ENCLOSURE 2

M200016

Proposed Amendment 51 to GESTAR II

Non-Proprietary Information

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space with an open and closed bracket as shown here [[ ]].

SUMMARY

The United States Nuclear Regulatory Commission (NRC) performed an audit of the "GNF3 Generic Compliance with NEDE-24011-P-A (GESTAR II)," NEDC-33879P, June 28-30, 2017. (Reference 1). A subsequent follow-up meeting was conducted in September 2017 (Reference 2). There were two actions from the audits and continuing discussions that involved commitments to modify the new fuel criteria of GESTAR II.

The major action of the two involves updating the lead fuel assembly provisions of GESTAR II. 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 requirements and allowable numbers for the different types of lead assemblies. The process is encapsulated in a new Appendix B to GESTAR II. Sections 1 and 2 have been modified to be consistent with the new appendix and provide a connection from the body of GESTAR II to the appendix. The second update involves the addition of a new Subsection containing a commitment to confirm the applicability of the GESTAR II design criteria to a new fuel assembly.

REFERENCES

1. United States Nuclear Regulatory Commission (NRC) Audit of GNF3 Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33879P, Revision 0, Wilmington, NC, June 28-30, 2017.
2. United States Nuclear Regulatory Commission (NRC) Follow-Up Audit of GNF3 Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33879P, Revision 0, Wilmington, NC, September 19-20, 2017.

DESCRIPTION OF CHANGES:

Section 1.1.1 is the General Criteria subsection of the Fuel Licensing Acceptance Criteria.

Item C is modified to point to Appendix B instead of the old References 1-3 and 1-4.

Item F is added per commitments made during the GNF3 audit to provide assurance that the criteria are appropriate for the features of the new fuel assembly.

Section 1.2.1 is the General Criteria subsection of the Basis for Fuel Licensing Criteria.

Item B is modified to remove the old Lead Use Assembly references and point to Appendix B for addition lead assembly programs.

Item C is modified to point to Appendix B instead of the old References 1-3 and 1-4.

Item F is added per commitments made during the GNF3 audit to provide assurance that the criteria are appropriate for the features of the new fuel assembly. If a new of modified criteria is needed, it does not mean the design is unacceptable. It simply means review and approval is needed.

Section 1.5 References

References 1-3, 1-4, 1-9, and 1-10 are deleted from Section 1.5 References.

Section 2.3 Testing, Inspection and Surveillance Plans

Subsection 2.3.3 was modified to speak of the more general "lead assembly" term. Editorial changes were made to remove outdated terminology and proprietary marking. The change in proprietary marking is not marked as a revision. A pointer to Appendix B was added. The sentence pointing to Reference 2-8 was deleted based on the new Appendix B.

Subsection 2.3.4, Lead Assembly Programs, was added to provide a formal introduction and pointer to Appendix B.

Section 2.4 References

Reference 2-8 was deleted from Section 2.4 References.

Appendix B Lead Assembly Programs

Appendix B was added to provide program definitions for Lead Test Assemblies (LTAs), Lead Use Assemblies (LUAs) and High-Burnup Lead Use Assemblies (HBLUAs). Appendix B provides test plans, the testing duration, and program requirements for each type of lead assembly.

1.1.1 General Criteria

A. NRC–approved analytical models and analysis procedures will be applied.

B. New design features will be included in lead use assemblies.

C. The ~~generic post–irradiation~~ fuel examination program**s are described in Appendix B**~~approved by the NRC will be maintained (References 1–3 and 1–4)~~.

D. New fuel related licensing issues identified by the NRC will be evaluated to determine if the current criteria properly address the concern; if necessary, new criteria will be proposed to the NRC for approval.

E. If any of the criteria in Subsection 1.1 are not met for a new fuel design, that aspect will be submitted for review by the NRC separately.

F. GNF will document in the new fuel compliance report that the criteria defined in GESTAR II are appropriate for use with any new features of the fuel design. When new or modified criteria or requirements for new design features are needed, they will be submitted for review and approval by the NRC.

1.1.2 Thermal–Mechanical

A. The fuel design thermal–mechanical analyses are performed for the following conditions:

i. Either worst tolerance assumptions are applied or probabilistic analyses are performed to determine statistically bounding results (i.e. upper 95% confidence).

ii Operating conditions are taken to bound the conditions anticipated during normal steady–state operation and anticipated operational occurrences.

B. The fuel design evaluations are performed against the following criteria.

i. The fuel rod and fuel assembly component stresses, strains, and fatigue life usage shall not exceed the material ultimate stress or strain and the material fatigue capability.

ii. Mechanical testing will be performed to ensure that loss of fuel rod and assembly component mechanical integrity will not occur due to fretting wear when operating in an environment free of foreign material.

iii. The fuel rod and assembly component evaluations include consideration of metal thinning and any associated temperature increase due to oxidation and the buildup of corrosion products to the extent that these effects influence the material properties and structural strength of the components.

iv. The fuel rod internal hydrogen content is controlled during manufacture of the fuel rod consistent with ASTM standards C776–83 and C934–85 to assure that

1.1.14 Fuel Loading Error (FLE) Event Analysis

Section S.5.3 of the country–specific supplement presents the requirements for analyzing the FLE (misloaded or misoriented fuel bundle) as an Infrequent Incident. Should a plant not meet the requirements in Section S.5.3, the event will be analyzed as an AOO.

A. As an Infrequent Incident, the FLE events are subject to the radiological limits of 10% of 10CFR100, or 10% of 10CFR50.67 for Alternate Source Term plants. Bounding radiological analysis of these events is referenced in the country–specific supplement to this base document.

B. As an AOO, the FLE events are subject to the MCPR criteria. (See Section 1.1.5 and 1.1.6)

1.2 Basis for Fuel Licensing Criteria

The following provides the basis for the criteria documented in Subsection 1.1.

1.2.1 General Criteria

A. *NRC–approved analytical models and analysis procedures will be applied*.

Consistent with current practice, NRC–approved procedures and methods are used to evaluate new fuel designs.

B. *New design features will be included in lead use assemblies*.

~~GE's~~ **GNF's** "test before use" fuel design philosophy includes irradiation experience with new fuel design features in full–scale fuel assemblies (Lead Use Assemblies) in operating reactors prior to standard reload application. ~~A method for licensing LUAs and the NRC acceptance of this method are documented in References 1–9 and 1–10, respectively.~~ **See Appendix B for a description of the lead use assembly program.**

GNF proposed in Reference 1-14 an enhanced lead use program for the use of channels made of the niobium-tin-iron (NSF) zirconium alloy. The US NRC has reviewed and approved the program by Reference 1-15. This program allows NSF Lead Use Channels (LUC) to be used in quantities up to 8% of the total number of channels in the core. The NSF LUC limit of 8% is exclusive of other lead assembly programs. ~~In other words, other lead use programs are not affected and continue to be allowed up to the ~2% limit of GESTAR II.~~

C. *The ~~generic post–irradiation~~ fuel examination program~~s approved by the NRC will be maintained.~~* **are described in Appendix B.**

Section 4.2.II.D.3 of the SRP requires each plant to implement a post–irradiation fuel surveillance program to detect anomalies or to confirm expected fuel performance. ~~The NRC has found (Reference 1–3) that the GE fuel surveillance program (Reference 1–4) is an acceptable means for licensees to satisfy the post–irradiation~~

~~surveillance requirement of the SRP.~~ The ~~GE~~ GNF program includes examination of ~~LUAs~~ lead assemblies and selected discharge bundles with the results reported to the NRC in a yearly operating experience report.

D. *New fuel related licensing issues identified by the NRC will be evaluated to determine if the current criteria properly address the concern; if necessary, new criteria will be proposed to the NRC for approval.*

New licensing concerns related to fuel design and performance may arise after the establishment of approved fuel licensing acceptance criteria. Upon identification of a new issue by the NRC, ~~GE~~ GNF will evaluate the concern against the established criteria to determine if this issue can be resolved through the application of approved criteria. If the current criteria does not adequately address the identified concern, ~~GE~~ GNF will propose a new criterion (criteria) to the NRC for review and approval.

E. *If any of the criteria in Subsection 1.1 are not met for a new fuel design, that aspect will be submitted for review by the NRC separately.*

If a new fuel design does not meet one of the criteria in Subsection 1.1, it does not mean this design is unacceptable. It simply means the design has gone beyond the generic approval and must be reviewed.

F. *GNF will document in the new fuel compliance report that the criteria defined in GESTAR II are appropriate for use with any new features of the fuel design. When new or modified criteria or requirements for new design features are needed, they will be submitted for review and approval by the NRC.*

If a new of modified criteria is needed, it does not mean the design is unacceptable. It simply means review and approval is needed.

1.2.2 Thermal–Mechanical

A. *The fuel design thermal–mechanical analyses are preformed for the following conditions*:

i. *Either worst tolerance assumptions are applied or probabilistic analyses are performed to determine statistically bounding results (i.e. upper 95% confidence).*

ii. *Operating conditions are taken to bound the conditions anticipated during normal steady–state operation and anticipated operational occurrences.*

These analyses are performed generically for each new fuel design or previous analyses are determined to be applicable.

B. *The fuel design evaluations are performed against the following criteria:*

1.5 References

1–1 *General Electric Fuel Bundle Designs Evaluated with TEXICO/CLAM Analyses Bases*, NEDE–31151P, Revision 0, April 1986.

1–2 *Global Nuclear Fuels Fuel Bundle Designs*, NEDE–31152P, Revision 9, May 2007, including Supplement 1, June 2000, through Supplement 6, May 2007.

1–3 ~~Letter, J. S. Charnley (GE) to C. H. Berlinger (NRC), *Post–Irradiation Fuel Surveillance Programs*, November 23, 1983.~~**Not Used**

1–4 ~~Letter, L. S. Rubenstein (NRC) to R. L. Gridley (GE), *Acceptance of GE Proposed Fuel Surveillance Program*, June 27, 1984.~~**Not Used**

1–5 *General Electric BWR Thermal Analysis Basis (GETAB): Data, Correlation and Design Application*, January 1977 (NEDE–10958–PA and NEDO–10958–A).

1–6 Letter, J. S. Charnley (GE) to C. 0. Thomas (NRC), *Amendment 15 to General Electric Licensing Topical Report NEDE–24011–P–A*, January 25, 1986.

1–7 *Assessment of BWR Mitigation of ATWS, Volume I and II (NUREG–0460 Alternate No. 3)*, December 1979, NEDE–24222.

1–8 *Assessment of BWR/3 Mitigation of ATWS (Alternate 3)*, December 1979, NEDE–24223.

1–9 ~~Letter from R. E. Engel (GE) to T. A. Ippolito (NRC), *Lead Test Assembly Licensing*, August 24, 1981.~~**Not Used**

1–10 ~~Letter from T. A. Ippolito (NRC) to R. E. Engel (GE), *Lead Test Assembly Licensing*, September 23, 1981.~~**Not Used**

1–11 Letter, M. A. Smith to Document Control Desk, *10CFR Part 21, Reportable Condition, Safety Limit MCPR Evaluations*, May 24, 1996.

1–12 *ODYSY Application for Stability Licensing Calculations*, NEDC–32992P–A, July 2001.

1-13 *ODYSY Application for Stability Licensing Calculations Including Option I-D and II Long Term Solutions*, NEDE–33213P–A, April 2009.

1-14 Letter from A. A. Lingenfelter (GNF) to Document Control Desk (NRC), *Enhanced Lead Use Channel (LUC) Program for NSF Fuel Bundle Channels*, MFN 12-074, September 25, 2012.

12. Nonconforming material control procedures.
13. Pre–production quality evaluation procedures.
14. Process and personnel qualification procedures.
15. Process control procedures.
16. Product/process quality plans.
17. Purchased material quality control plans.
18. Quality assurance document control procedures.
19. Quality assurance records specifications and instructions.
20. Quality control standards instructions.
21. Receiving inspection plans.
22. Shipment release control procedures.
23. Supplier evaluation and selection procedures.
24. Test instructions.

The quality assurance program described in Reference 2–15 applies explicitly to the Wilmington manufacturing site; however, similar quality assurance programs are implemented in the overseas manufacturing facilities.

2.3.2 On–Line Fuel System Monitoring

Provided by Applicant.

2.3.3 Post–Irradiation Surveillance

General Electric has an active program of interim and post–irradiation surveillance of ~~both~~ lead ~~use~~ assemblies **(see Appendix B)** ~~and developmental BWR fuel~~. The schedule of inspection is contingent on both the availability of the fuel as influenced by plant operation and the expected value of the information to be obtained.

The lead ~~use~~ assemblies are selectively inspected. Inspection techniques used include:

(1) Leak detection tests, such as "sipping."

(2) Visual inspection with various aids such as binoculars, borescope, or periscope, with a photographic record of observations as appropriate.

(3) Nondestructive testing of selected fuel rods by ultrasonic and eddy current test techniques.

(4) Dimensional measurements of selected fuel rods.

Unexpected conditions or abnormalities that may arise are analyzed. Examination of selected fuel rods in ~~Radioactive~~ **radioactive** ~~Material~~ **material** ~~Laboratory~~ **laboratory** ~~(RML)~~ facilities is undertaken when the expected value of the information to be obtained warrants

this type of examination. ~~Details of this surveillance program are documented in Reference 2–8.~~

In addition to the fuel surveillance program, offgas surveillance is performed for all operating plants, and leak detection tests such as sipping are performed by the utilities at the end of each cycle, if they deem it is warranted based on their analysis of the offgas surveillance results. Offgas surveillance is a very sensitive measure of fuel performance.

2.3.4 Lead Assembly Programs

Lead assemblies are required for introducing new fuel designs that contain new design features, which are distinctly different from previous fuel designs, or when technology that has not yet been approved is used in existing fuel designs. Lead Assembly programs are organized into groupings titled Lead Test Assemblies (LTAs), Lead Use Assemblies (LUAs) and High-Burnup Lead Use Assemblies (HBLUAs). Appendix B provides test plans, the testing duration, and program requirements for each type of lead assembly.

2.4 References

2–1 Letter from J. S. Charnley (GE) to R. Lobel (NRC), *Implementation of GESTR–M*, April 24, 1984.

2–2 *Global Nuclear Fuels Fuel Bundle Designs*, NEDE–31152P, Revision 9, May 2007 including Supplement 1, June 2000, through Supplement 6, May 2007.

2–3 *General Electric Fuel Bundle Designs Evaluated with TEXICO/CLAM Analyses Bases*, April 1986 (NEDE–31151–P).

2–4 *BWR Fuel Channel Mechanical Design and Deflection*, NEDE–21354–2–P (Proprietary) and NEDO–21354–2, July 1977.

2–5 American National Standard for Light Water Reactors Fuel Assembly Mechanical Design and Evaluation, American Nuclear Society Standards Committee Working Group ANS 57.5, ANSI/ANS–57.5–1981.

2–6 W. G. Jameson, Jr., *Fuel Assembly Evaluation of Shipping and Handling Loadings*, NEDE–23542–P (Proprietary), March 1977.

2–7 *Fuel Assembly Evaluation of Combined Safe Shutdown Earthquake (SSE) and Loss–of–Coolant Accident (LOCA) Loadings (Amendment No. 3)*, NEDE–21175–3–P–A (Proprietary) and NEDO–21175–3–A, October 1984.

2–8 ~~Letter from J. S. Charnley (GE) to M. S. Dunenfeld (NRC), *1984 Fuel Experience Report*, October 14, 1985.~~**Not Used**

2–9 K. W. Hill, et al., *Effect of a Rod Bowed to Contact on Critical Heat Flux in Pressurized Water Reactor Rod Bundles*, American Society of Mechanical Engineers Publication 75–WA/ HT–77.

2–10 E. S. Markowski, et al., *Effect of Rod Bowing on CHF in PWR Fuel Assemblies*, American Society of Mechanical Engineers Publication 77–HT–91.

Appendix B

Lead Assembly Programs

Appendix B
Table of Contents

B.1 Introduction

The purpose of this appendix is to clarify the requirements for lead assemblies within the GESTAR II licensing framework. Lead assemblies are required for introducing new fuel designs that contain new design features, which are distinctly different from previous fuel designs, or when technology that has not yet been approved is used in existing fuel designs. An existing fuel design has completed all new fuel licensing requirements in GESTAR II. Technology that has not been approved may be, for instance, a new material or an approved material to be operated beyond approved limitations (e.g., operating an existing fuel design beyond current burnup limits). Components of existing fuel designs may be modified and inserted in reload quantities (without lead assemblies) only after demonstrating compliance to all new fuel licensing requirements stipulated in GESTAR II.

If the licensee's Technical Specifications contains the provision (or substantively similar), "A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions," and there is no conflicting documentation elsewhere in the plant's licensing basis, then a licensee may load lead assemblies according to the requirements defined in this appendix, provided GESTAR II is referenced in the Technical Specifications.

B.2 Definitions, Limitations and Exceptions

To create clarity in communications about the purpose and requirements for lead assemblies, the following definitions for Lead Test Assemblies (LTAs), Lead Use Assemblies (LUAs) and High-Burnup Lead Use Assemblies (HBLUAs) are used. All terms are still understood to be covered under the language of the Technical Specifications as "lead test assemblies."

The general requirements as defined in Section B.5 provide assurance that the lead assemblies can be operated safely, and the NRC is informed when any lead assembly is inserted.

B.2.1 Lead Test Assemblies (LTAs)

The purpose of an LTA is to collect data that supports a fundamental understanding of how a new technology performs in-reactor. An example of a new technology is an unapproved material. While LTAs are fuel assemblies with unapproved technologies, LTAs are based on assembly designs that have been licensed per the provisions of GESTAR II and have an established performance record. LTAs may contain small quantities of test components to support fundamental understanding or may include large quantities to support collection of statistically significant data. By their new technology nature, LTAs may use approved methodologies outside application ranges for design evaluations; in some cases, unapproved methodologies may be used for design evaluations. Thus, the design of LTAs is accomplished using sound engineering judgement and analytical codes and methods that

reflect well-established engineering practices to provide assurance that the LTA does not adversely affect nuclear safety. In summary, an LTA contains new technology that is generally limited in scope to what is possible in the confines of current fuel assemblies. The range and scale of data needed for NRC approval of full reload application of a new technology would depend on the relative safety significance and required application range of the new technology.

B.2.1.1 Quantities of LTAs

Because the safety risk of a new technology depends on the relative certainty (or the "degree of characterization") in performance, the number of LTAs operating in each plant that meets the definition of a "limiting number" in a licensee's Technical Specifications shall be established prior to insertion. The basis for the number of LTAs in each program shall be provided in the information letter sent by the licensee to the NRC as part of the description of the LTA program. For perspective, LTA campaigns have ranged historically from a few rods within a single assembly to eight fuel assemblies, depending on the nature of the design and the degree of prior characterization of the LTAs' performance. The limit on the number of LTAs in each plant is defined exclusive of LUA or HBLUA programs.

If there is adequate certainty in the performance (or the "degree of characterization" is such) that a large number of LTAs may be inserted, a GESTAR II amendment may be submitted to define a maximum number of LTAs that can be inserted prior to NRC approval of full reload applications.

B.2.1.2 LTA Exemption to 10 CFR 50.46

LTAs shall be shown to not significantly influence the plant's behavior under loss-of-coolant accident conditions or adversely affect the performance of the emergency core cooling system. Therefore, when inserting non-approved materials in LTAs, it is not necessary for the licensee to request an exemption to "expand" the applicability of 10 CFR 50.46.

B.2.2 Lead Use Assemblies (LUAs)

In contrast to an LTA, an LUA is a pre-production prototype of a new fuel design, which contains new design features that are distinctly different from previous fuel designs. The purpose of LUAs is to confirm expected operation of a new fuel design rather than to gather specific technical information. A new fuel design is comprised of new features that are designed with NRC approved methods and design criteria to be compliant with GESTAR II requirements. Once compliance with new fuel licensing requirements in GESTAR II is shown, a new fuel design can be inserted in full reload applications. At a minimum, LUAs shall be compliant to all thermal-mechanical design requirements in Section 1.1.2 prior to

insertion. LUAs shall operate in a commercial BWR plant at least one cycle before full-reload applications of a new fuel design.

B.2.2.1 Quantities of LUAs

The number of LUAs operating in each plant shall be limited to 16. This value is a discrete numerical limit comparable to the historical NRC-approved requirement of approximately 2% of the core and allows for symmetrical core designs. This number meets the definition of a "limiting number" in a licensee's Technical Specifications because if failures were to occur, the number would be restricted, easily detectable and handled by normal plant operating systems.

B.2.3 High-Burnup Lead-Use Assemblies (HBLUAs)

The purpose of a HBLUA is to increase operational experience and to collect performance data that may be used to evaluate extension of current burnup limits. HBLUAs are assemblies of licensed fuel designs that are irradiated beyond the current burnup limit (i.e., those detailed in Section 2.2). Fuel assemblies shall be designated as HBLUAs prior to exceeding the current burnup limit.

B.2.3.1 Burnup Limit and Quantities of HBLUAs

HBLUAs shall operate to a burnup [[

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The number of HBLUAs operating in each plant shall be limited to 16, exclusive of other LTA or LUA programs. This value is a discrete numerical limit comparable to the historical NRC-approved requirement of approximately 2% of the core and allows for symmetrical core designs. In addition, based on extensive high-burnup experience of GNF fuel in European plants, there is little risk of failure during normal operations. Therefore, this number of HBLUAs meets the definition of a "limited number" in a licensee's Technical Specifications. The limit of 16 HBLUAs also meets the intent of the 2% limit on extended life NSF channels in NEDE-33798P-A and is therefore deemed an equivalent and alternate limit.

B.2.3.2 HBLUA Limitations and Exceptions

It is recognized that HBLUAs are expected to contain rods that exceed the 62 GWD/MTU rod-average exposure limit and the 6.3 kW/ft peak rod-average power for rod-average burnups exceeding 54 GWD/MTU that are described in Regulatory Guide 1.183. Exceeding these limits for the small number of bundles/rods in an HBLUA program is considered acceptable relative to Regulatory Guide 1.183 based on conservatisms in radiological analyses. 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 that bound the limiting bundle in the core. Therefore, licensees may take exception to the Regulatory Guide 1.183 guidance for HBLUA programs by referencing GESTAR II in the plant's Technical Specifications, which also satisfies the requirement of NRC approval to use under 10 CFR 50.67. This change with respect to the licensees' previously approved Alternate Source Term does not constitute a departure from an approved methodology as defined by 10 CFR 50.59.

While HBLUAs are exceeding the burnup limit defined in Section 2.2, they shall operate in "nonlimiting core regions" as required in Section 4.2.1 of the Standard Technical Specifications (NUREG-1433). Nonlimiting core regions refers to the power distribution limits in Section 3.2 of the Technical Specifications (APLHGR, MCPR, LHGR).

B.3 Test Plans

B.3.1 Lead Test Assemblies

The testing and inspection plans associated with an LTA program are variable and depend on the nature of the new technology. The licensee inserting an LTA shall send the NRC an information letter that describes the LTA, the duration of the LTA program, and associated inspection plans. LTA test plans and performance findings shall be included in the annual GNF Technology Update meetings. LTAs shall be characterized prior to insertion to provide a baseline for subsequent inspections.

B.3.2 Lead Use Assemblies

The inspection plans for a given LUA program shall be included in the information letter that the licensee sends the NRC. In addition, GNF shall provide the NRC with an LUA report describing the new fuel design and the overall LUA plans (including inspection plans), prior to insertion of the first LUAs of a new fuel design. LUAs shall be characterized prior to insertion to provide a baseline for subsequent inspections.

B.3.3 High-Burnup Lead Use Assemblies

When a plant designates HBLUAs, the licensee shall send the NRC an information letter describing the HBLUA program and the inspection plan. HBLUA test plans and performance findings shall be included in the annual GNF Technology Update meetings. While LTAs and LUAs are pre-characterized before insertion, HBLUAs might not be pre-characterized. The current inspection database of GNF fuel provides the pre-characterization evidence desired for HBLUAs; essentially, general performance of the fuel up to the current exposure limits has been established.

B.4 Duration of Testing

B.4.1 Lead Test Assemblies

The testing duration of LTAs in a specific plant program shall be defined in the information letter that the licensee sends to the NRC. The testing duration of the overall GNF LTA program for a new technology should correspond to the lifetime needs of the new technology, as well as other potential operational and logistical considerations. The licensing limits for a particular new technology may need to exceed the nominal design limits to accommodate special situations at a plant or to allow extended in-reactor experience to be gathered. The appropriate testing duration of the overall GNF LTA program will be established on a case-by-case basis.

B.4.2 Lead Use Assemblies

The duration of testing for LUAs is such that the LUAs lead the insertion of reload quantities. This is consistent with the purpose of LUAs – to confirm expected operation of a new fuel design rather than to gather specific technical information. LUAs are required to operate one cycle in at least one commercial BWR plant before inserting the first full reload of the new fuel design. In general, there should be at least one inspection of LUAs prior to inserting reloads of the new fuel design. After a new design is inserted in reload quantities, GNF will continue inspections of the LUAs (as defined in the LUA inspection plan) and the first reload applications. Specifically, GNF shall conduct a general visual examination of the exterior surfaces of a statistically meaningful number of fuel assemblies from two full-reload applications after discharge.

B.4.3 High-Burnup Lead Use Assemblies

Bundles are designated HBLUA prior to exceeding the burnup limit and shall operate [[ ]] Operating HBLUA bundles to an extended end-of-life exposure is the fundamental objective of this type of lead assembly to accumulate data to support extending burnup limits.

B.5 Program Requirements

The following provides general requirements for inserting any lead assembly, regardless of the type. Specific requirements are then defined for LUA, LTA, and HBLUA.

Common general requirements for inserting lead assemblies are as follows:

1. Compliance with Specified Acceptable Fuel Design Limits (SAFDLs) shall be maintained. Lead assemblies shall be accounted for in standard reload licensing evaluations documented in the Supplemental Reload Licensing Report (SRLR) or other appropriate licensing reports.

2. When lead assemblies are inserted into a plant, the licensee shall send the NRC an information letter describing the LUA, LTA, or HBLUA program, including an inspection plan with basis and duration of program.

3. A summary of the status of all lead assembly programs (including available inspection results) shall be provided annually in a presentation at the Technology Update meeting between GNF and the NRC or in a report sent to the NRC.

B.5.1 Additional Requirements for LTAs are as follows

1. By their new technology nature, LTAs may not have approved methodologies to use in the design evaluations. The design of LTAs is accomplished using sound engineering judgement and analytical codes and methods that reflect well-established engineering practices to provide assurance that the LTA does not adversely affect nuclear safety.

2. LTAs shall be shown to not significantly influence the plant's behavior under loss-of-coolant accident conditions or adversely affect the performance of the emergency core cooling system.

3. The number of LTAs operating in each plant shall be established based on the potential effect on nuclear safety. This justification shall be provided in the information letter sent by the licensee to the NRC as part of the description of the LTA. The number shall be exclusive of other LUA or HBLUA programs.

4. If there is adequate certainty in the performance (or the "degree of characterization" is such) that a large number of LTAs may be inserted, a GESTAR II amendment may be submitted to define a maximum number of LTAs that can be inserted prior to NRC approval of full reload applications.

5. If LTAs are operated beyond approved operating limits (e.g., burnup), the technical justification shall be provided in the information letter sent by the licensee to the NRC as part of the description of the LTA. LTAs shall be characterized prior to insertion to provide a baseline for subsequent inspections.

B.5.2 Additional Requirements for LUAs of new fuel designs are as follows:

1. Lead Use Assemblies shall be compliant to all thermal-mechanical design requirements in Section 1.1.2 prior to insertion.

2. The number of LUAs operating in each plant shall be limited to 16.

3. Prior to insertion of the first LUAs of a new fuel design, GNF shall provide the NRC with a report describing the new design and the anticipated LUA program (including the

anticipated inspection plans with basis for those plans). Changes to the plan shall be communicated in the annual GNF Technology Update.

4. LUAs shall be characterized prior to insertion to provide a baseline for subsequent inspections.

5. LUAs shall operate for one cycle in a commercial BWR plant before the first full reload application of a new fuel design.

6. After a new fuel design is inserted in reload quantities, GNF shall continue inspections of the LUAs (as defined in the LUA inspection plan) and the first reload applications. Specifically, GNF shall conduct a general visual examination of the exterior surfaces of a statistically meaningful number of fuel assemblies from two full-reload applications after discharge.

B.5.3 Additional Requirements for HBLUAs are as follows

1. Engineering evaluations to affirm compliance with SAFDLs shall use GNF's licensed methodologies. GNF's licensed methodologies (e.g., PRIME) that have limitations on exposure are allowed to be used beyond their approved range for design evaluations of HBLUAs. Use of GNF's licensed methodologies beyond their approved exposure limits does not result in a departure from a method of evaluation as defined by 10 CFR 50.59.

2. Exposed fuel assemblies shall be declared HBLUAs prior to exceeding the current burnup limit.

3. The burnup of HBLUAs shall be limited [[ ]]

4. The number of HBLUAs operating in each plant shall be limited to 16, exclusive of other LTA or LUA programs. The limit of 16 HBLUAs also meets the intent of the 2% limit on extended life NSF channels in NEDE-33798P-A.

5. Licensees referencing GESTAR II in the plant's Technical Specifications may take exception to Regulatory Guide 1.183 for HBLUAs without seeking pre-approval via a License Amendment Request.