Non-LOCA Gap Release Fractions for RG 1.183 Rev. 2

May 1, 2024 Public Meeting

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ADAMS Accession No. ML24120A351

Agenda

- Purpose
- Non-LOCA Gap Release Fraction Discussion of Recommendations
- Non-LOCA Gap Release Fraction Calculation Update

Purpose

- The purpose of this presentation is to provide updates regarding staff's efforts to address recommendations related to non-LOCA gap release fractions and updates to the staff's efforts to update the fission product release fraction tables in RG 1.183 Revision 1

Recommendation – Section C

Recommendation:

Modify Section C (page 9 RG 1.183) to allow 10wt% U-235 and 80 GWd/MTU - (1) The 3 IFA experiments used as the basis in NUREG/CR-7003 had enrichments of 7, 8 and 10 wt% U-235 and (2) Enrichment by itself does not influence the isotopics/gap release.

Staff Response:

Staff is open to the recommendation and considering making appropriate changes to reflect it. It should be noted that the staff will have to assume some fuel design modifications (e.g. increasing the plenum length) in order to prevent clad liftoff from terminating the fuel performance code runs.

Recommendation – Section C (cont.)

Recommendation:

Modify Section C (page 9 RG 1.183) 2nd paragraph using more generic verbiage such as, "for currently approved fuels," since multiple vendors have NRC approved variations of UO2 fuel dopants (e.g., GNFs aluminosilicate and WEC's ADOPT) and that this would be addressed explicitly when new fuel products are licensed - (1) There is nothing in the basis experiments that involves the testing Cr-doped fuel, (2) Also, the applicability of the RG explicitly includes Cr-coated cladding and chromia-doped fuel when discussing MHA LOCA models in the 3rd paragraph, (3) This becomes a PWR coating only statement leaving coated claddings for BWRs outside of the RG applicability and (4) Note, if incorporated, this change in verbiage would also be needed in the first paragraph on Page 20 of the RG.

Staff Response:

Staff is open to the recommendation and considering making appropriate changes to reflect it.

Recommendation – Section C (cont.)

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Recommendation:

Modify the 3rd para in Section C (page 9 of RG 1.183) to be consistent with the burnup and enrichment ranges of applicability with the rest of RG 1.183. Add the following sentence to the end of the para: " For rod designs outside of these limits, Appendix I provides an acceptable analytical technique to calculating maximum steady-state release fractions."

Staff Response:

Staff is open to the recommendation and considering making appropriate changes to reflect it.

Recommendation – Appendix I

Recommendation:

Proposed change to second para page App I-1: Instead of saying "the use of such means will be considered on a case-by-case basis," say: " The resulting burnup-dependent source terms could then be used to calculate radiological consequences at different times in life." The intent is to have the guidance acknowledge that more detailed, finite calculations are acceptable. The sentence that is recommended to be replaced implies it is not acceptable and further justification is required.

Staff Response:

Staff is open to the recommendation and considering making appropriate changes to reflect it.

Recommendation – Appendix I (cont.)

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Recommendation:

Recommend changing attribute I-3 (App I-4) to: "Release fractions should be calculated using an NRC-approved fuel rod thermal-mechanical code which has a NRC-approved methodology for calculating high-confidence stable fission gas release and fuel temperatures"

Staff Response:

Staff is open to the recommendation and considering making appropriate changes to reflect it.

Recommendation – Appendix I (cont.)

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Recommendation:

Recommend changing attribute I-3.1 to add the following to the end: "When using an NRC approved fuel rod thermal-mechanical code which may produce different values for R/B of Kr85m, an alternative factor may be derived following the same procedure as described in Sections 4.4.1 and 4.4.2 of NUREG/CR-7003 with nominal predicted fuel rod temperatures". The reason provided was: it should not be required to apply a factor of 5 multiplier on an upper tolerance temperature prediction. The use of best estimate predictions in the attribute refers to the use of Table I-1 which corresponds to the decay constants, alpha and fractal scaling factors; the temperatures used for calculating diffusion are separate.

Staff Response:

The staff would like further discussion to better understand the concern. Is the concern related to the temperatures that were used in NUREG/CR-7003 versus the vendors' approved fuel design codes?

Recommendation – Non-LOCA FFRD (cont.)

Recommendation:

Lack of FFRD guidance for non-LOCA transient analysis radionuclide releases represents significant gap for the industry. Industry recommends that the NRC qualitatively assess FFRD for non-LOCA events such that additional conservatisms do not need to be applied to the current modeling practices. Consider similar approach to NRC internal memo (ML21197A067, based on ML21197A069) that was the basis for the MHA LOCA guidance (Presentation provides recommended language)

Staff Response:

The staff understands the concern and is continuing to evaluate this comment internally with consideration of the timeline.

Non-LOCA Gap Release Fraction Calculation Update

The staff is currently developing non-LOCA gap release fractions based on 80 GWd/MTU burnup, 10 wt% U-235 fuel, and power histories similar to those proposed by the industry during the March 2024 workshop.

- Initial attempts result in significant clad liftoff, which the staff addressed with a fuel design modeling change to increase plenum volume
  - It is expected that these results will likely bound most options that fuel designers will take

Comments/Questions?