn:

- The requisite AISC N690-1994 100% visual examination regarding entire population (installed and uninstalled) of Cives coupler welds on carbon steel embedment plates is satisfactory in accordance with Section Q1.26.2.
- The Phase I static tension tests confirm that the reinforcing bar or the threads in the coupler fail before the PJP weld with fillet weld reinforcement fails.
- The Phase II static tension tests confirm that there is a minimum FoS of 2.08 (for the #9 sized samples) and 2.19 (for the #11 sized samples) between the calculated tensile strength of the coupler at the 90/95% confidence interval against the 125% minimum yield strength of the reinforcing bar.
- The Phase II static tension tests confirm that there is a minimum FoS of 1.42 (for the #9 sized samples) and 1.59 (for the #11 sized samples) between the calculated tensile strength of the coupler at the 90/95% confidence interval against the weak link (i.e., system strength, rebar/coupler threads) in the connection system.
- The Phase II samples all failed under tension within the coupler body, and demonstrate that the production PJP with fillet weld reinforcement is stronger than the filled-in coupler body. Due to the nature of the test setup and the tensile strengths of each component, it was not possible to drive the failure point to the production weld group. Therefore, the test data demonstrates that the NDE condition of the production weld did not have any influence on the lower bound strength of the coupler system.
- Demonstration of 100% satisfactory magnetic particle testing on a 10% sample of the uninstalled population of Cives coupler welds on carbon steel embedment plates was performed per AISC N690-1994, Section Q1.26.2.2 which supports the determination that the Cives coupler welds are capable of performing their intended design function, though recognizing that the 10% tested sample did not pool coupler welds from all Cives shop fabrication loads.

Change Evaluation

The proposed change demonstrates weld quality and strength of uninstalled production and supplemental populations of #9 sized and #11 sized C3J coupler PJP welds with reinforcing fillet welds using VT, MT, and static tension testing in lieu of NDE as being sufficient for the installed coupler welds to perform their intended design function.

The proposed change does not change the support, design, or operation of mechanical or fluid systems. The proposed change does not impact the support, design, or operation of any safety-related structures. The proposed change does not affect the ability of seismic Category I structures to resist design basis loadings. The change to the evaluation of the coupler welds does not change the capacity, function, or response to anticipated transients or postulated accident conditions of any system, structure, or component (SSC). There is no change to plant systems or the response systems to postulated accident conditions. The proposed change does not affect the prevention or mitigation of abnormal events; e.g., accidents, anticipated operational occurrences, earthquakes, floods and turbine missiles, or their safety or design analyses. There is no change to the predicted radioactive releases due to normal operation or postulated accident conditions. The plant response to previously evaluated accidents or external events is not adversely affected, nor does the proposed change described create any new accident precursors.

The proposed change does not adversely affect any safety-related equipment, design code, design code allowable value, function or design analysis, nor does the proposed change adversely affect any safety analysis input or result, or design/safety margin. The proposed change does not interface with or affect safety-related equipment or a fission product barrier. The change does not result in a new failure mode, malfunction or sequence of events that could adversely affect a radioactive material barrier or safety-related equipment. The proposed change does not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The proposed change does not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses, thus, the consequences of accidents are not affected. This change does not affect the containment, control, channeling, monitoring, processing or releasing of radioactive or non-radioactive materials. The location and design of penetrations and the permeability and waterproofing of the concrete in the exterior walls are not changed. The interface between the nuclear island and the external surrounding environment is not impacted by the proposed change. The types and quantities of expected effluents are not changed. No effluent release path is affected. The functionality of the design and operational features that are credited with controlling the release of effluents during plant operation is not diminished. Therefore, neither radioactive nor non-radioactive material effluents are affected. Plant radiation zones, controls required by 10 CFR Part 20, and expected amounts and types of radioactive materials, are not

affected by the proposed change. Therefore, individual and cumulative radiation exposures do not change.

The proposed change does not involve, nor interface with, any SSC accident initiator or initiating sequence of events, and thus, the probabilities of the accidents evaluated in the UFSAR are not affected.

The proposed change has no adverse effect on the ex-vessel severe accident. The overall design, geometry, and strength of the containment internal structures and other seismic Category I structures are not adversely affected. The design and material selection of the concrete floor beneath the reactor vessel is not altered. The response of the containment to a postulated reactor vessel failure, including direct containment heating, ex-vessel steam explosions, and core concrete interactions is not altered by the change to the evaluation of coupler welds used in structural modules. The design of the reactor vessel and the response of the reactor vessel to a postulated severe accident are not altered by the proposed change.
The proposed change has no adverse impact on the Aircraft Impact Assessment (AIA). The change described is internal to the structures and does not impact the design or response of the containment vessel or shield building because the failure mechanism remains ductile yield of the rebar, as analyzed in the AIA, and not of the weld. There is no change to protection of plant SSCs against aircraft impact provided by the design of the shield building. There is no change to the conclusion that a strike upon the auxiliary building would not result in a loss of spent fuel pool liner integrity. There is no change to the design of key design features described in UFSAR Appendix 19F.

The proposed change does not adversely impact the design of critical sections described in UFSAR Appendix 3H.

The change activity has no impact on the emergency plans or the physical security evaluation because there are no changes to the configuration of walls, doors, or access to the Nuclear Island.

Summary

The proposed change would revise UFSAR Section 3.8.4.5.2 Tier 2* information to specify the supplemental requirements of American Institute of Steel Construction (AISC) N690-1994, “American National Standard Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities,” (AISC N690-1994), Section Q1.26.2.2, “Partial-Penetration Welds,” for the demonstration of sufficient strength and quality of the carbon steel embedment plates coupler welds to be credited as justification for the demonstration that the installed coupler welds are capable of performing their intended design function.
The proposed change does not adversely affect the design functions of the weldable couplers or the structures in which the couplers are used.

The proposed change provides adequate protection for design basis events, does not adversely affect any safety-related equipment, design code and standard allowable value, safety related function or design analysis, nor does the change adversely affect any safety analysis input or result, radioactive missile barrier, or design/safety margin.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR Part 52, Appendix D, VIII.B.6, requires prior NRC approval for the departure from Tier 2* information. This change, which includes changes to supplemental requirements for steel structures includes a Tier 2* departure and thus requires NRC approval. Therefore, a license amendment request (LAR) (as supplied herein) is required.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1 requires that structures be designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety functions to be performed. The proposed change does not adversely change the criteria for the design, analysis, and construction of nuclear island structures. These structures remain in conformance with the code requirements identified in the UFSAR (i.e., applicable portions of ACI 349-01 and AISC N690-1994), including the supplemental requirements identified in the UFSAR Subsection 3.8, as supplemented by this proposed LAR. Therefore, it is concluded that compliance with 10 CFR Part 50, Appendix A, GDC 1 is not impacted as part of the proposed LAR.

10 CFR Part 50, Appendix A, GDC 2 requires that structures withstand the effects of earthquakes and appropriate combinations of the effects of normal and accident conditions, including the effects of environmental loadings, such as earthquakes and other natural phenomena. The proposed change has no impact on the seismic motions to which the nuclear island structures are subjected, no impact on the response of the nuclear island structures to seismic motions, and no impact on the ability of the structures to resist seismic loads. Therefore, it is concluded that compliance with 10 CFR Part 50, Appendix A, GDC 2 is not impacted as part of the proposed LAR.

10 CFR Part 50, Appendix A, GDC 4 requires that systems, structures and components can withstand the dynamic effects associated with missiles, pipe whipping, and discharge fluids, excluding dynamic effects associated with pipe ruptures, the probability of which is extremely low under conditions consistent with the design basis for the piping. The proposed change does not change the configuration of the walls and floors which provide separation between sources and potential targets. The proposed change has no impact on the capability of the systems, structures and components to withstand dynamic effects associated with missiles, pipe whipping, and discharging fluids as

required by the criterion. The proposed change does not change the requirements for anchoring safety related components and supports to seismic Category I structures. Therefore, it is concluded that compliance with 10 CFR Part 50, Appendix A, GDC 4 is not impacted as part of the proposed LAR.

4.2 Precedent

No precedent is identified.

4.3 Significant Hazards Consideration Determination

The requested amendment proposes a change to Updated Final Safety Analysis Report (UFSAR) Tier 2* information to specify the supplemental requirement of American Institute of Steel Construction (AISC) N690-1994, “American National Standard Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities,” (AISC N690-1994), Section Q1.26.2.2, “Partial-Penetration Welds,” for the demonstration of sufficient strength and quality of the carbon steel embedment plate coupler welds to be credited as justification for the determination that the installed coupler welds are capable of performing their intended design function.

The requested amendment proposes a change to Tier 2* information.

An evaluation to determine whether or not a significant hazards consideration is involved with the proposed amendment was completed by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of Amendment,” as discussed below:

4.3.1 Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The proposed change describes how evaluation of coupler strength, and by extension, weld strength and quality are used to demonstrate the capacity of partial joint penetration (PJP) welds with fillet weld reinforcement joining weldable couplers to carbon steel embedment plates as being able to perform their intended design function in lieu of satisfying the American Institute of Steel Construction (AISC) N690-1994, Section Q1.26.2.2 requirement for non-destructive examination (NDE) on 10 percent weld populations. The proposed change does not affect the operation of any systems or equipment that initiates an analyzed accident or alter any structures, systems, and components (SSC) accident initiator or initiating sequence of events.

The change has no adverse effect on the design function of the mechanical couplers or the SSCs to which the mechanical couplers are welded. The probabilities of the accidents evaluated in the Updated Final Safety Analysis Report (UFSAR) are not affected.

The change does not impact the support, design, or operation of mechanical or fluid systems. The change does not impact the support, design, or operation of any safety-related structures. There is no change to plant systems or the response of systems to postulated accident conditions. There is no change to the predicted radioactive releases due to normal operation or postulated accident conditions. The plant response to previously evaluated accidents or external events is not adversely affected, nor does the proposed change create any new accident precursors.

Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

4.3.2 Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed change describes how evaluation of coupler strength, and by extension, weld strength and quality are used to demonstrate the capacity of PJP welds with fillet weld reinforcement joining weldable couplers to carbon steel embedment plates as being able to perform their design function in lieu of satisfying the AISC N690-1994, Section Q1.26.2.2 requirement for non-destructive examination on 10 percent weld populations. The proposed change does not affect the operation of any systems or equipment that may initiate a new or different kind of accident, or alter any SSC such that a new accident initiator or initiating sequence of events is created.

The proposed change does not adversely affect the design function of the mechanical couplers, the structures in which the couplers are used, or any other SSC design functions or methods of operation in a manner that results in a new failure mode, malfunction, or sequence of events that affect safety-related or non-safety-related equipment. This activity does not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that result in significant fuel cladding failures.

Therefore, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

4.3.3 Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No

The proposed change describes how evaluation of coupler strength, and by extension, weld strength and quality are used to demonstrate the capacity of PJP welds with fillet weld reinforcement joining weldable couplers to carbon steel embedment plates as being able to perform their design function in lieu of satisfying the AISC N690-1994, Section Q1.26.2.2 requirement for non-destructive examination on 10 percent weld populations. The proposed change satisfies the same design functions in accordance with the same codes and standards as stated in the UFSAR. This change does not adversely affect compliance with any design code, function, design analysis, safety analysis input or result, or design/safety margin. No safety analysis or design basis acceptance limit/criterion is challenged or exceeded by the proposed change.

Because no safety analysis or design basis acceptance limit/criterion is challenged or exceeded by this change, no significant margin of safety is reduced. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, it is concluded that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

4.4 Conclusions

This assessment addresses the considerations discussed above. The plant licensing bases, safety analyses, and design bases evaluations demonstrate that the requested change is accommodated without an increase in the probability or consequences of an accident previously evaluated, without creating the possibility of a new or different kind of accident from any accident previously evaluated, and without a significant reduction in a margin of safety. In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. Having arrived at negative declarations with regard to the criteria in 10 CFR 50.92, this assessment determined that the requested change does not involve a Significant Hazards Consideration.

5.0 ENVIRONMENTAL CONSIDERATION

This review supports a request to amend the Combined License (COL) to allow departure from various elements of the certification information in the Updated Final Safety Analysis Report (UFSAR) Tier 2*. The proposed amendment specifies the supplemental requirement of American Institute of Steel Construction (AISC) N690-1994, "American National Standard Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities," (AISC N690-1994), Section Q1.26.2.2, "Partial-Penetration Welds," for the demonstration of sufficient strength and quality of the couplers, and by extension, coupler welds on carbon steel embedment plates to be credited in justification for the installed coupler welds being capable of performing their intended design function.

Sections 2 and 3 of this license amendment request (LAR) provide the details of the proposed change.

The Licensee has determined that the anticipated construction and operational effects of the proposed amendment meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), in that:

(i) There is no significant hazards consideration.

As documented in Section 4.3, No Significant Hazards Consideration Determination, of this LAR, an evaluation was completed to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment." The No Significant Hazards Consideration determined that (1) the requested amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) the requested amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated; and (3) the requested amendment does not involve a significant reduction in a margin of safety. Therefore, it is concluded that the requested amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of "no significant hazards consideration" is justified.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

The proposed change revises how evaluation of coupler strength, and by extension, weld strength and quality are used to demonstrate the capacity of PJP welds joining weldable couplers to carbon steel embedment plates satisfies the AISC N690-1994, Section Q1.26.2.2 requirement for non-destructive examination on 10 percent weld populations. Therefore, the proposed change is unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g.,

effluents containing chemicals or biocides, sanitary system effluents, and other effluents), or affect any plant radiological or non-radiological effluent release quantities. Furthermore, the proposed change does not affect any effluent release path or diminish the functionality of any design or operational features that are credited with controlling the release of effluents during plant operation.

Therefore, it is concluded that the requested amendment does not involve a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed change revises how evaluation of coupler strength, and by extension, weld strength and quality are used to demonstrate the capacity of PJP welds joining weldable couplers to carbon steel embedment plates satisfies the AISC N690-1994, Section Q1.26.2.2 requirement for non-destructive examination on 10 percent weld populations. Plant radiation zones (addressed in UFSAR Section 12.3) are not affected, and controls under 10 CFR 20 preclude a significant increase in occupational radiation exposure. Therefore, the requested amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above review of the proposed amendment, it has been determined that anticipated construction and operational impacts of the proposed amendment do not involve, (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

None