UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 24, 2019

Dr. Jennifer L. Uhle
Vice President, Generation and Suppliers
Nuclear Energy Institute
1201 F Street, NW, Suite 1100
Washington, DC 20004

SUBJECT: CLARIFICATION OF REGULATORY PATH FOR LEAD TEST ASSEMBLIES

The purpose of this letter is to finalize the U.S. Nuclear Regulatory Commission (NRC) staff's views on the regulatory positions discussed in the NRC's letter, "Response to Nuclear Energy Institute Letter Concerning the Regulatory Path for Lead Test Assemblies," from Dr. Mirela Gavrilas, NRC, to Mr. Andrew Mauer, Nuclear Energy Institute (NEI), dated June 29, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17150A443). This letter supersedes the June 29, 2017, letter and is intended to clarify several issues in that letter with regard to Section 4.2.1, "Fuel Assemblies," of the Standard Technical Specifications (STS), Volume 1,[1] including guidance on the use of approved methods; Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests, and experiments"; and 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." The guidance in this letter only addresses lead test assembly (LTA) campaigns that meet the STS LTA provision as described below. As the NRC and industry gain more experience with these regulatory approaches, the NRC will continue its engagement with stakeholders to determine whether further guidance is necessary.

LTAs are fuel assemblies that contain design features or materials for which additional data may be needed to support approval for unrestricted use.[2] LTAs have been loaded in operating reactor cores safely over the past several decades. In the past, licensees have taken different approaches when conducting LTA campaigns. Some licensees obtained prior NRC approval via license amendments approving changes to Technical Specification (TS) 4.2.1 or exemptions

---

1 Revision 4.0 of NUREG-1430, "Standard Technical Specifications—Babcock and Wilcox Plants" (ADAMS Accession No. ML12100A177); NUREG-1431, "Standard Technical Specifications—Westinghouse Plants" (ADAMS Accession No. ML12100A222); NUREG-1432, "Standard Technical Specifications—Combustion Engineering Plants" (ADAMS Accession No. ML12102A165); NUREG-1433, "Standard Technical Specifications—General Electric Plants (BWR/4)" (ADAMS Accession No. ML12104A192); and NUREG-1434, "Standard Technical Specifications—General Electric Plants (BWR/6)" (ADAMS Accession No. ML12104A195), all issued April 2012.

2 The term "unrestricted use" means that, unlike LTAs, the fuel has been approved for use at a plant without limits on quantity or placement within the core (except for those limits that are part of the approval). License amendments for approval of unrestricted use are commonly called "fuel transitions." Similar terms sometimes used include "batch quantities" and "reload quantities" of fuel assemblies.

from 10 CFR 50.46 for their LTA campaigns, or both. Other licensees conducted LTA campaigns under 10 CFR 50.59 without additional NRC approval.

LTAs are a necessary and important step in the fuel development and qualification process and have led to safety improvements in the design of nuclear fuel, such as improved resistance to corrosion, improved thermal-hydraulic performance, increased heat transfer properties, and reductions in the number of leaking fuel pins. New features of LTAs can include design and material changes to the fuel, cladding, or other parts of the fuel assembly. For example, an LTA may be nearly identical to the co-resident fuel except for a new fuel assembly filter design, or an LTA may be an assembly with a completely different design and materials.

LTA irradiation campaigns provide knowledge of and experience with irradiated material properties and performance, which is critical for qualifying analytical codes and methods and for developing the design bases to license new fuel material or design features for unrestricted use. In particular, the campaigns accomplish the following tasks:

- collection of data to characterize irradiated material properties and performance;
- provision of irradiated material for subsequent hot-cell examination, characterization, and research;
- demonstration of in-reactor performance.

The “Use of Approved Methods” section below describes the NRC staff’s position on use of approved codes and methods for the analysis of LTAs.

A licensee is responsible for assessing its ability to irradiate LTAs in accordance with its license and must comply with its license and the NRC’s regulations. By doing so, the NRC expects that licensees will load LTAs safely. The remainder of this letter provides background on the STS LTA provision, the staff’s view on the use of approved codes and methods, a description of a regulatory path for implementing LTA campaigns, and LTA-specific guidance for 10 CFR 50.59 and 10 CFR 50.46.

This letter does not address all regulatory requirements that licensees should consider when planning an LTA campaign, such as other TS; 10 CFR 50.68, “Criticality accident requirements”; and transportation and storage requirements in 10 CFR Part 71, “Packaging and Transportation of Radioactive Material,” and in 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste.” Licensees should also remain cognizant of other potential requirements, such as other TS or methodologies that apply more restrictive requirements to LTA campaigns. In any event, a licensee may voluntarily request prior NRC approval under 10 CFR 50.90, “Application for amendment of license, construction permit, or early site permit.”

Standard Technical Specifications Lead Test Assembly Provision

Many licensees have adopted the STS Section 4.2.1 language (e.g., NUREG-1431, Revision 4.0) or other substantively similar language into plant-specific TS, as follows:

> The reactor shall contain [###] fuel assemblies. Each assembly shall consist of a matrix of [Zircaloy or ZIRLO] fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of

> zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

In the past, some licensees have interpreted this TS as requiring a TS amendment to load LTAs using different materials or fuel. The NRC staff has approved such amendments. Other licensees have not submitted amendment requests for their LTA campaigns. This letter clarifies the staff's interpretation of the TS. The first two sentences provide a high-level description of the reactor core (i.e., many features of the reactor core and fuel assemblies important to safety are not described). The first sentence should be read to include LTAs (i.e., LTAs are fuel assemblies and count toward the specified number of fuel assemblies). The third sentence addresses the use of filler rods for the purposes of fuel reconstitution.[3] The fourth sentence requires the use of "fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases." This requirement does not apply to the final sentence, which allows loading of LTAs on a restricted basis. "Representative testing" means testing to fully characterize the irradiated material properties and performance. Because LTAs may, by definition, incorporate new design features or materials, this final sentence can be read as separate from the other limitations placed on fuel assemblies. As such, LTAs loaded under this TS provision may comprise features with different mechanical or material design specifications than the approved, unrestricted co-resident fuel assemblies defined earlier in STS Section 4.2.1. For the remainder of this letter, the term "STS LTA provision" refers to this last sentence of STS Section 4.2.1 and similar plant-specific TS LTA sentences.

Because LTAs have not completed representative testing (i.e., collected sufficient data to fully characterize irradiated material properties and performance), the STS LTA provision restricts LTAs to a "limited number" in "nonlimiting core regions." Licensees can demonstrate compliance with the STS LTA provision that LTAs are of "limited number" and "in nonlimiting core regions" through an evaluation of the LTAs using sound engineering judgment and analytical codes and methods that reflect well-established engineering practices, and by conservatively addressing uncertainties in input parameters and models using the current state of knowledge and all available data to the extent practical. The staff expects that this evaluation will confirm that the updated final safety analysis report (UFSAR) safety analyses and core operating limits report (COLR) limits remain applicable and bounding. If a licensee cannot demonstrate compliance with these restrictions within the STS LTA provision, then prior NRC approval may be necessary to insert LTAs.

The justification for the quantity of LTAs that meet the TS provision of a "limited number" should be informed by the degree of characterization of irradiated material properties and performance for a given material or design change. "Degree of characterization" refers to the amount and quality of the data that support the expected material or design performance. As irradiated material characterization matures, the quantity of "limited number" of LTAs may increase.

---

[3] *See* Generic Letter 90-02, Supplement 1, *available at* http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1990/gl90002s1.html.

Historically, LTA campaigns have ranged from a few rods within a single assembly to eight fuel assemblies,[4] depending on the nature of the design and the degree of prior characterization of the LTAs' performance.

To meet the TS provision of "nonlimiting core region," a licensee should perform an evaluation that demonstrates that the LTAs' core location, combined with their operating parameters (e.g., power density), ensures that the new design features maintain more thermal and mechanical margin to their respective design, performance, and safety limits relative to the co-resident fuel during normal operation, anticipated operational occurrences, and postulated accidents. As such, the performance of the LTAs will not impact the performance of safety-related structures, systems, and components (SSCs) (i.e., their ability to perform intended safety functions). This evaluation should demonstrate that under normal operation, anticipated operational occurrences, and postulated accidents (including loss-of-coolant accidents), the performance of the LTA will not negatively impact the performance of the co-resident fuel and confirm that the design bases, including the UFSAR safety analyses, COLR limits, and applicable terms, limitations, and conditions, remain applicable and bounding.

A licensee may seek to pursue an LTA campaign that does not meet the "limited number" and "nonlimiting core regions" provisions of the STS or substantively similar LTA TS provisions. Two LTA campaigns that would not meet the STS provisions were pursued at Catawba Nuclear Station, Units 1 and 2 (ADAMS Accession No. ML042260223), and Millstone Power Station, Unit 3 (ADAMS Accession No. ML053200224). These LTA campaigns exceeded established limitations on core dynamics and physics predictions, accident progression, or the radiological source term (or a combination of these) such that core operating limits, UFSAR safety analyses, or approved analytical methods were no longer applicable or bounding, or both. In those cases, the licensees sought, and the NRC approved, license amendments. Going forward, LTA campaigns such as these would require a license amendment if they do not meet the provisions of applicable TS.

Use of Approved Methods

In 1981, the NRC staff approved General Electric Company's (GE's) simplified licensing approach for LTAs involving only small changes relative to approved designs for which the design and safety analysis models and criteria documented in the generic reload fuel licensing topical report NEDE-24011-P-A-1, "General Electric Standard Application for Reactor Fuel," (also known as GESTAR) were applicable.[5] This approval stated that "as long as the analysis of the LTAs using approved methods meets the approved criteria, it would be concluded that no unreviewed safety questions [sic] exists."[6] This program predated the STS LTA provision and therefore did not involve consideration of the TS 4.2.1 restrictions regarding "limited number" of LTAs and their placement in a "nonlimiting core region." Other vendors have similar fuel design change processes that have been approved by the NRC.

---

4 U.S. power reactor cores range in size from 121 to 800 fuel assemblies.

5 Ippolito, Thomas A., U.S. Nuclear Regulatory Commission, letter to Ron Engel, General Electric Company, "Lead Test Assembly Licensing," (Sept. 23, 1981) (ADAMS Legacy Library Accession No. 8110090006) (Ippolito Letter); *see also* NEDE-24011-P-A, Rev. 23, General Electric Standard Application for Reactor Fuel (GESTAR II, Main), September 2016 (ADAMS Accession No. ML16250A047) (non-proprietary).

6 Ippolito Letter at 1.

Consistent with its TS (e.g., STS Section 5.6.3, “Core Operating Limits Report”), the licensee must perform reload analyses to establish core operating limits using NRC-approved analytical codes and methods. If a new fuel material or design feature, including an LTA, necessitates a change to these approved analytical codes and methods to determine the COLR limits and UFSAR safety analyses or is not within the terms, limitations, and conditions of the approval, then the licensee should request a license amendment to use the new or changed analytical code or method. In some instances, an approved method already covers an LTA campaign. For example, some plants have methods included in STS Section 5.6.3 that specify conditions for LTA insertion (e.g., NEDE-24011-P-A), in addition to the limitations identified in the STS LTA provision. The NRC has already approved these methods through the topical report approval process, and they continue to be acceptable for use within the scope of their approval.

In some cases, the NRC staff has approved the use of previously unapproved methods for limited analysis of LTAs. For example, in 1981 the staff approved an amendment that allowed the use of LTAs at Peach Bottom Atomic Power Station, even though some of the analysis was outside the bounds of the approved method. In its approval dated May 20, 1981 (ADAMS Accession No. ML011300274), the staff stated in relevant part:

> We believe that the licensee’s decision to use an uncorrected analysis for these four assemblies is acceptable because, (a) the allowable power rating of these assemblies at high exposures is significantly lower than the rest of the core, (b) only four lead test bundles are involved, and (c) the benefits to be derived from this high-burnup lead test assembly program outweigh the small risk that will be taken by relying on an uncorrected analysis.

The NRC staff’s position is that licensees should use approved methods wherever possible; however, approved methods for the LTA fuel (e.g., assembly-specific critical heat flux correlations) may not exist. In those instances, the licensee should perform a conservative evaluation of the LTAs using sound engineering judgment and analytical codes and methods that reflect well-established engineering principles. For example, on January 8, 2003, the staff approved WCAP-15604-NP, Revision. 2-A, “Limited Scope High Burnup Lead Test Assemblies” (ADAMS Accession No. ML070740225). The WCAP states, in relevant part:

> The fuel assembly shall be analyzed using either currently licensed fuel performance design models and methods or modified developmental versions of these models and shall demonstrate that currently licensed design limits are met for the extended burnup analyzed. However, the models and methods used for evaluation of the limited scope LTAs will not be required to be licensed to the projected burnups, but appropriate conservatism should be included. Limited pre-characterization measurements, if necessary, shall be assessed with the fuel performance design models and methods to ensure that the assembly will not exceed design limits after its final cycle of exposure.

As described above, LTA campaigns help to collect the data necessary to approve the codes and methods used for generation of the core operating limits for unrestricted use of a new fuel product. LTAs inserted in nonlimiting locations will, by definition, be within the bounds of the core operating limits.

The evaluation of LTA campaigns requires some engineering judgment because of the incomplete availability of representative data before irradiation of the LTAs, and evaluation may necessitate using modified or different codes and methods in the form of (1) modifications to

approved codes and methods, (2) use of approved codes and methods outside the bounds for which they were explicitly approved, or (3) use of a code or method, based on well-established engineering practices, that the NRC has not previously approved. Use of these modified or different codes and methods, solely for the evaluation of "a limited number" of LTAs, may be acceptable without additional NRC approval for confirming that the LTAs are placed in nonlimiting regions and that the core operating limits and UFSAR safety analyses, which themselves are calculated using approved codes and methods, remain applicable.

The next section of this letter discusses an acceptable regulatory approach and provides guidance on 10 CFR 50.59 and 10 CFR 50.46 related to LTA campaigns.

Regulatory Path for the Standard Technical Specifications Lead Test Assembly Provision

If the licensee's TS contains the STS LTA provision or substantively similar TS provision and there is no conflicting documentation elsewhere in the plant's licensing basis, then a licensee may be able to embark on an LTA campaign that meets the STS LTA provision under 10 CFR 50.59 without prior NRC approval. However, because of the different combinations of licensing basis considerations and TS language, the NRC staff is not providing more specific guidance in this letter for licensees that do not have the STS LTA provision or a substantively similar TS provision.

As described above, licensees complete core reload analyses before refueling the reactor. The NRC staff notes that a licensee may consider an LTA campaign as part of the core reload and evaluate it using the 10 CFR 50.59 process used for the core reload. The paragraphs below provide LTA-specific guidance related to 10 CFR 50.59.

Lead Test Assembly-Specific Guidance on 10 CFR 50.59

LTA campaigns that are not described in the UFSAR meet the definition of a change, test, or experiment under 10 CFR 50.59(a), and the licensee must perform a 10 CFR 50.59 evaluation to determine whether it may proceed with its campaign without prior NRC approval. Several of the 10 CFR 50.59 criteria relevant to LTAs are discussed below.

Section 50.59(c)(1) states:

> A licensee may make changes in the facility as described in the final safety analysis report (as updated), make changes in the procedures as described in the final safety analysis report (as updated), and conduct tests or experiments not described in the final safety analysis report (as updated) without obtaining a license amendment pursuant to § 50.90 only if:
>
> (i) A change to the technical specifications incorporated in the license is not required, and
>
> (ii) The change, test, or experiment does not meet any of the criteria in paragraph (c)(2) of this section.

If a licensee's TS contains a provision allowing for use of LTAs, and if the LTA irradiation campaign satisfies the TS, then a change to that TS is not required (item (i) above).

With respect to item (ii), it may be possible to evaluate all the criteria in 10 CFR 50.59(c)(2) and not trigger the need for a license amendment. Although all criteria must be addressed, 10 CFR 50.59(c)(2)(ii), (vii), and (viii) are of particular relevance to LTA campaigns.

For 10 CFR 50.59(c)(2)(ii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated)," the NRC-endorsed guidance in Section 4.3.2 of NEI 96-07, Revision 1, "Guidelines for 10 CFR 50.59 Implementation," dated November 17, 2000 (ADAMS Accession No. ML003771157), states, in part, that after identifying the affected SSCs and the direct and indirect effects of the proposed activity, "[q]ualitative engineering judgment and/or an industry precedent is typically used to determine if there is more than a minimal increase in the likelihood of occurrence of a malfunction."[7] Section 4.3.2 of NEI 96-07, Revision 1, also states, in relevant part, the following:

> Although this criterion allows minimal increases, licensees must still meet applicable regulatory requirements and other acceptance criteria to which they are committed (such as contained in regulatory guides and nationally recognized industry consensus standards, e.g., the ASME B&PV [American Society of Mechanical Engineers Boiler and Pressure Vessel] Code and IEEE [Institute for Electrical and Electronics Engineers] standards). Further, departures from the design, fabrication, construction, testing and performance standards as outlined in the General Design Criteria (Appendix A to Part 50) are not compatible with a "no more than minimal increase" standard.

The NRC staff expects licensees to evaluate LTAs against applicable design and functional requirements and to ensure that any new failure modes introduced by LTAs are assessed against the existing analyses. For an LTA campaign in which the design and functional requirements and new failure modes are bounded, the licensee may not meet this criterion (and therefore may not require a license amendment because of this criterion). Absent an evaluation showing that the LTAs satisfy the bounding analysis, the licensee would meet this criterion and thus require a license amendment.

For 10 CFR 50.59(c)(2)(vii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered," NEI 96-07, Revision 1, Section 4.3.7 states, in part, that "[i]f an engineering evaluation demonstrates that the analysis presented in the UFSAR remains bounding, then no further 10 CFR 50.59(c)(2)(vii) evaluation is required." If the LTA campaign demonstrates, via the selection of a "limited number" of LTAs placed in "nonlimiting core regions," that the COLR limits and UFSAR safety analyses continue to be applicable and remain bounding, then the licensee may not meet this criterion (and therefore may not require a license amendment because of this criterion). For example, if an LTA campaign impacts a design-basis parameter (such as linear heat generation rate), but does not challenge the existing design-basis limit associated with that parameter, then the limit remains bounding. If, however, the LTA is inserted such that the design-basis

---

[7] Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," issued November 2000 (ADAMS Accession No. ML003759710), states that NEI 96-07, Revision 1, provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.59.

parameter exceeds the design-basis limit associated with that parameter, then the criterion would be met and prior NRC approval would be required to change the limit.

With respect to 10 CFR 50.59(c)(2)(viii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses," NEI 96-07, Revision 1, Section 4.3.8.1 states, in relevant part:

> The definition of "departure..." provides licensees with the flexibility to make changes under 10 CFR 50.59 to methods of evaluation whose results are "conservative" or that are not important with respect to the demonstrations of performance that the analyses provide. Changes to elements of analysis methods that yield conservative results, or results that are essentially the same, would not be departures from approved methods.

The guidance in Section 4.3.8.2 of NEI 96-07, Revision 1, related to changing from one method of evaluation to another, is not necessary for LTA campaigns that meet the STS LTA provision. This is because such LTAs will not affect the performance of safety-related SSCs, and therefore, the method of evaluation used in establishing the design bases will remain the same. In such cases, the licensee may not meet 10 CFR 50.59(c)(2)(viii), and therefore, may not require a license amendment because of this criterion.

Exemptions from 10 CFR 50.46(a)(1)(i) for Lead Test Assembly Campaigns

Section 50.46 provides a means (via analytical requirements and prescriptive analytical limits) to satisfy General Design Criterion 35, "Emergency core cooling," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic licensing of production and utilization facilities." The requirements in 10 CFR 50.46 apply to light-water reactors fueled with uranium oxide pellets within cylindrical Zircaloy or ZIRLO cladding; however, section 50.46 does not expressly prohibit the use of alternate fuel designs. In the past, some licensees have requested exemptions to expand the applicability of 10 CFR 50.46 to other zirconium alloys. The NRC staff has granted these exemptions based upon supporting evidence that demonstrated the applicability of the analytical requirements and limits within 10 CFR 50.46 to the new zirconium alloy and the alloy's acceptable performance under loss-of-coolant accident conditions.

Insertion of LTAs under the STS LTA provision requires demonstration that under normal operation, anticipated operational occurrences, and postulated accidents, the performance of the LTAs will not negatively impact the performance of the co-resident fuel and confirmation that the UFSAR safety analyses and COLR limits remain applicable and bounding. This includes the demonstration of emergency core cooling system performance required to ensure compliance with 10 CFR 50.46, if applicable. In other words, the LTAs' performance must not significantly influence the plant's behavior under loss-of-coolant accident conditions or adversely affect the performance of the emergency core cooling system. Under these conditions, the licensee remains compliant with 10 CFR 50.46 because the emergency core cooling system performance demonstration remains applicable and bounding. In the staff's view, therefore, exemptions to "expand" the applicability of 10 CFR 50.46 to other materials may not be required to conduct an LTA campaign under the STS LTA provision. If a licensee determines that an exemption is not needed, it must maintain compliance with its licensing basis.

If the STS LTA provision requirements are not satisfied, then an exemption from 10 CFR 50.46 may be required.

Conclusions

LTAs are a necessary and important step in the fuel-development process and have led to safety improvements in the design of nuclear fuel. LTAs provide the material and data necessary to license new design features and provide in-reactor performance demonstration before broader commercial implementation. Throughout LTA campaigns, safety remains the primary focus of the NRC.

This letter supersedes the June 29, 2017, letter and clarifies the NRC staff's position on STS Section 4.2.1 as it relates to LTAs, including guidance on the use of approved methods, 10 CFR 50.59, and 10 CFR 50.46. It is important to note that, regardless of the approach taken by a licensee, the NRC maintains plant oversight via the Reactor Oversight Process, which includes sampling of licensees' 10 CFR 50.59 evaluations. This letter also finalizes the NRC staff's view that LTA campaigns may not require exemptions from 10 CFR 50.46. This letter does not address all regulatory requirements that licensees should consider when planning an LTA campaign, such as other TSs, 10 CFR 50.68 requirements, and transportation and storage requirements in 10 CFR Part 71 and 10 CFR Part 72. A licensee contemplating an LTA campaign should consider such issues.

Direct questions on this letter to Kimberly Green at 301-415-1627 or Kimberly.Green@nrc.gov, Phil McKenna at 301-415-0037 or Philip.McKenna@nrc.gov, or Reed Anzalone at 301-415-2988 or Reed.Anzalone@nrc.gov.

Sincerely,

/RA/

Ho K. Nieh, Director
Office of Nuclear Reactor Regulation

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 24, 2019

Mr. Keith Jury
Vice President, Regulatory Assurance
Entergy Services, Inc.
1340 Echelon Parkway
M-ECH-61
Jackson, MS 39213

SUBJECT: CLARIFICATION OF REGULATORY PATH FOR LEAD TEST ASSEMBLIES

The purpose of this letter is to finalize the U.S. Nuclear Regulatory Commission (NRC) staff's views on the regulatory positions discussed in the NRC's letter, "Response to Nuclear Energy Institute Letter Concerning the Regulatory Path for Lead Test Assemblies," from Dr. Mirela Gavrilas, NRC, to Mr. Andrew Mauer, Nuclear Energy Institute (NEI), dated June 29, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17150A443). This letter supersedes the June 29, 2017, letter and is intended to clarify several issues in that letter with regard to Section 4.2.1, "Fuel Assemblies," of the Standard Technical Specifications (STS), Volume 1,[1] including guidance on the use of approved methods; Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests, and experiments"; and 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." The guidance in this letter only addresses lead test assembly (LTA) campaigns that meet the STS LTA provision as described below. As the NRC and industry gain more experience with these regulatory approaches, the NRC will continue its engagement with stakeholders to determine whether further guidance is necessary.

LTAs are fuel assemblies that contain design features or materials for which additional data may be needed to support approval for unrestricted use.[2] LTAs have been loaded in operating reactor cores safely over the past several decades. In the past, licensees have taken different approaches when conducting LTA campaigns. Some licensees obtained prior NRC approval via license amendments approving changes to Technical Specification (TS) 4.2.1 or exemptions

---

1 Revision 4.0 of NUREG-1430, "Standard Technical Specifications—Babcock and Wilcox Plants" (ADAMS Accession No. ML12100A177); NUREG-1431, "Standard Technical Specifications—Westinghouse Plants" (ADAMS Accession No. ML12100A222); NUREG-1432, "Standard Technical Specifications—Combustion Engineering Plants" (ADAMS Accession No. ML12102A165); NUREG-1433, "Standard Technical Specifications—General Electric Plants (BWR/4)" (ADAMS Accession No. ML12104A192); and NUREG-1434, "Standard Technical Specifications—General Electric Plants (BWR/6)" (ADAMS Accession No. ML12104A195), all issued April 2012.

2 The term "unrestricted use" means that, unlike LTAs, the fuel has been approved for use at a plant without limits on quantity or placement within the core (except for those limits that are part of the approval). License amendments for approval of unrestricted use are commonly called "fuel transitions." Similar terms sometimes used include "batch quantities" and "reload quantities" of fuel assemblies.

from 10 CFR 50.46 for their LTA campaigns, or both. Other licensees conducted LTA campaigns under 10 CFR 50.59 without additional NRC approval.

LTAs are a necessary and important step in the fuel development and qualification process and have led to safety improvements in the design of nuclear fuel, such as improved resistance to corrosion, improved thermal-hydraulic performance, increased heat transfer properties, and reductions in the number of leaking fuel pins. New features of LTAs can include design and material changes to the fuel, cladding, or other parts of the fuel assembly. For example, an LTA may be nearly identical to the co-resident fuel except for a new fuel assembly filter design, or an LTA may be an assembly with a completely different design and materials.

LTA irradiation campaigns provide knowledge of and experience with irradiated material properties and performance, which is critical for qualifying analytical codes and methods and for developing the design bases to license new fuel material or design features for unrestricted use. In particular, the campaigns accomplish the following tasks:

- collection of data to characterize irradiated material properties and performance;
- provision of irradiated material for subsequent hot-cell examination, characterization, and research;
- demonstration of in-reactor performance.

The “Use of Approved Methods” section below describes the NRC staff’s position on use of approved codes and methods for the analysis of LTAs.

A licensee is responsible for assessing its ability to irradiate LTAs in accordance with its license and must comply with its license and the NRC’s regulations. By doing so, the NRC expects that licensees will load LTAs safely. The remainder of this letter provides background on the STS LTA provision, the staff’s view on the use of approved codes and methods, a description of a regulatory path for implementing LTA campaigns, and LTA-specific guidance for 10 CFR 50.59 and 10 CFR 50.46.

This letter does not address all regulatory requirements that licensees should consider when planning an LTA campaign, such as other TS; 10 CFR 50.68, “Criticality accident requirements”; and transportation and storage requirements in 10 CFR Part 71, “Packaging and Transportation of Radioactive Material,” and in 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste.” Licensees should also remain cognizant of other potential requirements, such as other TS or methodologies that apply more restrictive requirements to LTA campaigns. In any event, a licensee may voluntarily request prior NRC approval under 10 CFR 50.90, “Application for amendment of license, construction permit, or early site permit.”

Standard Technical Specifications Lead Test Assembly Provision

Many licensees have adopted the STS Section 4.2.1 language (e.g., NUREG-1431, Revision 4.0) or other substantively similar language into plant-specific TS, as follows:

> The reactor shall contain [###] fuel assemblies. Each assembly shall consist of a matrix of [Zircaloy or ZIRLO] fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of

> zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

In the past, some licensees have interpreted this TS as requiring a TS amendment to load LTAs using different materials or fuel. The NRC staff has approved such amendments. Other licensees have not submitted amendment requests for their LTA campaigns. This letter clarifies the staff's interpretation of the TS. The first two sentences provide a high-level description of the reactor core (i.e., many features of the reactor core and fuel assemblies important to safety are not described). The first sentence should be read to include LTAs (i.e., LTAs are fuel assemblies and count toward the specified number of fuel assemblies). The third sentence addresses the use of filler rods for the purposes of fuel reconstitution.[3] The fourth sentence requires the use of "fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases." This requirement does not apply to the final sentence, which allows loading of LTAs on a restricted basis. "Representative testing" means testing to fully characterize the irradiated material properties and performance. Because LTAs may, by definition, incorporate new design features or materials, this final sentence can be read as separate from the other limitations placed on fuel assemblies. As such, LTAs loaded under this TS provision may comprise features with different mechanical or material design specifications than the approved, unrestricted co-resident fuel assemblies defined earlier in STS Section 4.2.1. For the remainder of this letter, the term "STS LTA provision" refers to this last sentence of STS Section 4.2.1 and similar plant-specific TS LTA sentences.

Because LTAs have not completed representative testing (i.e., collected sufficient data to fully characterize irradiated material properties and performance), the STS LTA provision restricts LTAs to a "limited number" in "nonlimiting core regions." Licensees can demonstrate compliance with the STS LTA provision that LTAs are of "limited number" and "in nonlimiting core regions" through an evaluation of the LTAs using sound engineering judgment and analytical codes and methods that reflect well-established engineering practices, and by conservatively addressing uncertainties in input parameters and models using the current state of knowledge and all available data to the extent practical. The staff expects that this evaluation will confirm that the updated final safety analysis report (UFSAR) safety analyses and core operating limits report (COLR) limits remain applicable and bounding. If a licensee cannot demonstrate compliance with these restrictions within the STS LTA provision, then prior NRC approval may be necessary to insert LTAs.

The justification for the quantity of LTAs that meet the TS provision of a "limited number" should be informed by the degree of characterization of irradiated material properties and performance for a given material or design change. "Degree of characterization" refers to the amount and quality of the data that support the expected material or design performance. As irradiated material characterization matures, the quantity of "limited number" of LTAs may increase.

---

[3] *See* Generic Letter 90-02, Supplement 1, *available at* http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1990/gl90002s1.html.

Historically, LTA campaigns have ranged from a few rods within a single assembly to eight fuel assemblies,[4] depending on the nature of the design and the degree of prior characterization of the LTAs' performance.

To meet the TS provision of "nonlimiting core region," a licensee should perform an evaluation that demonstrates that the LTAs' core location, combined with their operating parameters (e.g., power density), ensures that the new design features maintain more thermal and mechanical margin to their respective design, performance, and safety limits relative to the co-resident fuel during normal operation, anticipated operational occurrences, and postulated accidents. As such, the performance of the LTAs will not impact the performance of safety-related structures, systems, and components (SSCs) (i.e., their ability to perform intended safety functions). This evaluation should demonstrate that under normal operation, anticipated operational occurrences, and postulated accidents (including loss-of-coolant accidents), the performance of the LTA will not negatively impact the performance of the co-resident fuel and confirm that the design bases, including the UFSAR safety analyses, COLR limits, and applicable terms, limitations, and conditions, remain applicable and bounding.

A licensee may seek to pursue an LTA campaign that does not meet the "limited number" and "nonlimiting core regions" provisions of the STS or substantively similar LTA TS provisions. Two LTA campaigns that would not meet the STS provisions were pursued at Catawba Nuclear Station, Units 1 and 2 (ADAMS Accession No. ML042260223), and Millstone Power Station, Unit 3 (ADAMS Accession No. ML053200224). These LTA campaigns exceeded established limitations on core dynamics and physics predictions, accident progression, or the radiological source term (or a combination of these) such that core operating limits, UFSAR safety analyses, or approved analytical methods were no longer applicable or bounding, or both. In those cases, the licensees sought, and the NRC approved, license amendments. Going forward, LTA campaigns such as these would require a license amendment if they do not meet the provisions of applicable TS.

Use of Approved Methods

In 1981, the NRC staff approved General Electric Company's (GE's) simplified licensing approach for LTAs involving only small changes relative to approved designs for which the design and safety analysis models and criteria documented in the generic reload fuel licensing topical report NEDE-24011-P-A-1, "General Electric Standard Application for Reactor Fuel," (also known as GESTAR) were applicable.[5] This approval stated that "as long as the analysis of the LTAs using approved methods meets the approved criteria, it would be concluded that no unreviewed safety questions [sic] exists."[6] This program predated the STS LTA provision and therefore did not involve consideration of the TS 4.2.1 restrictions regarding "limited number" of LTAs and their placement in a "nonlimiting core region." Other vendors have similar fuel design change processes that have been approved by the NRC.

---

4 U.S. power reactor cores range in size from 121 to 800 fuel assemblies.

5 Ippolito, Thomas A., U.S. Nuclear Regulatory Commission, letter to Ron Engel, General Electric Company, "Lead Test Assembly Licensing," (Sept. 23, 1981) (ADAMS Legacy Library Accession No. 8110090006) (Ippolito Letter); *see also* NEDE-24011-P-A, Rev. 23, General Electric Standard Application for Reactor Fuel (GESTAR II, Main), September 2016 (ADAMS Accession No. ML16250A047) (non-proprietary).

6 Ippolito Letter at 1.

Consistent with its TS (e.g., STS Section 5.6.3, “Core Operating Limits Report”), the licensee must perform reload analyses to establish core operating limits using NRC-approved analytical codes and methods. If a new fuel material or design feature, including an LTA, necessitates a change to these approved analytical codes and methods to determine the COLR limits and UFSAR safety analyses or is not within the terms, limitations, and conditions of the approval, then the licensee should request a license amendment to use the new or changed analytical code or method. In some instances, an approved method already covers an LTA campaign. For example, some plants have methods included in STS Section 5.6.3 that specify conditions for LTA insertion (e.g., NEDE-24011-P-A), in addition to the limitations identified in the STS LTA provision. The NRC has already approved these methods through the topical report approval process, and they continue to be acceptable for use within the scope of their approval.

In some cases, the NRC staff has approved the use of previously unapproved methods for limited analysis of LTAs. For example, in 1981 the staff approved an amendment that allowed the use of LTAs at Peach Bottom Atomic Power Station, even though some of the analysis was outside the bounds of the approved method. In its approval dated May 20, 1981 (ADAMS Accession No. ML011300274), the staff stated in relevant part:

> We believe that the licensee’s decision to use an uncorrected analysis for these four assemblies is acceptable because, (a) the allowable power rating of these assemblies at high exposures is significantly lower than the rest of the core, (b) only four lead test bundles are involved, and (c) the benefits to be derived from this high-burnup lead test assembly program outweigh the small risk that will be taken by relying on an uncorrected analysis.

The NRC staff’s position is that licensees should use approved methods wherever possible; however, approved methods for the LTA fuel (e.g., assembly-specific critical heat flux correlations) may not exist. In those instances, the licensee should perform a conservative evaluation of the LTAs using sound engineering judgment and analytical codes and methods that reflect well-established engineering principles. For example, on January 8, 2003, the staff approved WCAP-15604-NP, Revision. 2-A, “Limited Scope High Burnup Lead Test Assemblies” (ADAMS Accession No. ML070740225). The WCAP states, in relevant part:

> The fuel assembly shall be analyzed using either currently licensed fuel performance design models and methods or modified developmental versions of these models and shall demonstrate that currently licensed design limits are met for the extended burnup analyzed. However, the models and methods used for evaluation of the limited scope LTAs will not be required to be licensed to the projected burnups, but appropriate conservatism should be included. Limited pre-characterization measurements, if necessary, shall be assessed with the fuel performance design models and methods to ensure that the assembly will not exceed design limits after its final cycle of exposure.

As described above, LTA campaigns help to collect the data necessary to approve the codes and methods used for generation of the core operating limits for unrestricted use of a new fuel product. LTAs inserted in nonlimiting locations will, by definition, be within the bounds of the core operating limits.

The evaluation of LTA campaigns requires some engineering judgment because of the incomplete availability of representative data before irradiation of the LTAs, and evaluation may necessitate using modified or different codes and methods in the form of (1) modifications to

approved codes and methods, (2) use of approved codes and methods outside the bounds for which they were explicitly approved, or (3) use of a code or method, based on well-established engineering practices, that the NRC has not previously approved. Use of these modified or different codes and methods, solely for the evaluation of "a limited number" of LTAs, may be acceptable without additional NRC approval for confirming that the LTAs are placed in nonlimiting regions and that the core operating limits and UFSAR safety analyses, which themselves are calculated using approved codes and methods, remain applicable.

The next section of this letter discusses an acceptable regulatory approach and provides guidance on 10 CFR 50.59 and 10 CFR 50.46 related to LTA campaigns.

Regulatory Path for the Standard Technical Specifications Lead Test Assembly Provision

If the licensee's TS contains the STS LTA provision or substantively similar TS provision and there is no conflicting documentation elsewhere in the plant's licensing basis, then a licensee may be able to embark on an LTA campaign that meets the STS LTA provision under 10 CFR 50.59 without prior NRC approval. However, because of the different combinations of licensing basis considerations and TS language, the NRC staff is not providing more specific guidance in this letter for licensees that do not have the STS LTA provision or a substantively similar TS provision.

As described above, licensees complete core reload analyses before refueling the reactor. The NRC staff notes that a licensee may consider an LTA campaign as part of the core reload and evaluate it using the 10 CFR 50.59 process used for the core reload. The paragraphs below provide LTA-specific guidance related to 10 CFR 50.59.

Lead Test Assembly-Specific Guidance on 10 CFR 50.59

LTA campaigns that are not described in the UFSAR meet the definition of a change, test, or experiment under 10 CFR 50.59(a), and the licensee must perform a 10 CFR 50.59 evaluation to determine whether it may proceed with its campaign without prior NRC approval. Several of the 10 CFR 50.59 criteria relevant to LTAs are discussed below.

Section 50.59(c)(1) states:

> A licensee may make changes in the facility as described in the final safety analysis report (as updated), make changes in the procedures as described in the final safety analysis report (as updated), and conduct tests or experiments not described in the final safety analysis report (as updated) without obtaining a license amendment pursuant to § 50.90 only if:
>
> (iii) A change to the technical specifications incorporated in the license is not required, and
>
> (iv) The change, test, or experiment does not meet any of the criteria in paragraph (c)(2) of this section.

If a licensee's TS contains a provision allowing for use of LTAs, and if the LTA irradiation campaign satisfies the TS, then a change to that TS is not required (item (i) above).

With respect to item (ii), it may be possible to evaluate all the criteria in 10 CFR 50.59(c)(2) and not trigger the need for a license amendment. Although all criteria must be addressed, 10 CFR 50.59(c)(2)(ii), (vii), and (viii) are of particular relevance to LTA campaigns.

For 10 CFR 50.59(c)(2)(ii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated)," the NRC-endorsed guidance in Section 4.3.2 of NEI 96-07, Revision 1, "Guidelines for 10 CFR 50.59 Implementation," dated November 17, 2000 (ADAMS Accession No. ML003771157), states, in part, that after identifying the affected SSCs and the direct and indirect effects of the proposed activity, "[q]ualitative engineering judgment and/or an industry precedent is typically used to determine if there is more than a minimal increase in the likelihood of occurrence of a malfunction."[7] Section 4.3.2 of NEI 96-07, Revision 1, also states, in relevant part, the following:

> Although this criterion allows minimal increases, licensees must still meet applicable regulatory requirements and other acceptance criteria to which they are committed (such as contained in regulatory guides and nationally recognized industry consensus standards, e.g., the ASME B&PV [American Society of Mechanical Engineers Boiler and Pressure Vessel] Code and IEEE [Institute for Electrical and Electronics Engineers] standards). Further, departures from the design, fabrication, construction, testing and performance standards as outlined in the General Design Criteria (Appendix A to Part 50) are not compatible with a "no more than minimal increase" standard.

The NRC staff expects licensees to evaluate LTAs against applicable design and functional requirements and to ensure that any new failure modes introduced by LTAs are assessed against the existing analyses. For an LTA campaign in which the design and functional requirements and new failure modes are bounded, the licensee may not meet this criterion (and therefore may not require a license amendment because of this criterion). Absent an evaluation showing that the LTAs satisfy the bounding analysis, the licensee would meet this criterion and thus require a license amendment.

For 10 CFR 50.59(c)(2)(vii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered," NEI 96-07, Revision 1, Section 4.3.7 states, in part, that "[i]f an engineering evaluation demonstrates that the analysis presented in the UFSAR remains bounding, then no further 10 CFR 50.59(c)(2)(vii) evaluation is required." If the LTA campaign demonstrates, via the selection of a "limited number" of LTAs placed in "nonlimiting core regions," that the COLR limits and UFSAR safety analyses continue to be applicable and remain bounding, then the licensee may not meet this criterion (and therefore may not require a license amendment because of this criterion). For example, if an LTA campaign impacts a design-basis parameter (such as linear heat generation rate), but does not challenge the existing design-basis limit associated with that parameter, then the limit remains bounding. If, however, the LTA is inserted such that the design-basis

---

[7] Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," issued November 2000 (ADAMS Accession No. ML003759710), states that NEI 96-07, Revision 1, provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.59.

parameter exceeds the design-basis limit associated with that parameter, then the criterion would be met and prior NRC approval would be required to change the limit.

With respect to 10 CFR 50.59(c)(2)(viii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses," NEI 96-07, Revision 1, Section 4.3.8.1 states, in relevant part:

> The definition of "departure..." provides licensees with the flexibility to make changes under 10 CFR 50.59 to methods of evaluation whose results are "conservative" or that are not important with respect to the demonstrations of performance that the analyses provide. Changes to elements of analysis methods that yield conservative results, or results that are essentially the same, would not be departures from approved methods.

The guidance in Section 4.3.8.2 of NEI 96-07, Revision 1, related to changing from one method of evaluation to another, is not necessary for LTA campaigns that meet the STS LTA provision. This is because such LTAs will not affect the performance of safety-related SSCs, and therefore, the method of evaluation used in establishing the design bases will remain the same. In such cases, the licensee may not meet 10 CFR 50.59(c)(2)(viii), and therefore, may not require a license amendment because of this criterion.

Exemptions from 10 CFR 50.46(a)(1)(i) for Lead Test Assembly Campaigns

Section 50.46 provides a means (via analytical requirements and prescriptive analytical limits) to satisfy General Design Criterion 35, "Emergency core cooling," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic licensing of production and utilization facilities." The requirements in 10 CFR 50.46 apply to light-water reactors fueled with uranium oxide pellets within cylindrical Zircaloy or ZIRLO cladding; however, section 50.46 does not expressly prohibit the use of alternate fuel designs. In the past, some licensees have requested exemptions to expand the applicability of 10 CFR 50.46 to other zirconium alloys. The NRC staff has granted these exemptions based upon supporting evidence that demonstrated the applicability of the analytical requirements and limits within 10 CFR 50.46 to the new zirconium alloy and the alloy's acceptable performance under loss-of-coolant accident conditions.

Insertion of LTAs under the STS LTA provision requires demonstration that under normal operation, anticipated operational occurrences, and postulated accidents, the performance of the LTAs will not negatively impact the performance of the co-resident fuel and confirmation that the UFSAR safety analyses and COLR limits remain applicable and bounding. This includes the demonstration of emergency core cooling system performance required to ensure compliance with 10 CFR 50.46, if applicable. In other words, the LTAs' performance must not significantly influence the plant's behavior under loss-of-coolant accident conditions or adversely affect the performance of the emergency core cooling system. Under these conditions, the licensee remains compliant with 10 CFR 50.46 because the emergency core cooling system performance demonstration remains applicable and bounding. In the staff's view, therefore, exemptions to "expand" the applicability of 10 CFR 50.46 to other materials may not be required to conduct an LTA campaign under the STS LTA provision. If a licensee determines that an exemption is not needed, it must maintain compliance with its licensing basis.

If the STS LTA provision requirements are not satisfied, then an exemption from 10 CFR 50.46 may be required.

Conclusions

LTAs are a necessary and important step in the fuel-development process and have led to safety improvements in the design of nuclear fuel. LTAs provide the material and data necessary to license new design features and provide in-reactor performance demonstration before broader commercial implementation. Throughout LTA campaigns, safety remains the primary focus of the NRC.

This letter supersedes the June 29, 2017, letter and clarifies the NRC staff's position on STS Section 4.2.1 as it relates to LTAs, including guidance on the use of approved methods, 10 CFR 50.59, and 10 CFR 50.46. It is important to note that, regardless of the approach taken by a licensee, the NRC maintains plant oversight via the Reactor Oversight Process, which includes sampling of licensees' 10 CFR 50.59 evaluations. This letter also finalizes the NRC staff's view that LTA campaigns may not require exemptions from 10 CFR 50.46. This letter does not address all regulatory requirements that licensees should consider when planning an LTA campaign, such as other TSs, 10 CFR 50.68 requirements, and transportation and storage requirements in 10 CFR Part 71 and 10 CFR Part 72. A licensee contemplating an LTA campaign should consider such issues.

Direct questions on this letter to Kimberly Green at 301-415-1627 or Kimberly.Green@nrc.gov, Phil McKenna at 301-415-0037 or Philip.McKenna@nrc.gov, or Reed Anzalone at 301-415-2988 or Reed.Anzalone@nrc.gov.

Sincerely,

/RA/

Ho K. Nieh, Director
Office of Nuclear Reactor Regulation

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 24, 2019

Mr. Don Moul
Vice President, Nuclear Division and
Chief Nuclear Officer
Florida Power & Light Company
NextEra Energy
Mail Stop: NT3/JW
15430 Endeavor Drive
Jupiter, FL 33478

SUBJECT: CLARIFICATION OF REGULATORY PATH FOR LEAD TEST ASSEMBLIES

The purpose of this letter is to finalize the U.S. Nuclear Regulatory Commission (NRC) staff's views on the regulatory positions discussed in the NRC's letter, "Response to Nuclear Energy Institute Letter Concerning the Regulatory Path for Lead Test Assemblies," from Dr. Mirela Gavrilas, NRC, to Mr. Andrew Mauer, Nuclear Energy Institute (NEI), dated June 29, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17150A443). This letter supersedes the June 29, 2017, letter and is intended to clarify several issues in that letter with regard to Section 4.2.1, "Fuel Assemblies," of the Standard Technical Specifications (STS), Volume 1,[1] including guidance on the use of approved methods; Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests, and experiments"; and 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." The guidance in this letter only addresses lead test assembly (LTA) campaigns that meet the STS LTA provision as described below. As the NRC and industry gain more experience with these regulatory approaches, the NRC will continue its engagement with stakeholders to determine whether further guidance is necessary.

LTAs are fuel assemblies that contain design features or materials for which additional data may be needed to support approval for unrestricted use.[2] LTAs have been loaded in operating reactor cores safely over the past several decades. In the past, licensees have taken different approaches when conducting LTA campaigns. Some licensees obtained prior NRC approval

---

1 Revision 4.0 of NUREG-1430, "Standard Technical Specifications—Babcock and Wilcox Plants" (ADAMS Accession No. ML12100A177); NUREG-1431, "Standard Technical Specifications—Westinghouse Plants" (ADAMS Accession No. ML12100A222); NUREG-1432, "Standard Technical Specifications—Combustion Engineering Plants" (ADAMS Accession No. ML12102A165); NUREG-1433, "Standard Technical Specifications—General Electric Plants (BWR/4)" (ADAMS Accession No. ML12104A192); and NUREG-1434, "Standard Technical Specifications—General Electric Plants (BWR/6)" (ADAMS Accession No. ML12104A195), all issued April 2012.

2 The term "unrestricted use" means that, unlike LTAs, the fuel has been approved for use at a plant without limits on quantity or placement within the core (except for those limits that are part of the approval). License amendments for approval of unrestricted use are commonly called "fuel transitions." Similar terms sometimes used include "batch quantities" and "reload quantities" of fuel assemblies.

via license amendments approving changes to Technical Specification (TS) 4.2.1 or exemptions from 10 CFR 50.46 for their LTA campaigns, or both. Other licensees conducted LTA campaigns under 10 CFR 50.59 without additional NRC approval.

LTAs are a necessary and important step in the fuel development and qualification process and have led to safety improvements in the design of nuclear fuel, such as improved resistance to corrosion, improved thermal-hydraulic performance, increased heat transfer properties, and reductions in the number of leaking fuel pins. New features of LTAs can include design and material changes to the fuel, cladding, or other parts of the fuel assembly. For example, an LTA may be nearly identical to the co-resident fuel except for a new fuel assembly filter design, or an LTA may be an assembly with a completely different design and materials.

LTA irradiation campaigns provide knowledge of and experience with irradiated material properties and performance, which is critical for qualifying analytical codes and methods and for developing the design bases to license new fuel material or design features for unrestricted use. In particular, the campaigns accomplish the following tasks:

- collection of data to characterize irradiated material properties and performance;
- provision of irradiated material for subsequent hot-cell examination, characterization, and research;
- demonstration of in-reactor performance.

The “Use of Approved Methods” section below describes the NRC staff’s position on use of approved codes and methods for the analysis of LTAs.

A licensee is responsible for assessing its ability to irradiate LTAs in accordance with its license and must comply with its license and the NRC’s regulations. By doing so, the NRC expects that licensees will load LTAs safely. The remainder of this letter provides background on the STS LTA provision, the staff’s view on the use of approved codes and methods, a description of a regulatory path for implementing LTA campaigns, and LTA-specific guidance for 10 CFR 50.59 and 10 CFR 50.46.

This letter does not address all regulatory requirements that licensees should consider when planning an LTA campaign, such as other TS; 10 CFR 50.68, “Criticality accident requirements”; and transportation and storage requirements in 10 CFR Part 71, “Packaging and Transportation of Radioactive Material,” and in 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste.” Licensees should also remain cognizant of other potential requirements, such as other TS or methodologies that apply more restrictive requirements to LTA campaigns. In any event, a licensee may voluntarily request prior NRC approval under 10 CFR 50.90, “Application for amendment of license, construction permit, or early site permit.”

Standard Technical Specifications Lead Test Assembly Provision

Many licensees have adopted the STS Section 4.2.1 language (e.g., NUREG-1431, Revision 4.0) or other substantively similar language into plant-specific TS, as follows:

> The reactor shall contain [###] fuel assemblies. Each assembly shall consist of a matrix of [Zircaloy or ZIRLO] fuel rods with an initial composition of natural or

> slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

In the past, some licensees have interpreted this TS as requiring a TS amendment to load LTAs using different materials or fuel. The NRC staff has approved such amendments. Other licensees have not submitted amendment requests for their LTA campaigns. This letter clarifies the staff's interpretation of the TS. The first two sentences provide a high-level description of the reactor core (i.e., many features of the reactor core and fuel assemblies important to safety are not described). The first sentence should be read to include LTAs (i.e., LTAs are fuel assemblies and count toward the specified number of fuel assemblies). The third sentence addresses the use of filler rods for the purposes of fuel reconstitution.[3] The fourth sentence requires the use of "fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases." This requirement does not apply to the final sentence, which allows loading of LTAs on a restricted basis. "Representative testing" means testing to fully characterize the irradiated material properties and performance. Because LTAs may, by definition, incorporate new design features or materials, this final sentence can be read as separate from the other limitations placed on fuel assemblies. As such, LTAs loaded under this TS provision may comprise features with different mechanical or material design specifications than the approved, unrestricted co-resident fuel assemblies defined earlier in STS Section 4.2.1. For the remainder of this letter, the term "STS LTA provision" refers to this last sentence of STS Section 4.2.1 and similar plant-specific TS LTA sentences.

Because LTAs have not completed representative testing (i.e., collected sufficient data to fully characterize irradiated material properties and performance), the STS LTA provision restricts LTAs to a "limited number" in "nonlimiting core regions." Licensees can demonstrate compliance with the STS LTA provision that LTAs are of "limited number" and "in nonlimiting core regions" through an evaluation of the LTAs using sound engineering judgment and analytical codes and methods that reflect well-established engineering practices, and by conservatively addressing uncertainties in input parameters and models using the current state of knowledge and all available data to the extent practical. The staff expects that this evaluation will confirm that the updated final safety analysis report (UFSAR) safety analyses and core operating limits report (COLR) limits remain applicable and bounding. If a licensee cannot demonstrate compliance with these restrictions within the STS LTA provision, then prior NRC approval may be necessary to insert LTAs.

The justification for the quantity of LTAs that meet the TS provision of a "limited number" should be informed by the degree of characterization of irradiated material properties and performance for a given material or design change. "Degree of characterization" refers to the amount and quality of the data that support the expected material or design performance. As irradiated

---

[3] *See* Generic Letter 90-02, Supplement 1, *available at* http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1990/gl90002s1.html.

material characterization matures, the quantity of "limited number" of LTAs may increase. Historically, LTA campaigns have ranged from a few rods within a single assembly to eight fuel assemblies,[4] depending on the nature of the design and the degree of prior characterization of the LTAs' performance.

To meet the TS provision of "nonlimiting core region," a licensee should perform an evaluation that demonstrates that the LTAs' core location, combined with their operating parameters (e.g., power density), ensures that the new design features maintain more thermal and mechanical margin to their respective design, performance, and safety limits relative to the co-resident fuel during normal operation, anticipated operational occurrences, and postulated accidents. As such, the performance of the LTAs will not impact the performance of safety-related structures, systems, and components (SSCs) (i.e., their ability to perform intended safety functions). This evaluation should demonstrate that under normal operation, anticipated operational occurrences, and postulated accidents (including loss-of-coolant accidents), the performance of the LTA will not negatively impact the performance of the co-resident fuel and confirm that the design bases, including the UFSAR safety analyses, COLR limits, and applicable terms, limitations, and conditions, remain applicable and bounding.

A licensee may seek to pursue an LTA campaign that does not meet the "limited number" and "nonlimiting core regions" provisions of the STS or substantively similar LTA TS provisions. Two LTA campaigns that would not meet the STS provisions were pursued at Catawba Nuclear Station, Units 1 and 2 (ADAMS Accession No. ML042260223), and Millstone Power Station, Unit 3 (ADAMS Accession No. ML053200224). These LTA campaigns exceeded established limitations on core dynamics and physics predictions, accident progression, or the radiological source term (or a combination of these) such that core operating limits, UFSAR safety analyses, or approved analytical methods were no longer applicable or bounding, or both. In those cases, the licensees sought, and the NRC approved, license amendments. Going forward, LTA campaigns such as these would require a license amendment if they do not meet the provisions of applicable TS.

Use of Approved Methods

In 1981, the NRC staff approved General Electric Company's (GE's) simplified licensing approach for LTAs involving only small changes relative to approved designs for which the design and safety analysis models and criteria documented in the generic reload fuel licensing topical report NEDE-24011-P-A-1, "General Electric Standard Application for Reactor Fuel," (also known as GESTAR) were applicable.[5] This approval stated that "as long as the analysis of the LTAs using approved methods meets the approved criteria, it would be concluded that no unreviewed safety questions [sic] exists."[6] This program predated the STS LTA provision and therefore did not involve consideration of the TS 4.2.1 restrictions regarding "limited number" of LTAs and their placement in a "nonlimiting core region." Other vendors have similar fuel design change processes that have been approved by the NRC.

---

4 U.S. power reactor cores range in size from 121 to 800 fuel assemblies.

5 Ippolito, Thomas A., U.S. Nuclear Regulatory Commission, letter to Ron Engel, General Electric Company, "Lead Test Assembly Licensing," (Sept. 23, 1981) (ADAMS Legacy Library Accession No. 8110090006) (Ippolito Letter); *see also* NEDE-24011-P-A, Rev. 23, General Electric Standard Application for Reactor Fuel (GESTAR II, Main), September 2016 (ADAMS Accession No. ML16250A047) (non-proprietary).

6 Ippolito Letter at 1.

Consistent with its TS (e.g., STS Section 5.6.3, “Core Operating Limits Report”), the licensee must perform reload analyses to establish core operating limits using NRC-approved analytical codes and methods. If a new fuel material or design feature, including an LTA, necessitates a change to these approved analytical codes and methods to determine the COLR limits and UFSAR safety analyses or is not within the terms, limitations, and conditions of the approval, then the licensee should request a license amendment to use the new or changed analytical code or method. In some instances, an approved method already covers an LTA campaign. For example, some plants have methods included in STS Section 5.6.3 that specify conditions for LTA insertion (e.g., NEDE-24011-P-A), in addition to the limitations identified in the STS LTA provision. The NRC has already approved these methods through the topical report approval process, and they continue to be acceptable for use within the scope of their approval.

In some cases, the NRC staff has approved the use of previously unapproved methods for limited analysis of LTAs. For example, in 1981 the staff approved an amendment that allowed the use of LTAs at Peach Bottom Atomic Power Station, even though some of the analysis was outside the bounds of the approved method. In its approval dated May 20, 1981 (ADAMS Accession No. ML011300274), the staff stated in relevant part:

> We believe that the licensee’s decision to use an uncorrected analysis for these four assemblies is acceptable because, (a) the allowable power rating of these assemblies at high exposures is significantly lower than the rest of the core, (b) only four lead test bundles are involved, and (c) the benefits to be derived from this high-burnup lead test assembly program outweigh the small risk that will be taken by relying on an uncorrected analysis.

The NRC staff’s position is that licensees should use approved methods wherever possible; however, approved methods for the LTA fuel (e.g., assembly-specific critical heat flux correlations) may not exist. In those instances, the licensee should perform a conservative evaluation of the LTAs using sound engineering judgment and analytical codes and methods that reflect well-established engineering principles. For example, on January 8, 2003, the staff approved WCAP-15604-NP, Revision. 2-A, “Limited Scope High Burnup Lead Test Assemblies” (ADAMS Accession No. ML070740225). The WCAP states, in relevant part:

> The fuel assembly shall be analyzed using either currently licensed fuel performance design models and methods or modified developmental versions of these models and shall demonstrate that currently licensed design limits are met for the extended burnup analyzed. However, the models and methods used for evaluation of the limited scope LTAs will not be required to be licensed to the projected burnups, but appropriate conservatism should be included. Limited pre-characterization measurements, if necessary, shall be assessed with the fuel performance design models and methods to ensure that the assembly will not exceed design limits after its final cycle of exposure.

As described above, LTA campaigns help to collect the data necessary to approve the codes and methods used for generation of the core operating limits for unrestricted use of a new fuel product. LTAs inserted in nonlimiting locations will, by definition, be within the bounds of the core operating limits.

The evaluation of LTA campaigns requires some engineering judgment because of the incomplete availability of representative data before irradiation of the LTAs, and evaluation may necessitate using modified or different codes and methods in the form of (1) modifications to

approved codes and methods, (2) use of approved codes and methods outside the bounds for which they were explicitly approved, or (3) use of a code or method, based on well-established engineering practices, that the NRC has not previously approved. Use of these modified or different codes and methods, solely for the evaluation of "a limited number" of LTAs, may be acceptable without additional NRC approval for confirming that the LTAs are placed in nonlimiting regions and that the core operating limits and UFSAR safety analyses, which themselves are calculated using approved codes and methods, remain applicable.

The next section of this letter discusses an acceptable regulatory approach and provides guidance on 10 CFR 50.59 and 10 CFR 50.46 related to LTA campaigns.

Regulatory Path for the Standard Technical Specifications Lead Test Assembly Provision

If the licensee's TS contains the STS LTA provision or substantively similar TS provision and there is no conflicting documentation elsewhere in the plant's licensing basis, then a licensee may be able to embark on an LTA campaign that meets the STS LTA provision under 10 CFR 50.59 without prior NRC approval. However, because of the different combinations of licensing basis considerations and TS language, the NRC staff is not providing more specific guidance in this letter for licensees that do not have the STS LTA provision or a substantively similar TS provision.

As described above, licensees complete core reload analyses before refueling the reactor. The NRC staff notes that a licensee may consider an LTA campaign as part of the core reload and evaluate it using the 10 CFR 50.59 process used for the core reload. The paragraphs below provide LTA-specific guidance related to 10 CFR 50.59.

Lead Test Assembly-Specific Guidance on 10 CFR 50.59

LTA campaigns that are not described in the UFSAR meet the definition of a change, test, or experiment under 10 CFR 50.59(a), and the licensee must perform a 10 CFR 50.59 evaluation to determine whether it may proceed with its campaign without prior NRC approval. Several of the 10 CFR 50.59 criteria relevant to LTAs are discussed below.

Section 50.59(c)(1) states:

> A licensee may make changes in the facility as described in the final safety analysis report (as updated), make changes in the procedures as described in the final safety analysis report (as updated), and conduct tests or experiments not described in the final safety analysis report (as updated) without obtaining a license amendment pursuant to § 50.90 only if:
>
> (v) A change to the technical specifications incorporated in the license is not required, and
>
> (vi) The change, test, or experiment does not meet any of the criteria in paragraph (c)(2) of this section.

If a licensee's TS contains a provision allowing for use of LTAs, and if the LTA irradiation campaign satisfies the TS, then a change to that TS is not required (item (i) above).

With respect to item (ii), it may be possible to evaluate all the criteria in 10 CFR 50.59(c)(2) and not trigger the need for a license amendment. Although all criteria must be addressed, 10 CFR 50.59(c)(2)(ii), (vii), and (viii) are of particular relevance to LTA campaigns.

For 10 CFR 50.59(c)(2)(ii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated)," the NRC-endorsed guidance in Section 4.3.2 of NEI 96-07, Revision 1, "Guidelines for 10 CFR 50.59 Implementation," dated November 17, 2000 (ADAMS Accession No. ML003771157), states, in part, that after identifying the affected SSCs and the direct and indirect effects of the proposed activity, "[q]ualitative engineering judgment and/or an industry precedent is typically used to determine if there is more than a minimal increase in the likelihood of occurrence of a malfunction."[7] Section 4.3.2 of NEI 96-07, Revision 1, also states, in relevant part, the following:

> Although this criterion allows minimal increases, licensees must still meet applicable regulatory requirements and other acceptance criteria to which they are committed (such as contained in regulatory guides and nationally recognized industry consensus standards, e.g., the ASME B&PV [American Society of Mechanical Engineers Boiler and Pressure Vessel] Code and IEEE [Institute for Electrical and Electronics Engineers] standards). Further, departures from the design, fabrication, construction, testing and performance standards as outlined in the General Design Criteria (Appendix A to Part 50) are not compatible with a "no more than minimal increase" standard.

The NRC staff expects licensees to evaluate LTAs against applicable design and functional requirements and to ensure that any new failure modes introduced by LTAs are assessed against the existing analyses. For an LTA campaign in which the design and functional requirements and new failure modes are bounded, the licensee may not meet this criterion (and therefore may not require a license amendment because of this criterion). Absent an evaluation showing that the LTAs satisfy the bounding analysis, the licensee would meet this criterion and thus require a license amendment.

For 10 CFR 50.59(c)(2)(vii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered," NEI 96-07, Revision 1, Section 4.3.7 states, in part, that "[i]f an engineering evaluation demonstrates that the analysis presented in the UFSAR remains bounding, then no further 10 CFR 50.59(c)(2)(vii) evaluation is required." If the LTA campaign demonstrates, via the selection of a "limited number" of LTAs placed in "nonlimiting core regions," that the COLR limits and UFSAR safety analyses continue to be applicable and remain bounding, then the licensee may not meet this criterion (and therefore may not require a license amendment because of this criterion). For example, if an LTA campaign impacts a design-basis parameter (such as linear heat generation rate), but does not challenge the existing design-basis limit associated with that parameter, then the limit remains bounding. If, however, the LTA is inserted such that the design-basis

---

[7] Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," issued November 2000 (ADAMS Accession No. ML003759710), states that NEI 96-07, Revision 1, provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.59.

parameter exceeds the design-basis limit associated with that parameter, then the criterion would be met and prior NRC approval would be required to change the limit.

With respect to 10 CFR 50.59(c)(2)(viii), under which a licensee shall obtain a license amendment prior to implementing a change, test, or experiment that would "result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses," NEI 96-07, Revision 1, Section 4.3.8.1 states, in relevant part:

> The definition of "departure..." provides licensees with the flexibility to make changes under 10 CFR 50.59 to methods of evaluation whose results are "conservative" or that are not important with respect to the demonstrations of performance that the analyses provide. Changes to elements of analysis methods that yield conservative results, or results that are essentially the same, would not be departures from approved methods.

The guidance in Section 4.3.8.2 of NEI 96-07, Revision 1, related to changing from one method of evaluation to another, is not necessary for LTA campaigns that meet the STS LTA provision. This is because such LTAs will not affect the performance of safety-related SSCs, and therefore, the method of evaluation used in establishing the design bases will remain the same. In such cases, the licensee may not meet 10 CFR 50.59(c)(2)(viii), and therefore, may not require a license amendment because of this criterion.

Exemptions from 10 CFR 50.46(a)(1)(i) for Lead Test Assembly Campaigns

Section 50.46 provides a means (via analytical requirements and prescriptive analytical limits) to satisfy General Design Criterion 35, "Emergency core cooling," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic licensing of production and utilization facilities." The requirements in 10 CFR 50.46 apply to light-water reactors fueled with uranium oxide pellets within cylindrical Zircaloy or ZIRLO cladding; however, section 50.46 does not expressly prohibit the use of alternate fuel designs. In the past, some licensees have requested exemptions to expand the applicability of 10 CFR 50.46 to other zirconium alloys. The NRC staff has granted these exemptions based upon supporting evidence that demonstrated the applicability of the analytical requirements and limits within 10 CFR 50.46 to the new zirconium alloy and the alloy's acceptable performance under loss-of-coolant accident conditions.

Insertion of LTAs under the STS LTA provision requires demonstration that under normal operation, anticipated operational occurrences, and postulated accidents, the performance of the LTAs will not negatively impact the performance of the co-resident fuel and confirmation that the UFSAR safety analyses and COLR limits remain applicable and bounding. This includes the demonstration of emergency core cooling system performance required to ensure compliance with 10 CFR 50.46, if applicable. In other words, the LTAs' performance must not significantly influence the plant's behavior under loss-of-coolant accident conditions or adversely affect the performance of the emergency core cooling system. Under these conditions, the licensee remains compliant with 10 CFR 50.46 because the emergency core cooling system performance demonstration remains applicable and bounding. In the staff's view, therefore, exemptions to "expand" the applicability of 10 CFR 50.46 to other materials may not be required to conduct an LTA campaign under the STS LTA provision. If a licensee determines that an exemption is not needed, it must maintain compliance with its licensing basis.

If the STS LTA provision requirements are not satisfied, then an exemption from 10 CFR 50.46 may be required.

Conclusions

LTAs are a necessary and important step in the fuel-development process and have led to safety improvements in the design of nuclear fuel. LTAs provide the material and data necessary to license new design features and provide in-reactor performance demonstration before broader commercial implementation. Throughout LTA campaigns, safety remains the primary focus of the NRC.

This letter supersedes the June 29, 2017, letter and clarifies the NRC staff's position on STS Section 4.2.1 as it relates to LTAs, including guidance on the use of approved methods, 10 CFR 50.59, and 10 CFR 50.46. It is important to note that, regardless of the approach taken by a licensee, the NRC maintains plant oversight via the Reactor Oversight Process, which includes sampling of licensees' 10 CFR 50.59 evaluations. This letter also finalizes the NRC staff's view that LTA campaigns may not require exemptions from 10 CFR 50.46. This letter does not address all regulatory requirements that licensees should consider when planning an LTA campaign, such as other TSs, 10 CFR 50.68 requirements, and transportation and storage requirements in 10 CFR Part 71 and 10 CFR Part 72. A licensee contemplating an LTA campaign should consider such issues.

Direct questions on this letter to Kimberly Green at 301-415-1627 or Kimberly.Green@nrc.gov, Phil McKenna at 301-415-0037 or Philip.McKenna@nrc.gov, or Reed Anzalone at 301-415-2988 or Reed.Anzalone@nrc.gov.

Sincerely,

/RA/

Ho K. Nieh, Director
Office of Nuclear Reactor Regulation

SUBJECT: CLARIFICATION OF REGULATORY PATHS FOR LEAD TEST ASSEMBLIES DATED JUNE 24, 2019

DISTRIBUTION:

PUBLIC
RidsNrrDorl Resource
RidsNrrDss Resource
RidsNrrDirs Resource
RidsNrrOd Resource
RidsRgn1MailCenter Resource
RidsRgn2MailCenter Resource
RidsRgn3MailCenter Resource
RidsRgn4MailCenter Resource
RidsOpaMail Resource
RidsOcaMailCenter Resource
RidsACRS_MailCTR Resource
RidsOgcMailCenter Resource
RidsNrrOd Resource
RidsNrrDorl Resource
RidsNrrDss Resource
RidsNrrDssSrxb Resource
RidsNrrDirs Resource
RidsNrrDorlLAJBurkhardt Resource
KGreen, NRR
Josh Whitman, NRR
RAnzalone, NRR
PClifford, NRR
PMcKenna, NRR

ADAMS Accession No.: ML18323A169 ***concurrence via email**

OFFICE	NRR/DORL/LSPB/LA	QTE*	NRR/DSS/SRXB/BC*
NAME	JBurkhardt	KAzariah-Kribbs	JWhitman
DATE	11/20/18	11/27/18	12/21/18
OFFICE	NRR/DSS*	NRR/DSS/D*	NRR/DIRS/DD (acting)*
NAME	PClifford	MGavrilas	JGroom
DATE	12/21/18	12/21/18	12/21/18
OFFICE	NRR/DORL/DD*	OGC*	NRR/D
NAME	KBrock	KGamin (NLO w/edits)	HNieh
DATE	12/21/18	1/18/19	06/24/19

OFFICIAL RECORD COPY

SUBJECT: CLARIFICATION OF REGULATORY PATHS FOR LEAD TEST ASSEMBLIES DATED JUNE 24, 2019

Identical letters sent to:

Dr. Jennifer L. Uhle
Vice President, Generation and Suppliers
Nuclear Energy Institute
1201 F Street, NW, Suite 1100
Washington, DC 20004

Mr. Keith Jury
Vice President, Regulatory Assurance
Entergy Services, Inc.
1340 Echelon Parkway
M-ECH-61
Jackson, MS 39213

Mr. Don Moul
Vice President, Nuclear Division and Chief Nuclear Officer
Florida Power & Light Company
Mail Stop: NT3/JW
15430 Endeavor Drive
Jupiter, FL 33478