framatome

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U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Additional Information Regarding ANP-10342P, "GAIA Fuel Assembly Mechanical Design"

Ref. 1: Letter, Gary Peters (AREVA Inc.) to Document Control Desk (NRC), "Request for Review and Approval of ANP-10342P, 'GAIA Fuel Assembly Mechanical Design'," NRC:16:038, December 21, 2016.

Ref. 2: Letter, Gary Peters (Framatome Inc.) to Document Control Desk (NRC), "Additional Information Regarding ANP-10342P, 'GAIA Fuel Assembly Mechanical Design'," NRC:18:044, December 19, 2018.

In Reference 1, Framatome Inc. (formerly AREVA Inc.) submitted ANP-10342P to the NRC for review and approval. As a result of discussions between Framatome and NRC regarding the draft safety evaluation report, Framatome is proposing to remove Section 9.0, "Design Update Process," from ANP-10342P. Framatome understands that corresponding sections will be removed from the safety evaluation report.

Enclosure 1 of this letter contains markups to the topical report that will be incorporated into the approved version of ANP-10342P. The markups are shown on the non-proprietary version of the topical report for convenience. Enclosure 1 also contains one markup of a page that was included in a package of proposed changes in Reference 2.

There are no commitments within this letter or its enclosures.

If you have any questions related to this information please contact Mr. Nathan Hottle, Product Licensing Manager, by telephone at (434) 832-3864, or by e-mail at Nathan.Hottle@framatome.com.

Sincerely,

Gary Peters

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cc: J. G. Rowley
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Enclosures:
1) ANP-10342 proposed markups

ABSTRACT

The purpose of this topical report is to present the GAIA fuel assembly mechanical design and an evaluation of its mechanical performance on a generic basis. The GAIA design is intended for use in Westinghouse type plants with a 17x17 fuel rod array. The GAIA fuel assembly design is a combination of previously utilized and advanced performance components. This topical report is intended to be referenced in site specific licensing basis documents for plants using the GAIA design.

A discussion of the current regulatory guidance related to fuel assemblies is presented, based on the Nuclear Regulatory Commission's (NRC) Standard Review Plan (SRP), NUREG-0800 Chapter 4.2. A comparison is presented of applicable NUREG-0800 Chapter 4.2 acceptance criteria and the specified acceptable fuel design limits (SAFDLs) established for the GAIA design. The SAFDLs established for the GAIA design have been previously approved for other AREVA fuel assembly designs.

A description of the GAIA fuel assembly design is provided. The components which have been previously utilized and those which are new are identified.

The fuel assembly mechanical tests which have been performed on the GAIA fuel assembly design are summarized.

The relevant operating experience with the GAIA fuel assembly design is summarized.

The Lead Test Assembly (LTA) programs which are ongoing to obtain information regarding the performance of the GAIA fuel assembly design are described.

An evaluation of the performance of the GAIA fuel assembly design for representative operating conditions is presented and compared to the established criteria.

~~A design update process is described which will facilitate future GAIA fuel assembly design changes. The update process defines the conditions under which the design can be modified without NRC review and approval.~~

1.0 INTRODUCTION

AREVA has developed the GAIA fuel assembly design for use in Westinghouse three- and four-loop reactors using a 17x17 fuel rod array. The GAIA design is a combination of previously utilized components and advanced performance components. The primary new features are: GAIA spacer grids, GRIP™ bottom nozzle, and Q12™ guide tube material.

Section 3.0 provides a summary of the regulatory guidance provided in NUREG-0800 Chapter 4.2 related to fuel assemblies, and a comparison to the SAFDLs established for the GAIA fuel assembly design. Section 4.0 describes the GAIA design, highlighting its distinguishing features. Section 5.0 summarizes the mechanical testing performed on the GAIA fuel assembly design. Section 6.0 presents the component operating experience. Section 7.0 presents the associated LTA programs. Section 8.0 provides the results of an evaluation of the GAIA fuel assembly under representative conditions against the SAFDLs defined in Section 3.0 of this report. The SAFDLs established for the GAIA fuel assembly performance are consistent with NUREG-0800 Chapter 4.2 and those previously established in topical reports reviewed and approved by the NRC. ~~Section 9.0 describes an update process to be utilized for future design changes to the GAIA fuel assembly design.~~

Evaluations of the GAIA fuel assembly, which will reference the NRC-approved version of this topical report, will be performed on a plant-specific basis. ~~The design update process described in this report will also be used to justify changes in the GAIA fuel assembly design without specific NRC review and approval.~~

9.0 DESIGN UPDATE PROCESS

This section defines an update process to be used to support updates to the GAIA fuel assembly design which will not require specific NRC review and approval.

This topical report defines the base GAIA fuel assembly design, provides the GAIA fuel assembly design criteria, and a representative evaluation of compliance to the criteria. The update process includes:

- Documenting the fuel assembly design drawings.
- Performing analyses with NRC-approved models and methods against the GAIA fuel assembly design specific criteria defined in this topical report (or in separate NRC approved topical reports such as a new fuel rod performance topical report).
- Confirming the adequacy of significant new design features using prototype tests or lead test assemblies prior to full reload implementation.
- Continuing irradiation surveillance programs, including post irradiation examinations, to confirm fuel assembly performance.
- Using the AREVA quality assurance procedures, quality control inspection program, and design control requirements set forth in the NRC-approved quality assurance program.
- Notification to the NRC by letter of major updates made to the base GAIA design, either generically or on a plant specific basis.

Acceptable updates to the GAIA design will meet all of the following conditions:

- The GAIA fuel assembly design criteria continue to be met.
- No revisions to plant technical specifications are required.
- The applicability of NRC-approved methodologies is demonstrated to be valid.
- Burnup limits are within those approved by the NRC.

~~Design updates shall be developed within the conditions of the NRC-approved criteria and methods.~~

~~Examples of minor design updates that can be made with this update process include but are not limited to:~~

- ~~A design update to the spacer grid to guide tube attachment.~~
- ~~A design update to the spacer grid strip thickness and/or material.~~
- ~~A design update to the cladding thickness.~~
- ~~The first use of an assembly design feature previously irradiated in conjunction with one lattice (i.e. 17x17) in a different lattice (i.e. 14x14).~~
- ~~A design update to the enrichment.~~
- ~~A design update to the Gadolinia-bearing rod locations.~~
- ~~A design update to the plenum spring material and/or addition of a lower plenum spring.~~

~~Examples of major design updates are:~~

- ~~New cladding material.~~
- ~~A spacer grid with a new functional mixing behavior or new rod support mechanism.~~
- ~~A design update that would alter the fuel behavior relative to NRC approved models outside of any update process approved for use with those models or topical reports.~~

~~A separate topical report would generally be required to justify revised methodologies necessary to analyze major design updates. Once the updated methodology is approved and demonstrated to be applicable to the GAIA fuel assembly design, its application to the GAIA design would be made in accordance with this update process.~~

~~The GAIA fuel assembly design specific criteria defined in this topical report may be revised if revised criteria have been approved in a separate topical report. For example, a new fuel rod performance code/methodology may be approved with revised fuel rod criteria. If a new fuel rod performance code/methodology were used for the GAIA fuel assembly design then the corresponding criteria would replace those defined in this report.~~

~~In summary, the update process described in this section will be used to justify updates to the GAIA fuel assembly design without requiring NRC review and approval when this topical report is referenced.~~

~~Both minor and major design updates will be made, justified, and documented in AREVA internal documents. An information letter will be sent to the NRC for major design updates. This information letter will describe the update to the design and summarize the design analyses performed to support comparison to the design criteria. No notification will be provided for minor design updates.~~

8.0 { NEW SECTION 8.4 }

8.4 *Additional Acceptance Criteria*

This subsection identifies SAFDLs that are not evaluated as part of this topical report. These additional SAFDLs address the remaining fuel design criteria from SRP Section 4.2 and any pertinent criteria from SRP Sections 4.3 and 4.4 that are not covered by the SRP Section 4.2 criteria (Section 8.4.7). With the inclusion of these criteria, this topical report presents a complete set of SAFDLs to be used for evaluation of the GAIA fuel assembly design ~~and in the design update process defined in Section 9.0~~.

8.4.1 Overheating of Cladding

The criteria for departure from nucleate boiling are included in the NRC-approved critical heat flux (CHF) correlation topical report for use with the GAIA fuel assembly.

Departure from nucleate boiling is addressed in plant-specific thermal hydraulic analyses using NRC-approved methods, including approved mixed core methods. The ORFEO-GAIA and ORFEO-NMGRID correlations are applied to the GAIA fuel assembly as described in Reference 14.

8.4.2 Excessive Fuel Enthalpy

The criteria for excessive fuel enthalpy during a reactivity initiated accident are included in the NRC-approved control rod ejection methods.

Reactivity initiated accidents are addressed in plant-specific analyses using NRC-approved methods.

8.4.3 Bursting

Cladding swelling and rupture requirements are included in the NRC-approved loss-of-coolant accident (LOCA) evaluation models.

LOCAs are addressed in plant-specific analyses using NRC-approved methods.