



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

September 28, 2018

MEMORANDUM TO: Dennis C. Morey, Chief
Licensing Processes Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

FROM: Joseph A. Golla, Project Manager */RA/*
Licensing Processes Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

SUBJECT: AUDIT PLAN FOR GLOBAL NUCLEAR FUEL – AMERICAS, LLC
LICENSING TOPICAL REPORT NEDE-33885P, REVISION 0,
GLOBAL NUCLEAR FUEL CONTROL ROD DROP ACCIDENT
APPLICATION METHODOLOGY (EPID L-2018-TOP-0006)

By letter dated February 28, 2018, Global Nuclear Fuel (GNF) submitted NEDE-33885P, Revision 0, "GNF CRDA Application Methodology," to the U.S. Regulatory Commission (NRC) for staff review (Agencywide Documents Access and Management System Accession No. ML18059A874). The NRC staff technical review of this licensing topical report is ongoing. In order to facilitate the review, the staff will perform a regulatory audit at the Global Nuclear Fuel facility located near Wilmington, North Carolina. The staff's audit plan is enclosed.

Project No. 712
Docket No. 99901376

Enclosure:
As stated

CONTACT: Scott Krepel, NRR/DSS
(301) 302-0399

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 TOPICAL REPORT NEDE-33885P, REVISION 0, GLOBAL NUCLEAR FUEL
 CONTROL ROD DROP ACCIDENT APPLICATION METHODOLOGY
 (EPID L-2018-TOP-0006) DATED SEPTEMBER 28, 2018

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DATE	8/24/2018	9/20/2018	9/27/2018/	9/28/2018

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AUDIT PLAN FOR GLOBAL NUCLEAR FUEL – AMERICAS, LLC

LICENSING TOPICAL REPORT NEDE-33885P, REVISION 0

GLOBAL NUCLEAR FUEL CONTROL ROD DROP ACCIDENT

APPLICATION METHODOLOGY

PROJECT NO. 712

EPID L-2018-TOP-0006

1.0 INTRODUCTION

By letter dated February 28, 2018, Global Nuclear Fuel – Americas, LLC (GNF) submitted a licensing topical report (LTR) which presents a methodology for the evaluation of the Control Rod Drop Accident (CRDA) for boiling water reactors (BWRs) using the technical models in PANACEA, TRACG, and PRIME as used in other U.S. Nuclear Regulatory Commission (NRC)-approved applications. The LTR is entitled, “GNF CRDA Application Methodology,” and can be identified its LTR number, NEDE-33885P.

The applicant proposes use of the technical models for the PANACEA, TRACG, and PRIME codes, unchanged from what has been reviewed and approved by the NRC to analyze other events. Significant work has already been done to validate how these technical models capture the dynamic response of BWRs during anticipated operational occurrences and stability events which require accurate tracking of the impact of thermal hydraulics and fuel rod performance on the core neutronics. As a result, the NRC staff is drawing on the prior knowledge base for these applications to determine whether the technical models continue to be valid for application to analysis of the CRDA event.

The LTR currently under review was submitted to document and obtain NRC approval for an analysis methodology specifically addressing the CRDA event. The LTR provides the additional information necessary to demonstrate applicability of the aforementioned technical models in PANACEA, TRACG, and PRIME to the CRDA event, as well as the processes, interfaces, and analyses needed to demonstrate that the acceptance criteria are met. The specific regulatory requirements associated with the CRDA event are GDC 13, “Instrumentation and control,” and GDC 28, “Reactivity limits,” as well as radiation dose limits from Title 10, “Energy,” of the *U.S. Code of Federal Regulations* (CFR) 50.67, “Accident source term,” and 10 CFR 100.11, “Determination of exclusion area, low population zone, and population center distance.” The LTR uses interim acceptance criteria for the reactivity initiated accident (RIA) provided in the Standard Review Plan (SRP) Section 4.2 Appendix B, but this review will also consider the draft regulatory guide, DG-1327, which is intended to establish final acceptance criteria for RIAs. The NRC guidance related to the BWR CRDA event is presented in SRP Section 15.4.9.

The LTR provides: (1) additional assessment of PANACEA and TRACG to validate the model predictions of the dynamic response of the reactor during reactivity excursions, (2) a specific methodology to perform the CRDA analysis that includes application of the acceptance criteria, (3) technical justification for generic analysis assumptions, and (4) an example CRDA analysis. Since the NRC has already reviewed and approved the predictive capabilities of the codes associated with most of the expected phenomena for the expected general plant response to

typical analyzed events, the NRC staff focus is on the key issues unique to the CRDA event. This includes the assessments of the technical models' ability to predict the reactivity response to control rod drop events, the treatment of the Doppler reactivity feedback, the sensitivity studies performed to support the CRDA analysis methodology, the degree of flexibility built into the CRDA analysis methodology, and any other technical justification for generic issue resolutions that will not be evaluated on a cycle-specific basis.

The NRC staff has determined that an audit, following the Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, "Regulatory Audits," will be beneficial in identifying additional information required to complete the review.

2.0 REGULATORY AUDIT BASES

The application of the PANACEA, TRACG, and PRIME technical models for CRDA analysis purposes was developed primarily to satisfy NRC regulatory guidelines to meet the regulatory requirements established in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 28, "Reactivity limits." This requirement is met by satisfying interim acceptance criteria defined for the Reactivity Insertion Accident (RIA) in Section 4.2, Appendix B of the SRP and the "Service Limit C" maximum reactor pressure criterion defined in the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*.

The NRC is currently in the process of publishing an updated regulatory guide with new acceptance criteria for RIAs that will supersede the interim criteria in SRP Section 4.2, Appendix B. A draft version was published for public comment as Draft Guide 1327 (DG-1327), however, this guide is not yet finalized. The LTR indicates that information from an NRC memorandum describing the technical and regulatory basis for the revised guide was used as the basis for the CRDA analysis methodology. This memorandum does not represent final NRC regulatory guidance document for use in evaluating the acceptability of a proposed methodology to meet regulatory requirements, however, it was used to inform the development of DG-1327. As a result, the NRC staff review considered the guidance in both SRP Section 4.2, Appendix B, and the most recent version of DG-1327.

The requirements at 10 CFR 50.67, "Accident source term," and 10 CFR 100.11, "Determination of exclusion area, low population zone, and population center distance," are met by demonstrating that no fuel rod failures will occur as a result of the CRDA event. The acceptance criteria for determining whether a fuel rod failure will occur are derived based on guidance provided in SRP 4.2, Appendix B, or DG-1327.

The NRC staff will audit NEDE-33885P and supporting documentation, to identify appropriate additional information to request for submittal. Such information would be that required to determine: (1) whether the proposed extension of the PANACEA, TRACG, and PRIME technical models to analyze the CRDA event is supported by the assessments and technical justifications provided by GNF, and (2) whether the CRDA analysis methodology, as described in NEDE-33885P, is sufficient to meet the aforementioned regulatory requirements and NRC guidance.

3.0 REGULATORY AUDIT SCOPE/OBJECTIVES

The audit is planned to cover the following four topics below.

3.1. OVERVIEW OF NEDE-33885P

The NRC staff would like GNF staff to deliver an introductory presentation with a basic overview of NEDE-33885P. The presentation is expected to provide a framework to allow NRC staff and GNF staff to have a structured discussion about specific aspects of the content provided in the LTR.

Areas of special focus include:

- Limiting rod enthalpy response calculation based on rod power local peaking factor
- Applicability for direct moderator heating model in TRACG to cold conditions
- Applicability of fission gas release modeling to DG-1327 guidance
- Form of PCMI enthalpy vs exposure
- Cladding failure predictions using the TRACG perforation model
- Potential variations in control blade designs
- Range of applicability for Doppler coefficient correction
- []
- Analytical approach for out of sequence rods
- Definition of core exposures for analysis
- Use of updated technical models/codes, once they have been approved for other applications

3.2. REVIEW OF INPUT PROCESSING AND PROCEDURES

GNF should provide the NRC staff with sample input files for CRDA analyses, and all user manuals necessary to interpret the input files. This will support NRC staff review of inputs in calculation files during subsequent audit activities. Also, all relevant procedures that will support the implementation of the methodology discussed in NEDE-33885P should be provided for NRC staff to review, including documents that specify the input requirements for CRDA analyses.

3.3. REVIEW OF SPECIFIC NEDE-33885P CALCULATIONS AND ANALYSES

The NRC staff will audit calculation files for the sensitivity studies and the sample CRDA analyses, as necessary, to address any further questions or gaps in understanding after Objectives 3.1 and 3.2.

3.4. ADDITIONAL DISCUSSION AND EXIT MEETING

At the conclusion of the audit, an exit meeting will be held to summarize additional information, if any, that GNF will be requested to submit to continue the review. Other appropriate next steps, including an update to the licensing topical report review schedule, will be discussed, as well.

4.0 TEAM ASSIGNMENTS

The following personnel will be supporting the review:

<u>NAME</u>	<u>AFFILIATION</u>
Scott Krepel	Technical Reviewer, NRC/NRR/Division of Safety Systems

5.0 LOGISTICS AND SCHEDULE

The audit will take place on Thursday and Friday, October 4 and 5, 2018. The location is the GNF facilities at 3901 Castle Hayne Road in Wilmington, NC.

Thursday, October 4, 2018:

- Overview/Discussion
- Begin Input Processing

Friday, October 5, 2018:

- Continue Input Processing (if needed)
- Specific Calculation Files
- Exit Meeting