December 6, 2006

Andrew A. Lingenfelter, Manager
GNF Engineering
Global Nuclear Fuels - Americas, LLC
P.O. Box 780, M/C F12
Wilmington, NC 28402

SUBJECT: DRAFT SAFETY EVALUATION FOR GLOBAL NUCLEAR FUEL (GNF) TOPICAL REPORT (TR) AMENDMENT 28, "MISLOADED FUEL BUNDLE EVENT LICENSING BASIS CHANGE TO COMPLY WITH STANDARD REVIEW PLAN 15.4.7," TO GENERAL ELECTRIC STANDARD APPLICATION FOR RELOAD FUEL (GESTAR II) (TAC NO. MC3559)

Dear Mr. Lingenfelter:

By letter dated May 17, 2004, as supplemented by letters dated August 23, 2004, May 5 and June 2, 2006, GNF submitted Amendment 28, "Misloaded Fuel Bundle Event Licensing Basis Change to Comply with Standard Review Plan 15.4.7," to General Electric Standard Application for Reload Fuel (GESTAR II) to the U.S. Nuclear Regulatory Commission (NRC) staff for review. Enclosed for GNF review and comment is a copy of the NRC staff's draft safety evaluation (SE) for the TR.

Pursuant to Section 2.390 of Title 10 of the *Code of Federal Regulations* (10 CFR), we have determined that the enclosed draft SE does not contain proprietary information. However, we will delay placing the draft SE in the public document room for a period of 10 working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects. If you believe that any information in the enclosure is proprietary, please identify such information line-by-line and define the basis pursuant to the criteria of 10 CFR 2.390. After 10 working days, the draft SE will be made publicly available, and an additional 10 working days are provided to you to comment on any factual errors or clarity concerns contained in the draft SE. The final SE will be issued after making any necessary changes and will be made publicly available. The NRC staff's disposition of your comments on the draft SE will be discussed in the final SE.

To facilitate the NRC staff's review of your comments, please provide a marked-up copy of the draft SE showing proposed changes and provide a summary table of the proposed changes.

If you have any questions, please contact Michelle Honcharik at 301-415-1774.

Sincerely,

/RA By JHopkins For/

Stacey L. Rosenberg, Chief
Special Projects Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 712

Enclosure: Draft SE

cc w/encl: See next page

To facilitate the NRC staff's review of your comments, please provide a marked-up copy of the draft SE showing proposed changes and provide a summary table of the proposed changes.

If you have any questions, please contact Michelle Honcharik at 301-415-1774.

Sincerely,

/RA By JHopkins For/

Stacey L. Rosenberg, Chief
Special Projects Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 712

Enclosure: Draft SE

cc w/encl: See next page

DISTRIBUTION:
PUBLIC
PSPB Reading File
RidsNrrDpr
RidsNrrDprPspb
RidsNrrPMMHoncharik
RidsNrrLADBaxley
RidsOgcMailCenter
RidsAcrsAcnwMailCenter
Anthony Attard
Jay Lee
RidsNrrDraAadb
RidsNrrDssSnpb

ADAMS ACCESSION NO.: ML062840516 *No major changes to SE input. NRR-043

OFFICE	PSPB/PM	PSPB/LA	SNPB/BC*	AADB/BC*	PSPB/BC
NAME	MHoncharik	DBaxley	FAkstulewicz	MKotzalas	SRosenberg
DATE	11/9/06	11/9/06	1/26/06	8/3/2006	12-6-06

OFFICIAL RECORD COPY

DRAFT SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT GESTAR II AMENDMENT 28

"MISLOADED FUEL BUNDLE EVENT LICENSING BASIS CHANGE TO COMPLY WITH STANDARD REVIEW PLAN 15.4.7"

GLOBAL NUCLEAR FUEL

PROJECT NO. 712

1.0 INTRODUCTION AND BACKGROUND

By letter dated May 17, 2004, as supplemented by letters dated August 23, 2004, May 5 and June 2, 2006 (References 1 through 4, respectively) Global Nuclear Fuel (GNF) submitted Amendment 28, "Misloaded Fuel Bundle Event Licensing Basis Change to Comply with Standard Review Plan (SRP) 15.4.7," to General Electric Standard Application for Reload Fuel (GESTAR II). This amendment proposes to make changes to GESTAR II to reclassify the misloaded fuel bundle event from "incident of moderate frequency" to "infrequent incident." Regulatory Guide (RG) 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR [Light Water Reactor] Edition)," Revision 3 (Reference 5), defines incidents of moderate frequency as incidents that may occur during a calendar year and infrequent incidents as events that may occur during the lifetime of a plant.

Historically, General Electric (GE) and GNF have considered two potential types of bundle loading errors: the misoriented bundle and the mislocated bundle. In the mislocated bundle event, GE assumed a more reactive higher power bundle can inadvertently be switched with a depleted, lower power bundle. Analyses showed that the consequences of the mislocated bundle were not expected to be severe, and normal plant operating limits provide sufficient protection to meet the licensing basis for this event. In the misoriented bundle event, GE assumed the bundle to be rotated 90 degrees or 180 degrees out of normal position. In the D-lattice reactors where the water gaps are non-uniform around the bundle, rotation can cause increases in local rod power through increased moderation. The consequences of mislocated or misoriented fuel loading errors (FLEs) are typically bounded by other events.

The proposal would change the way that the analysis is performed of the misloaded fuel bundle event, also termed as FLE, from that of an "incident of moderate frequency" category to that of an "infrequent incident" category. With this change, the event would be subject to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (Reference 6) Section 15.4.7, "Inadvertent Loading and Operation of a Fuel Assembly in an Improper Position." The FLE would then be evaluated at less demanding radiological consequence dose acceptance limits (a small fraction of Part 100 of Title 10 of *Code of Federal Regulations* (10 CFR) limits rather than 10 CFR Part 20 limits).

2.0 REGULATORY EVALUATION

There is no specific guidance in SRP Section 15.4.7 as to acceptable methods for the radiological consequence analysis for the misloaded fuel bundle event other than specifying the acceptable dose limit as a small fraction of 10 CFR Part 100 limits. Also, this event is not addressed in RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," (Reference 7) as a design-basis accident (DBA). Therefore, GNF proposed: (1) use of radiological consequence analysis guidance provided in SRP Section 15.4.9, Appendix A, "Radiological Consequences of Control Rod Drop Accident (BWR)" for the reactor plants whose DBAs are analyzed using the source term provided in Technical Information Document (TID)-14844, and (2) use of radiological consequence analysis guidance provided in RG 1.183, Appendix C, "Assumptions for Evaluating the Radiological Consequences of a BWR Rod Drop Accident," for the reactor plants whose DBAs are analyzed using the alternative source term (AST).

GNF evaluated the radiological consequences of the misloaded fuel bundle event against a small fraction of the 10 CFR Part 100 limits (30 rem to the thyroid and 2.5 rem to the whole body) for the TID-14844 source term, and a small fraction of the 10 CFR 50.67 limit (2.5 rem total effective dose equivalent (TEDE)) for the AST. These dose acceptance criteria are more restrictive than those specified in SRP Section 15.4.9 (75 rem to the thyroid and 6.3 rem to the whole body) for the TID-14844 source term or those specified in SRP Section 15.0.1, "Radiological Consequence Analysis Using Alternative Source Terms," (6.3 rem TEDE) for the AST.

The regulations in 10 CFR Part 100 specify how the exclusion area, low population zone (LPZ), and population center distance should be determined. Radiation criteria stipulated in 10 CFR Part 100 provide reference values to be used in the site suitability determination based on postulated fission product releases associated with accidents.

The regulations in 10 CFR Part 100 also specify the methodology for calculating radiation exposures at the site boundary for postulated accidents or events that might be caused by an FLE. For events having a moderate frequency of occurrence, any releases of radioactive material must be such that the calculated doses at the site boundary are a small fraction of the 10 CFR Part 100 guidelines. A small fraction is interpreted to be less than 10 percent of 10 CFR Part 100 reference values. Meeting the requirements of 10 CFR Part 100 provides assurance that, in the event of an undetected FLE, radiation exposure at the site boundary will not exceed a small fraction of the reference values specified in 10 CFR Part 100.

Appendix A to 10 CFR Part 50, General Design Criterion (GDC) 13, "Instrumentation and control," states that "Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences [(AOOs)], and for accident conditions as appropriate to assure adequate safety...." An FLE could adversely affect the fission process (power distribution), the integrity of the reactor core, and the reactor coolant pressure boundary. Meeting the requirements of GDC 13 provides assurance that an FLE will be detected before it can affect power distribution, core integrity, or could produce unacceptable stress on the reactor coolant pressure boundary.

SRP Section 15.4.7, gives the criteria found acceptable by the U.S. Nuclear Regulatory Commission (NRC) staff for meeting GDC 13 and 10 CFR Part 100 requirements. SRP Section 15.4.7 also provides the accident dose guidelines (a small fraction of 10 CFR Part 100 limits) for the exclusion area boundary (EAB) and LPZ. Appendix A to 10 CFR Part 50, GDC 19, “Control room,” provides the control room dose assessment limits (5 rem TEDE).

3.0 TECHNICAL EVALUATION

The FLE event is the improper loading of a fuel bundle and subsequent operation of the core. Two types of FLEs are possible, the mislocation of a fuel assembly and the misorientation of a fuel assembly. GNF evaluated two scenarios for the misloaded fuel bundle event. The first scenario (Scenario 1) assumes the release of fission products from the core to the environment via the turbine and condensers following main steam isolation valve (MSIV) closure for those plants having a main steam line high radiation isolation trip capability. In the second scenario (Scenario 2), GNF assumed that no automatic MSIV closure occurred in that fission products were transported to an augmented offgas system for those plants having no main steam line high radiation isolation trip capability. Results show that offsite doses will not exceed 10 percent of the 10 CFR Part 100 limits which must be met in order to categorize an FLE as an “infrequent incident.”

3.1 RADIOLOGICAL CONSEQUENCES

GNF assumed that no fuel melt occurs as a result of this event and that this event will result in failure of the equivalent of five fuel assemblies (primary and four adjacent). GNF stated that the adverse consequences from an FLE would be the failure of one or more fuel rods in a single fuel assembly that is operating in a higher-than-normal power range. The incident would be similar to a fuel assembly operating with one or more leaking fuel rods. However, the radiological consequences would be difficult to assess for each fuel bundle in the core for each operating cycle. Therefore, in order to bound the consequences for this event, GNF conservatively assumed that all of the fuel rods in five failed fuel assemblies will experience instantaneous failure.

GNF used a conservative fuel bundle radial peaking factor of 2.5 instead of a radial peaking factor of 1.5 as specified in SRP Section 15.4.9, Appendix A to ensure that the peak bundle power to bundle average cycle power ratio was bounded. In addition, GNF used a safety factor of 1.4 to address the variation in fission product inventory over the cycle of the operating fuel.

3.1.1 Scenario 1

This scenario assumes the release of fission products from all of the fuel rods in five failed fuel assemblies in the reactor core. The release to the environment is modeled as a ground level release via the turbine and condensers following MSIV closure.

Consistent with the guidelines provided in SRP Section 15.4.9, Appendix A, and RG 1.183, Appendix C, GNF assumed that:

- 10 percent of the core inventory of noble gases and iodine and 20 percent of alkali metals (instead of 12 percent for alkali metals as specified in RG 1.183) were released to the coolant,

- 100 percent of noble gases, 10 percent of iodine, and 1 percent of the remaining nuclides released from the failed fuel assembly to the coolant reach the turbine and condensers before MSIV closure,

- of those fission products which reach the turbine and condensers, 100 percent of noble gases, 10 percent of iodine, and 1 percent of the remaining nuclides are available for release to the environment from the turbine and condensers, and

- the turbine and condensers leak to the environment at a rate of 1 percent per day as a ground-level release for a period of 24 hours, at which time the leakage is assumed to terminate.

GNF proposed no deviation or departure from the guidelines provided in SRP Section 15.4.9 or RG 1.183.

GNF back-calculated the following bounding atmospheric dispersion factors (χ/Q values) from the radiological consequence dose criteria (a small fraction of 10 CFR 50.67 for the AST and a small fraction of 10 CFR Part 100 for the TID-14844 source term) assuming these χ/Q values represent the limiting χ/Q values for a ground level release from the condensers to the EAB and LPZ.

Source Terms	Dose Criteria	EAB/LPZ χ/Q Value (s/m^3)
TID	30 rem thyroid	1.67E-3
AST	2.5 rem TEDE	5.04E-3

GNF labeled these χ/Q values as 2-hour χ/Q values but applied them for the entire 24-hour release.

The NRC staff performed an independent confirmatory dose calculation to verify GNF's results. A χ/Q value at the EAB and LPZ less than 1.67E-3 s/m^3 will result in a thyroid dose at or below the 30 rem limit for the TID-14844 source term and a χ/Q value at the EAB and LPZ less than 5.04E-3 s/m^3 will result in a TEDE at or below the 2.5 rem limit for the AST. The relationships between calculated doses and χ/Q values for the TID-14844 source term and AST are shown in Figures B-1 and B-4, respectively, in Attachment B, "Fuel Loading Error Event Radiological Analysis for Offsite and Control Room Dose," of Reference 4.

GNF assumed that the control room is not isolated during this event and neither the emergency filtration system nor control room air recirculation system is assumed to be operational. GNF selected the following ranges of two control room variables:

Control room volumes:	1.0E+3 to 1.0E+6 ft^3
Control room air flow rates:	1.0E+2 to 1.0E+5 cfm

GNF back-calculated the following bounding control room χ/Q values that result in meeting the respective radiological consequence dose acceptance criteria:

Source Terms	Dose Criteria	Control Room χ/Q Value (s/m^3)
TID	30 rem thyroid	1.81E-3
AST	5 rem TEDE	1.25E-2

The highest radiological doses occurred with the highest control room air flow rate due to the inhalation dose and largest control room volume due to the gamma immersion dose. Control room doses as a function of the control room χ/Q values are shown in Figures 7 and 8 of Amendment 28 for the TID-14844 source term and AST, respectively.

3.1.2 Scenario 2

This scenario assumes the release of fission products from all fuel rods in five failed fuel assemblies in the reactor core to the environment via the plant stack as an elevated release through the offgas system. In this scenario, it was assumed that the MSIVs did not close immediately after initiation of the event and that steam flow continued for a period of time. The main steam line radiation monitor (MSLRM) and the steam jet air ejector radiation monitor would alarm almost immediately. These monitors are required by the BWR technical specifications and will activate an alarm in the main control room.

There is no specific guidance in SRP Section 15.4.7, SRP Section 15.4.9, or RG 1.183 regarding acceptable methods for the radiological consequence analysis for this scenario. However, in May 1991, the NRC staff reviewed and accepted the methodology proposed in the BWR Owners' Group Licensing Topical Report, NEDO-31400, "Safety Evaluation for Eliminating the Boiling Water Reactor Main Steam Line Isolation Valve Closure Function and Scram Function of Main Steam Line Radiation Monitor." In its safety evaluation (SE) (Reference 9), the NRC staff concluded that the removal of the MSLRM trips, that automatically shut down the reactor and close the MSIVs, is acceptable. The NRC staff further concluded that the removal of the automatic reactor shutdown and MSIV closure trips from the MSLRM does not change the radiological consequences evaluated in the Final Safety Analysis Reports for meeting the dose acceptance criteria specified in SRP Section 15.4.7.

The augmented offgas system designed and supplied by GE and currently in use at operating BWRs typically contains, catalytic recombiners, a series of charcoal adsorber delay tanks, and high efficiency particulate air filters to achieve adequate decay of noble gases and removal of iodine prior to release to the environment from the plant stack. The system is designed to process non-condensible and volatile fission products received from the condenser evacuation system to meet 10 CFR Part 20 and Appendix I to 10 CFR Part 50 limits prior to release from the plant stack. The system typically provides minimum decay times of 46 hours for krypton and 42 days for xenon for the offgas received from the main condenser evacuation system. The delay time in the charcoal adsorber delay tanks is proportional to the mass of charcoal and to the dynamic adsorption coefficients for the gas. These are, in turn, functions of the operational temperature and humidity conditions in the charcoal. GNF stated, and the NRC staff agrees, that any iodine releases from the offgas system are negligible, because the iodine is retained in the charcoal adsorber delay tanks for decay.

The offgas system effluent is continuously monitored by the offgas system post-treatment radiation monitor and by the stack effluent monitor. The monitor trip outputs are used to initiate closure of the offgas system discharge, and the trip setpoint is set so that valve closure is initiated prior to exceeding the offsite and control room doses. These monitors are also equipped with a trip circuit that actuates corresponding main control room annunciators. Therefore, the NRC staff finds that the radiological consequence resulting from Scenario 2 is bounded by that of Scenario 1.

3.2 FUEL LOADING

In the GNF responses to the NRC staff requests for additional information (RAIs), GNF utilized the error rate for the past 25 years, in particular, the zero error rate for the past 10 years to demonstrate the effectiveness of core verification procedures. Since 1995 there have not been any cases of a plant operating with a misoriented or mislocated fuel bundle. Although no hardware, software, or mechanical interlocks, etc. are in place, each operating BWR has its own core verification procedures that follow the recommendations of Service Information Letter (SIL)-347 (Reference 10). Details of SIL-347 are provided below. The recommendations outlined in SIL-347 contributed to the prevention of an FLE in the past 10 years.

GNF stated that the extensive period of refueling history as reflected in its responses makes a probabilistic risk assessment (PRA) model of limited value. GNF also states, "...There is no particular information provided by a model that is not reflected in the actual refueling data for the past 25 years." In its submittal, GNF provided a table summarizing FLEs that occurred between 1995 and February 2005. From this table, GNF calculated the probability of an FLE as 0.19 FLE per plant per lifetime. This number is less than the value used in defining infrequent incidents (1 FLE per plant per lifetime).

3.2.1 SIL-347 Background

During the 1980's, four plants had reported operation with misoriented fuel bundles. GE issued a SIL-347 highlighting the importance of preventing misoriented bundles and provided recommended guidelines for developing procedures for core loading verification to help eliminate their recurrence. The action of refueling a LWR, be it a BWR or PWR, requires the movement of fuel assemblies from one location to another within the core, and the retrieving and loading of new and burned fuel assemblies from the spent fuel pool. Each movement of the assemblies, location and orientation, is monitored, observed, and checked at the time of completion by the fuel movement operator and spotters.

Since 1978, the FLE has been analyzed as an AOO and, as such, the change in critical power ratio (CPR) for the event has been factored into the determination of the minimum CPR (MCPR) operating limit for each cycle. Section 6.3 of the NRC SE of NEDE-24011-A-15-US, "Generic Reload Fuel Application," dated May 12, 1978 (Reference 11), describes the basis for this treatment of the FLE, which includes fuel loading experience in that time period.

In response to SIL-347, utilities began in 1981 to improve the procedures used for core verification following refueling. The typical procedure of core verification at the plants which experienced misoriented bundles was to scan the core with an underwater television camera at a distance close enough to distinguish the bundle serial numbers on top of the lifting bails. In the scan, and in a subsequent verification of the videotapes, one person was responsible for reading the serial number and verifying orientation. The conclusion reached by GE after studying the affected sites was that the close-up picture needed for serial number verification did not permit easy recognition of proper bundle orientation, and the verifier's attention was primarily focused on the difficult task of reading the serial numbers. As a result of its findings, GE proposed all BWR owner/operators ensure that their reload procedures provide for a separate scan of the core during final core verification to verify bundle orientation. GE also recommended guidelines for developing a procedure for bundle orientation verification. This was provided as Attachment A to the SIL-347.

The FLE rate for the recent 25-year period and the trend for the most recent 10 years of refueling outages support the classification of the FLE event as an "infrequent incident." Section S.2.1, supplemental to GESTAR, provides the basis for categorizing and analyzing the FLE as an infrequent incident and the associated analysis limits. Upon approval of the proposed Amendment 28, licensees may choose to analyze the FLE as an infrequent incident, or to continue analyzing the event as an AOO. In order to apply the infrequent incident option, several items must be confirmed and documented with the reload design procedures. The first group of these involves the core verification procedures applied following refueling, and the second involves the input parameters and plant offgas system bases used to perform the generic radiological analysis. The requirements apply for licensees with either 10 CFR Part 100 or 10 CFR 50.67 radiological licensing bases.

3.2.2 Core Verification

To select the infrequent incident option, the licensee's core verification procedures must be consistent with those generally used during the recent historical period forming the basis for the Amendment 28 analysis of the event frequency. Therefore, the licensee must certify that its core verification procedures have the following characteristics:

1. During fuel movement, each move (location, orientation, and seating) is observed and checked at the time of completion by the operator and a spotter.

2. After completion of the core load, the core is verified by a video recording of the core using an underwater camera. The recording may involve two or more records made at different ranges to provide clear resolution of the bundle serial number, and to illustrate the orientation in four bundle clusters. The core verification may take place during the recording process, by viewing after recording, or a combination.

3. Two independent reviewers perform the verification of the bundle serial number location, orientation, and seating. Each independent team records the bundle serial numbers on a core map, which is verified with the design core-loading pattern.

3.2.3 Staff Requirements

In RAI response 1(b) of Reference 2, GNF stated that each operating BWR licensee has its own procedure for core verification following fuel loading and core component movements prior to startup. The procedures follow the recommendations of SIL-347. However, GNF also pointed out that while the emphasis of SIL-347 was on the misoriented bundle, the utilities generalized its procedures to include the recommendations provided in SIL-347, namely the requirement of “at least 2 independent reviewers of core assemble configuration” and applied them to each of the three core verification elements: bundle location, bundle orientation, and bundle seating.

Therefore, the NRC staff concludes that the recommendations of SIL-347 as expanded by the BWR licensees has reduced the likelihood of a FLE. The NRC staff finds that there is enough information present to conclude that the FLE can be reclassified as an infrequent incident on a plant-specific basis. Because the approval requires certain plant-specific verifications, the documentation must be reconfirmed every refueling outage.

The NRC staff conclusion is based on information provided by GNF which supports the classification of the FLE as an “infrequent incident,” based on the FLE error rate for the period since 1980 and plant data from refueling outages since SIL-347 recommendations have been implemented. Although there are no hardware, software, mechanical interlocks, etc. that prevent an FLE from occurring, operating BWRs have procedures for core verification following fuel and core component movements prior to startup, which follow the recommendations of SIL-347. Since 1995, the use of these procedures has prevented core operation with a mislocated or misoriented fuel bundle.

4.0 LIMITATIONS AND CONDITIONS

NRC staff requires that users of GESTAR II, Amendment 28, generate EAB and LPZ χ/Q values in a manner consistent with RG 1.145, “Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants,” (Reference 12). All comparisons with χ/Q values in GESTAR II, Amendment 28, should use the limiting 5 or 0.5 percentile plant-specific 2-hour EAB and 8-hour LPZ χ/Q values unless the user provides a plant-specific analysis for NRC review that justifies use of other χ/Q values. Users of GESTAR II, Amendment 28, should generate control room χ/Q values in a manner consistent with RG 1.194, “Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants,” (Reference 13). All comparisons with χ/Q values in GESTAR II, Amendment 28, should use the limiting 5 percentile plant-specific 2-hour control room χ/Q value unless the user provides a plant-specific analysis for NRC review that justifies use of other χ/Q values. Thus, hold up of effluent in a tank with delayed release to the environment as postulated in Scenario 2 does not justify use of a lower plant-specific χ/Q value representative of a later time interval (e.g., one day hold-up does not justify comparison of the GESTAR II, Amendment 28, χ/Q value with a plant-specific 1 to 4-day χ/Q value) without further review by the NRC staff.

The FLE can now be analyzed as an infrequent incident provided that the licensee confirms the requirements for application of the generic analysis in Amendment 28. Licensees seeking to apply the infrequent incident basis must confirm that their core refueling verification procedures meet the requirements defined in Section 5.3, “Fuel Loading Error Analysis Requirements,” of the GESTAR US Supplement. This confirmation will be documented every refueling outage through the plant-specific reload design documentation and the analysis basis stated in the Supplemental Reload Licensing Report (SRLR).

Should a bundle mislocation, misorientation, and seating occur and go undetected, the plant-specific acceptance of this submittal will be revoked, and the classification of this event will revert from “infrequent incident” classification back to an “incident of moderate frequency” classification immediately.

5.0 CONCLUSION

The NRC staff has reviewed GESTAR II, Amendment 28, to assess the acceptability of the justifications therein for changing the way that the analysis of an FLE is performed from that of an “incident of moderate frequency” category to that of an “infrequent incident” category.

The NRC staff finds that GNF has provided an acceptable method for determining the radiological consequences resulting from a misloaded fuel bundle event. The radiological consequence of the two scenarios, as discussed in Section 3.1 of this SE, would meet the dose acceptance criteria provided in SRP Section 15.4.7, RG 1.183, Appendix C, and SRP Section 15.4.9 when using bounding χ/Q values at the EAB, LPZ, and control room. Therefore, the NRC staff concludes that the changes requested to reclassify the misloaded fuel bundle event as an “infrequent incident” from an “incident of moderate frequency” are acceptable with respect to the radiological consequences resulting from a misloaded fuel bundle event.

Additionally, the NRC staff concludes that GNF has provided a sufficient basis for approval of the reclassification, because the necessary action to prevent such events are plant-specific. Therefore, the NRC staff finds that there is sufficient basis to support a reclassification of the FLE on a plant-specific basis as described above. The NRC staff approval applies only to licensees implementing GESTAR and for cores containing only fuel supplied by GE. GE did not provide information related to refueling procedures governing mixed core designs, therefore, this approval does not apply to those instances.

6.0 REFERENCES

1. Letter FLN-2004-009 from M. E. Harding (GNF) to USNRC, “GESTAR II Amendment 28, Misloaded Fuel Bundle Event Licensing Basis Change to Comply with Standard Review Plan 15.4.7,” May 17, 2004 (ADAMS Accession No. ML062860291).

2. Letter FLN-2004-026 from M. E. Harding (GNF) to USNRC, “GESTAR II Amendment 28, Revision 1, Misloaded Fuel Bundle Event Licensing Bases Change to Comply with Standard Review Plan 15.4.7," August 23, 2004 (ADAMS Accession No. ML062860295).

3. Letter FLN-2006-018, from A. A. White (GNF) to USNRC, “Response to NRC Request for Information Regarding Amendment 28 to GESTAR II (TAC NO. MC3559),” May 11, 2006 (ADAMS Accession No. ML061350416).

4. Letter FLN-2006-020 from A. A. White (GNF) to USNRC, “Transmittal of Updated Attachments Supporting GESTAR II Amendment 28 and Associated GESTAR II Sections (TAC NO. MC3559),” June 2, 2006 (ADAMS Accession No. ML061580106).

5. Regulatory Guide 1.70, "Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," Revision 3, November 1978 (ADAMS Accession No. ML011340122).

6. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

7. Regulatory Guide 1.83, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes, Revision 1, July 1975 (ADAMS Accession No. ML003740256).

8. Technical Information Document-14844, "Calculation of Distance Factors for Power and Test Reactor Sites," March 23, 1962 (ADAMS Accession No. ML051770099).

9. Letter from A. C. Thadani (USNRC) to G. J. Beck (BWROG), NRC Safety Evaluation RE: Licensing Topical Report, NEDO-31400, "Safety Evaluation for Eliminating the Boiling Water Reactor Main Steam Line Isolation Valve Closure Function and Scram Function of Main Steam Line Radiation Monitor," May 15, 1991 (ADAMS Legacy Library Accession No. 9105230048).

10. GE Nuclear Services Information Letter No. 347, "Misoriented Fuel Bundles," December 1980 (ADAMS Accession No. ML062860435).

11. Letter from D. G. Eisenhut (USNRC) to R. L. Gridley (GE), NRC Safety Evaluation RE: NEDE-24011-A-15-US, "Generic Reload Fuel Application," (GESTAR II, Revision 0) May 12, 1978 (ADAMS Accession No. ML062860426).

12. Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1 (ADAMS Accession No. ML003740205).

13. Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants" (ADAMS Accession No. ML031530505)

Principle Contributors: A. Attard
J. Lee

Date: December 6, 2006

cc:
Mr. Charles M. Vaughan, Manager
Facility Licensing
Global Nuclear Fuel - Americas
P.O. Box 780
Wilmington, NC 28402

Mr. George B. Stramback
Regulatory Services Project Manager
GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

Mr. James F. Klapproth, Manager
Engineering & Technology
GE Nuclear Energy
3901 Castle Hayne Road
Wilmington, NC 28402

Mr. Glen A. Watford, Manager
Technical Services
GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125