June 29, 2017

Mr. Andrew Mauer
Technical Advisor, Nuclear Generation
Nuclear Energy Institute
1201 F Street N.W., Suite 1100
Washington, DC 20004

SUBJECT: RESPONSE TO NUCLEAR ENERGY INSTITUTE LETTER CONCERNING THE REGULATORY PATH FOR LEAD TEST ASSEMBLIES

Dear Mr. Mauer:

In a letter dated May 19, 2017, the Nuclear Energy Institute (NEI) requested confirmation of U.S. Nuclear Regulatory Commission (NRC) regulatory positions regarding the irradiation of lead test assemblies (LTAs). These regulatory positions were presented by a member of the NRC staff at the 2017 Regulatory Information Conference (RIC), in a discussion of "Accident Tolerant Fuel Lead Test Assemblies." The slides are available on the NRC's public web site at www.nrc.gov under Agencywide Documents Access and Management System Accession No. ML17180A017. Specifically, NEI is seeking confirmation regarding the following positions, which NEI restated as follows:

- Certain Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," licenses contain technical specifications allowing for the irradiation of a limited number of lead test assemblies in nonlimiting core regions.
    - The number of lead test assemblies may be determined by the licensee based on engineering judgement and on codes and methods that have not been submitted to the NRC for review and approval.
    - The core region for locating the lead test assemblies may be determined by the licensee based on engineering judgement and on codes and methods that have not been submitted to the NRC for review and approval.

- An exemption to 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," (or 10 CFR 50.46c, if finalized) is not required for lead test assemblies irradiated under these technical specification provisions.

This letter responds to your request by providing the staff's preliminary views on the positions set forth above. These views (as well as the slides presented at the RIC identified above) do not constitute formal positions by the NRC staff or final NRC positions for the purposes of the Backfit Rule or any issue finality provisions in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," because the staff has not had a complete opportunity to consider all of the regulatory issues associated with these positions. Nor has the staff determined if the positions will require Commission review and approval. Nonetheless, the staff

is providing its preliminary views in order to advise all stakeholders of the staff's current views and to indicate the staff's openness to public engagement and further stakeholder involvement in the staff's consideration of these positions.

1. NRC staff's preliminary views on technical specifications (TS) regarding lead test assemblies (LTAs)

All standard technical specifications (STS) allow for a limited number of lead test assemblies without completed representative testing to be loaded in nonlimiting core positions, for the purpose of developing data necessary for qualifying analytical codes and methods and developing the safety design bases for new design features. For example, NUREG-1434, "Standard Technical Specifications General Electric BWR/6 Plants," states:

> The reactor shall contain [800] 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 (UO2) as fuel material and [water rods]. […] 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 safety design bases. *A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions (emphasis added).*

Lead test assembly programs provide pool-side, post-irradiation examination data collection, irradiated material for subsequent hot-cell examination and research, and demonstration of in-reactor performance. This characterization of irradiated material properties and performance is essential for qualifying analytical codes and methods and developing the safety design bases for new design features. Given this purpose, the NRC recognizes that the use of lead test assemblies may precede the availability of approved analytical codes and methods prior to the conduct of representative testing, consistent with the intent of the lead test assembly standard technical specifications.

In recognition of the lack of approved analytical codes and methods and incomplete safety design basis, the lead test assembly standard technical specifications limits the quantity and placement of lead test assemblies. This limitation is intended to minimize the potential interaction with co-resident fuel assemblies and plant systems, thereby providing reasonable assurance that lead test assemblies will not result in unacceptable safety consequences if the technical specification is properly implemented.

At this time, it is the staff's view that licensees' current processes for using lead test assemblies with fuel design and material composition in use historically and up to current time, in the current generations of light-water reactors, are implementing the lead test assembly standard technical specifications in a manner which provides reasonable assurance of adequate protection. The staff based this determination upon NRC's review and oversight over the years with respect to licensee implementation of the standard technical specifications governing lead test assemblies. The staff's oversight on the use of lead test assemblies supports the staff's current view that licensees are acceptably implementing the lead test assembly criteria in the standard technical specifications with respect to "limited number" and "nonlimiting core regions." This view is based upon the staff's determination as to the number and location of lead test assemblies that are being loaded for testing by licensees, and the staff's understanding that licensees are using engineering judgement by experienced engineers in developing the lead test assembly loading regime. The staff cautions that, as part of the overall safety assessment

to justify the limited quantity and placement of lead test assemblies, licensees should address General Design Criterion 35, “Emergency core cooling,” based upon knowledge of lead test assembly fuel performance under loss-of-coolant accident conditions.

Finally, the staff is also aware that many licensees conduct evaluations under 10 CFR § 50.59, “Changes, Tests and Experiments,” and that licensees are conducting robust review and documentation of the 10 CFR § 50.59 evaluation to identify any aspects of the lead test assembly program that may need prior NRC review and approval. If licensees use good engineering judgment and analytical codes and methods that (although not yet submitted to the NRC for review and approval) reflect good engineering practices and consideration of risk, then the staff believes that the existing regulatory approach provides reasonable assurance of adequate protection with respect to the loading and irradiation of lead test assemblies involving evolutions of fuel types and material compositions currently or formerly in use.[1] In the future, as reactor fuel evolves in design and material composition and the reactor core design departs from light-water reactor core designs currently and historically in use, current technical specifications on lead test assemblies may or may not be sufficient to provide reasonable assurance of adequate protection, given such factors such as fission gas retention, cladding oxidation, and other fuel properties, as well as the lack of generally accepted principles for implementing the key criteria in the technical specifications. The NRC staff believes that regulatory stability and predictability in licensing and inspection of new fuel designs will be enhanced by developing generally accepted principles for implementing the key criteria (e.g., limited number and nonlimiting core regions) in the technical specifications.

The NRC staff expects that, as irradiation experience expands and irradiated material characterization matures, licensees will consider the latest state-of-knowledge in the lead test assembly safety assessment as well as in lead test assembly irradiation cycles to justify the quantity and placement of lead test assemblies.

2. NRC staff’s preliminary views on the need for an exemption from ECCS requirements in 10 CFR 50.46 (or 10 CFR 50.46c, if adopted by the Commission) for LTAs

The NRC staff believes that a licensee need not obtain an exemption from 10 CFR 50.46 (or 10 CFR 50.46c, if adopted by the Commission) in order to load lead test assemblies into the reactor core and irradiate those lead test assemblies, unless 50.59 requires prior NRC review and approval. The licensee must, however, comply with the requirements of its operating license and its TS, including provisions applicable to lead test assembly TS.

3. Conclusion

   Licensees may, under the lead test assembly Standard Technical Specifications, place a limited number of lead test assemblies that have not completed representative testing in nonlimiting core regions, for the purposes of obtaining data to support development of: (i) qualifying analytical codes and methods, and (ii) the safety design bases for new fuel design features.

[1] The staff notes that licensees’ existing lead test assembly technical specifications will continue to be in effect even if the Commission adopts 10 CFR 50.46c as a final rule.

The NRC staff is willing, if and when it becomes necessary, to work with industry and other stakeholders on: (i) developing guidance on generally accepted principles for implementing the key criteria in the technical specifications, and (ii) addressing the need for prior NRC review and approval as result of 50.59 analyses. Please do not hesitate to contact Paul Clifford at 301-415-4043 of my staff if you have any questions.

Sincerely,

/RA/

Mirela Gavrilas, Director
Division of Safety Systems
Office of Nuclear Reactor Regulation

Project No. 689

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