

**U.S. NUCLEAR REGULATORY COMMISSION REGULATORY AUDIT OF  
GLOBAL NUCLEAR FUEL – AMERICAS (GNF) TOPICAL REPORT,  
NEDE-24011-P-A-29, GESTAR II, AMENDMENT 51  
APPENDIX B, LEAD ASSEMBLY PROGRAMS  
AUDIT SUMMARY REPORT**

## **1.0 BACKGROUND**

By letter dated March 17, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20077J160), Global Nuclear Fuel – Americas, LLC (GNF) submitted Amendment 51 to NEDE-24011-P-A-29, *General Electric Standard Application for Nuclear Fuel (GESTAR II)* for U.S. Nuclear Regulatory Commission (NRC) staff review. Amendment 51 involves two modifications stemming from past NRC audits: (1) updating the lead fuel assembly provisions and (2) adding a new subsection containing a commitment to confirm the applicability of the GESTAR II design criteria for a new fuel assembly. This audit focused on the lead fuel assembly portion of Amendment 51.

The existing lead fuel assembly requirements in GESTAR II are a composite of old letters which have been a source of confusion and questions over the years. The proposed new content improves the definitions for lead fuel assemblies and clarifies the differences in test requirements and numbers for the different types of lead assemblies. Specifically, an overarching lead fuel assembly program is presented that defines a different lead use program for each of three different types of lead assemblies: lead test assemblies (LTAs), lead use assemblies (LUAs), and high burnup lead use assemblies (HBLUAs). The process is encapsulated in a new appendix to GESTAR II.

The audit is conducted with the intent to gain understanding, to verify information, and to identify information that will require docketing to support the basis of a licensing or regulatory decision. Performing a regulatory audit is expected to assist the U.S. Nuclear Regulatory Commission (NRC) staff in efficiently conducting its review and gaining insights to the licensee's processes and procedures. Information that the NRC staff relies upon to make the safety determination must be submitted on the docket.

Due to the corona virus disease (COVID)-19 pandemic, the audit was conducted remotely using multiple webinars to facilitate discussions. The audit took place over several weeks in May - June 2020. Participants in the audit are listed in Table 1. Because the audit was limited in scope and straight-forward in nature, no audit plan was issued.

## **2.0 AUDIT OBJECTIVES**

Amendment 51 to NEDE-24011-P-A-29 (GESTAR II) adds Appendix B, *Lead Assembly Programs*. The main objectives of the audit were to gain understanding, seek clarification, resolve open items, and clarify the definitions and limitations in the new lead fuel assembly provisions. The staff's concerns, audit discussions, and proposed changes to the lead assembly provisions are detailed in Section 3 of this audit report.

**Table 1: List of Attendees**

<b>NAME</b>	<b>ORGANIZATION</b>
Paul Clifford	NRC
Kevin Heller	NRC
Robert Lukes	NRC
Ngola Otto	NRC
James Harrison	GNF
Kent Halac	GNF
Paul Cantonwine	GNF
Russ Fawcett	GNF
Russell Stachowski	GNF
Charles Lamb	GNF
Patty McCumbee	GNF
Randy Jacobs	GNF

### **3.0 DISCUSSIONS**

#### **Technical Specification Lead Test Assembly Provision:**

Boiling Water Reactor (BWR) Standard Technical Specifications (STS) include a common lead test assembly (LTA) provision within Section 4.2.1, *Fuel Assemblies*.

A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

A majority of operating BWRs contain this provision or language very similar. Section B.1 of Amendment 51 refers to this LTA provision and states "... a licensee may load lead assemblies according to the requirements defined in this appendix, provided GESTAR II is referenced in the Technical Specifications (TS)." During the audit, NRC and GNF staff discussed the need to clarify the bases for satisfying the limited number and non-limiting location requirements within the TS LTA provision for each type of lead use program. Based on these discussions, GNF proposed new or modified text to address the following topics:

- Connection between GESTAR II Appendix B and TS 4.2.1 LTA provision
- Licensee's Title 10 of the Code of Federal Regulations (10 CFR) 50.59, "Changes, Tests and Experiments," evaluation of lead use program and when a license amendment request may be needed
- Bases for specified limited number of LUAs and HBLUAs in different BWR core configurations
- Bases of limited number of LTAs
- Treatment of concurrent lead use programs in different BWR core configurations
- Bases for non-limiting location for each lead use program during normal operations and under design basis accident (DCA) conditions

General agreement for the proposed modifications to Appendix B was reached during the audit. The following request for additional information (RAI) captures the additional information needed (and docketed) to support the staff's safety finding.

**RAI #1:** Section B.1 of Amendment 51 refers to TS 4.2.1 LTA provision and states "... a licensee may load lead assemblies according to the requirements defined in this appendix, provided GESTAR II is referenced in the Technical Specifications." Please

provide modifications to Appendix B needed to clarify the connection between GESTAR II Lead Assembly Programs, TS 4.2.1 LTA provision and restrictions, and 50.59.

### **HBLUA Fuel Burnup Limit:**

Section B.2.3.1, "Burnup Limit and Quantities of HBLUAs)," proposes that HBLUAs be allowed to achieve a maximum fuel pellet burnup equivalent to GNF's operating experience in European BWRs. During the audit, GNF presented a summary of their European operating experience. This information is necessary to justify the limiting quantity of HBLUAs proposed in Appendix B. The following RAI captures the additional information needed (and docketed) to support the staff's safety finding.

**RAI #2:** Section B.2.3.1 of Amendment 51 defines a quantity of HBLUAs satisfying the limited number provision of TS 4.2.1 LTA provision. In addition, this section defines a maximum allowable fuel burnup limit based on European operating experience. Please provide a summary of the European operating experience including established burnup limits, distribution of assemblies achieving exposures beyond current U.S. regulatory limit and at or beyond proposed HBLUA BU limit, post-irradiation examinations and measurements, and evidence supporting the validation of existing analytical models and acceptance criteria at the proposed burnup limit.

### **Lead Use Radiological Consequence Assessment:**

Section B.2.3.2, "HBLUA Limitations and Exceptions," of Amendment 51 states "...licensees may take exception to the Regulatory Guide 1.183 guidance...". This assertion is based on "*studies have indicated that the gap fractions in Regulatory Guide 1.183 are conservatively acceptable for increased exposures and the radial peaking of high exposure bundles would be substantially less than licensing basis peaking assumptions*". During the audit, NRC and GNF staff discussed the text and requirements related to radiological consequence assessments for lead use programs. The staff had concerns that Appendix B did not clearly stipulate that licensees must demonstrate that current UFSAR radiological consequence assessments remain applicable and bounding.

Based on these discussions, GNF proposed new or modified text to address the following topics:

- GNF's lead assembly technical evaluation report will demonstrate that all radiological consequences docketed within the licensee's UFSAR remain conservative even with some bundles or rods exceeding current exposure limits
- Given the low probability of occurrence for postulated DBAs, limited quantities, and non-limiting locations, changes to inputs and assumptions used in the technical evaluation to demonstrate that existing UFSAR radiological consequences remain conservative do not constitute a departure from an approved methodology as defined by 50.59 and the requirement of NRC approval to use under 10 CFR 50.67, "Accident Source Term."
- Examples of acceptable changes to inputs and assumptions

General agreement for the proposed modifications to Appendix B was reached during the audit. The following RAI captures the additional information needed (and docketed) to support the staff's safety finding.

**RAI #3:** Section B.2.3.2 of Amendment 51 describes a potential conflict between HBLUAs and limitations of applicability defined in RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors." Please provide modifications to Appendix B needed to clarify the need to demonstrate that all radiological consequences docketed within the licensee's UFSAR remain conservative for all lead use programs even with some bundles or rods exceeding current exposure limits. Provide examples of changes in inputs and assumptions which may be used to assess the lead use program.

#### **4. CONCLUSIONS AND FINDINGS**

All the regulatory audit objectives listed in Section 2 were completed. Although changes to Appendix B to Amendment 51 were discussed and will be proposed, no errors or negative findings were identified during the audit. Three RAIs were needed to provide further information.