

10 CFR 50.46c Rule Making

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Scope of Topics

- NRC Approved Fuel
- Reporting Requirements
- Significant Change
- Evaluation Model Interpretation
- Long Term Core Cooling

Important to Industry

- Short Term vs. Longer Term Fuel Utilization
- Language Should be Acceptable for Presentation to NRC Commissioners, While Leaving Available an Opportunity to Negotiate a Guidance Document.
 - Long Term Core Cooling
 - Reporting/Configuration Management
- A Significant Change Should not *Automatically* Require Re-analysis.

Paragraph (k): Use of NRC Approved Fuel

Concern:

- All Fuel Must Demonstrate Compliance with Paragraphs (d) & (g)

Issue:

- For uranium oxide and mixed uranium-plutonium oxide pellets within cylindrical zirconium-alloy cladding (i.e., current operating reactors), § 50.46c(k) invokes the fuel-specific analytical limits and requirements of § 50.46c(g) to approve fuel loading and reactor operation
- § 50.46c(g)(1) requires that such fuel be “. . . designed and manufactured . . .” to meet certain requirements, including confirmatory testing of breakaway oxidation behavior
- ***Strict interpretation of proposed language suggests that fuel manufactured before implementation of NRC-approved breakaway oxidation (BAO) testing programs would, at some point in time, be unacceptable for use in reactor cores***

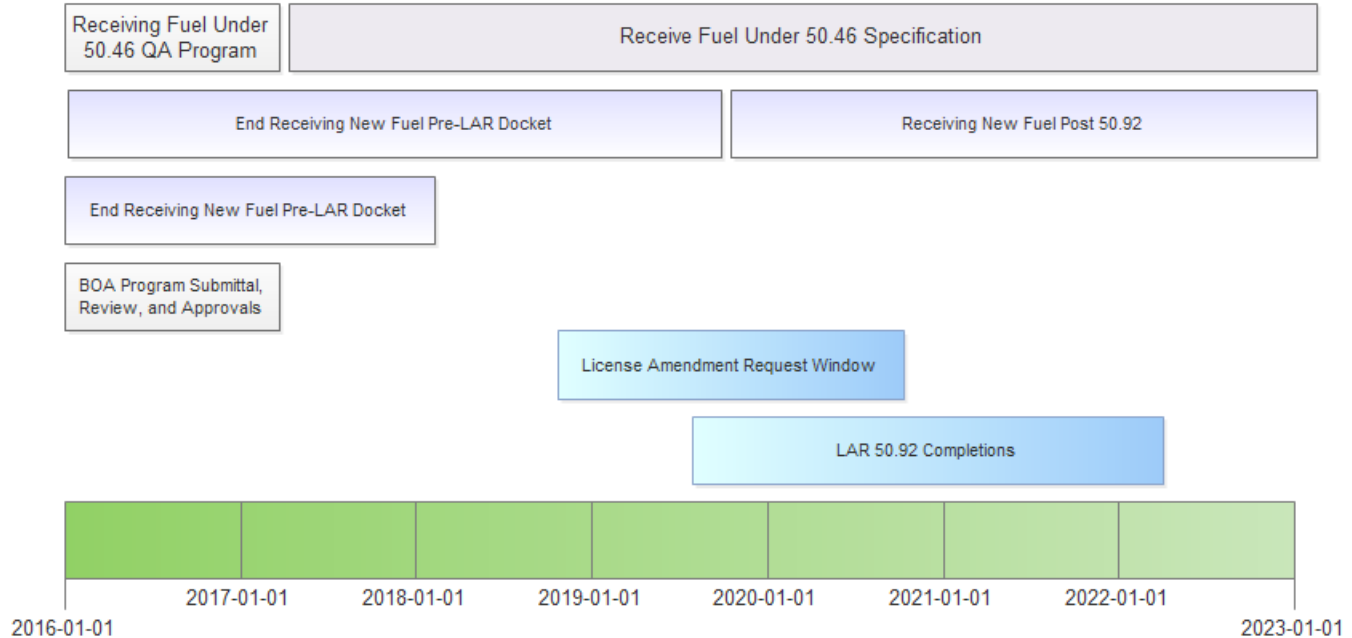
Paragraph (k): Use of NRC Approved Fuel

Discussion

- Regulatory Guide 1.224, “Establishing Analytical Limits for Zirconium-Alloy Cladding Material,” would provide guidance to allow the use of certain fuel manufactured prior to implementation of NRC-approved BAO testing programs
- “Doughnut Hole” – Addresses fuel manufactured prior to the effective date of the § 50.46c rule, but does not address fuel that may be manufactured after that date and before implementation of testing programs
- Could Delay Implementation of New Fuel

Paragraph (k): Use of NRC Approved Fuel

Time Line



Paragraph (k): Use of NRC Approved Fuel

Discussion

- Addresses only irradiated fuel bundles that would operate at substantially lower power, but does not address unirradiated fuel
- § 50.46c language is legally enforceable, whereas regulatory guidance is not
- Other pertinent NRC regulations cannot be easily “backfit” to previously manufactured fuel, such as the quality assurance program requirements of Appendix B to 10 CFR Part 50
- Criterion IV, Procurement Document Control – Regulatory requirements, design bases, and other requirements to be suitably included or referenced in procurement documents
- Criterion XVII, Quality Assurance Records – Must have evidence of activities affecting quality, including tests, inspections, and materials analyses

Paragraph (k): Use of NRC Approved Fuel

Recommendation

- Prevent misinterpretation of § 50.46c(k) requirements by modifying § 50.46c(g)(1)
- “. . . Fuel consisting of uranium oxide or mixed uranium-plutonium oxide pellets within cylindrical zirconium-alloy cladding must ~~be designed and manufactured to~~ meet the following requirements: . . .”
- Modify Regulatory Guide 1.224 to address all fuel that may be manufactured prior to implementation of NRC-approved BAO testing programs, both irradiated and unirradiated

Paragraph (m): Reporting (§ 50.46c(m)(1)(i))

Issue

- For non-significant changes and errors, § 50.46c(m)(1)(i) would require that a report be submitted to NRC “. . . no later than 12 months after the change or discovery of the error . . .”
- Currently, §§ 50.46(a)(3)(ii) and 50.46(a)(3)(iii) require that non-significant changes and errors be reported to NRC “. . . at least annually . . .”
- ***Change in language suggests that an annual report would not be required if there were nothing new to report***
- ***Change in language would likely require entities to modify their administrative practices in order to track specific (non-periodic) due dates in lieu of annual (periodic) dates***

Paragraph (m): Reporting (§ 50.46c(m)(1)(i))

Discussion

- Entities typically comply with current § 50.46 requirements by preparing and submitting reports on a calendar year basis
- Entities have submitted annual § 50.46 reports despite having no new changes or errors in a given calendar year
- Licensees support proposed § 50.46c(m)(1)(i) language because NRC would be notified only when there is something new to report
 - 1974 version of § 50.46 did not require annual reports
 - 1988 version of § 50.46 added annual reporting requirement

Paragraph (m): Reporting (§ 50.46c(m)(1)(i))

Discussion *(continued)*

- NRC staff supported elimination of § 50.46 annual reports in SECY-99-181
- § 50.46c Statement of Considerations suggests the NRC staff expects entities will incorporate non-significant changes into their UFSARs pursuant to § 50.71(e)
- Distinction between reporting [§ 50.46] and recordkeeping [§ 50.71(e)]
- UFSAR format, content, and change control practices vary throughout the industry
- Some entities revise their UFSARs only after new AORs are approved, but change control practices could be standardized on a forward-going basis

Paragraph (m): Reporting (§ 50.46c(m)(1)(i))

Recommendation:

- Option 1
 - Retain proposed § 50.46c(m)(1)(i) language as-is, that is, require that non-significant changes and errors be reported to NRC “. . . no later than 12 months after the change or discovery of the error . . .”
 - Clarify Statement of Considerations to remove any reference to annual reports
 - Clarify Statement of Considerations to establish expectation, on a forward-going basis, for standardized industry practice for UFSAR change control
 - Clarify NEI 98-03, “Guidelines for Updated Final Safety Analysis Reports,” which is endorsed by NRC Regulatory Guide 1.181, “Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e)”
 - UFSARs and § 50.46c(m)(1)(i) reports (issued between UFSAR revisions) would inform the staff of how each entity complies with ECCS performance requirements
- Option 2
 - Modify § 50.46c(m)(1)(i) language and Statement of Considerations to restore NRC expectation for annual reports

Paragraph (m): Reporting (§ 50.46c(m)(1)(ii))

Issue

- For significant changes and errors, § 50.46c(m)(1)(ii) would require “. . . a schedule for providing a reanalysis and implementation of corrective actions . . .”
- Currently, §§ 50.46(a)(3)(ii) and 50.46(a)(3)(iii) require “. . . a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with § 50.46 requirements . . .”
- ***Change in language suggests that a reanalysis would always be required as a result of submitting a report to NRC of a significant change or error***
- ***Change in language suggests that § 50.46c would establish a more restrictive requirement than other regulations that require entities to perform ECCS performance analyses and evaluations (e.g., §§ 50.34, 50.36, 52.47, 52.79, 52.137, 52.157)***

Paragraph (m): Reporting (§ 50.46c(m)(1)(ii))

Discussion

- Fundamental purpose of a safety analysis is to provide a technical basis to demonstrate that a plant can be operated, and can withstand postulated Design Basis Events, without undue radiological risk to the health and safety of the public
 - Purpose and scope of safety analyses are addressed in widely-used design standards for PWRs [e.g., ANS 51.1, formerly ANSI N18.2] and BWRs [e.g., ANS 52.1]
 - Format and content are addressed in guidance documents [e.g., NRC Regulatory Guide 1.70]
 - Regulations require that safety analysis reports include analyses and evaluations of ECCS performance following postulated LOCAs [§§ 50.34, 52.47, 52.79, 52.137, 52.157]
 - Regulations require that Technical Specifications (and, through reference in the Technical Specifications, core operating limits) are derived from analyses and evaluations in safety analysis reports [§ 50.36]
- Statement of Considerations for the 1988 version of § 50.46 suggests that reanalysis is in order when “significant” changes and errors erode confidence in an existing ECCS performance analysis

Paragraph (m): Reporting (§ 50.46c(m)(1)(ii))

Discussion *(continued)*

- Margin considerations
 - Regulatory limits – NRC acceptance criteria for safety analysis
 - Analyzed plant condition – Analyzed envelope of plant conditions, determined by safety analysis for a particular plant utilizing an NRC-approved ECCS Evaluation Model
 - Operating plant condition – Actual allowed envelope of plant conditions, determined by Technical Specifications, core operating limits, and plant configuration data

Paragraph (m): Reporting (§ 50.46c(m)(1)(ii))

Discussion *(continued)*

- Compliance considerations
 - §§ 50.46 and 50.46c requires that there be margin between the regulatory limits and the analyzed plant condition
 - §§ 50.34, 50.36, etc., on the other hand, require that the analyzed plant condition bound the operating plant condition, with or without margin
- Reanalysis has the effect of changing the analyzed plant condition, which in turn can either increase or decrease the margin between the regulatory limits and the analyzed plant condition
- Definition of “significant” in § 50.46c(n) is not necessarily synonymous, however, with an erosion of confidence in compliance with §§ 50.34, 50.36, etc.

Paragraph (m): Reporting (§ 50.46c(m)(1)(ii))

Recommendation:

- Restore an Alternative to Reanalysis in § 50.46c(m)(1)(ii)
- Recognize Entities have an Obligation to Demonstrate Compliance with all Pertinent Requirements
 - Not just § 50.46c
- Recognize that “other action” does not mean “no action”
- Consider the Following Language:
 - “. . . If an entity identifies any change to, or error in, an ECCS evaluation model, or the application of such a model, that does not result in any predicted response that exceeds any of the acceptance criteria but is significant as defined in paragraph (n) of this section, then a report describing each such change or error, and a **proposed** schedule for providing a reanalysis ~~and implementation of corrective actions~~ **or taking other action as needed to demonstrate compliance with requirements and the adequacy of the plant licensing basis**, must be submitted within 60 days of the change or discovery of the error.
- Language Should be Acceptable for Presentation to NRC Commissioners, While Leaving Available an Opportunity to Negotiate a Guidance Document Defining What Types of Demonstrations are Suitable for Various Types of “Significant” Changes and Errors

Paragraph (n): Significant Change

Concern:

- Basis for Significant (Historical vs. Safety)
- Language Mis-match Between PCT and Oxidation (Singular vs. Plural)

Issue

- (i) Peak fuel cladding temperature different by more than 50 °F from the temperature calculated for the limiting transient using the last acceptable evaluation model, or is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50 °F; or
- (ii) Integral time at temperature different by more than 0.4 percent ECR from the oxidation calculated for the limiting transient using the last acceptable evaluation model, or is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective oxidation changes is greater than 0.4 percent ECR.
- *§ 50.46c(n) defines “significant” changes and errors on the basis of quantitative impacts on Peak Cladding Temperature (PCT) and Equivalent Cladding Reacted (ECR)*
- *§ 50.46c(n) defines “significant” for a single change or error, as well as by using a cumulative sum of absolute magnitudes approach for multiple changes or errors (similar to § 50.46)*

Paragraph (n): Significant Change

Discussion:

- Utilize a Performance Based Approach
 - Rule Only Identifies *What* Qualitatively
- Leave Specifics to Regulatory Guide
 - Too Many Degrees of Freedom to Effectively Address by Rule
- Rely Upon Existing Appendix B Programs
 - Corrective Action Program Determines Corrective Action(s)

Paragraph (n): Significant Change

Recommendation:

- (i) ~~Peak Fuel cladding temperature different by more than 50 °F from the temperature~~ calculated for the limiting transient using the last acceptable evaluation model, **resulting in individual or cumulative substantial loss of margin to the limit regarding paragraph (g)(1)(i), or leads to a loss of confidence in the acceptable methodology** ~~is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50 °F~~; or
- (ii) Integral time at temperature ~~different by more than 0.4 percent ECR from the oxidation~~ calculated for the limiting transient using the last acceptable evaluation model, **resulting in individual or cumulative substantial loss of margin to the limit regarding paragraph (g)(1)(ii), or leads to a loss of confidence in the acceptable methodology** ~~or is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective oxidation changes is greater than 0.4 percent ECR.~~

Evaluation Model Interpretation

Concern:

- Treatment of Plant-Specific Input as Part of the Approved Evaluation Model

Issue

- (b) ... ECCS evaluation model means the calculational framework for evaluating the behavior of the light water reactor system (including fuel) during a postulated LOCA. It includes one or more computer programs and all other information necessary for application of the calculational framework to a specific LOCA, such as mathematical models used, assumptions included in the programs, procedure for treating the program input and output information, specification of those portions of analysis not included in computer programs, values of parameters, and all other information necessary to specify the calculational procedure.
- *Inconsistent interpretation of “plant specific information”*

Evaluation Model Interpretation

Discussion

- Plant-Specific Information Isn't Part of an Approved Evaluation Model
- Plant Changes to Improve Physical Safety Can Be Discouraged
- Licensee Should Have Ownership of Margins to Acceptance Criteria
- Recognize Distinction Between Plant-Specific Input vs. Element of an Approved Evaluation Model
 - Analogous with Distinction Made in §50.59

Evaluation Model Interpretation

Recommendation:

- Refer to Table A.2 of the NEI Public Comments on Draft 50.46c rule language FRN.
- Work with NRC Staff to develop guidance to clarify what is, or is not, plant specific information.

Appendix K and Long Term Core Cooling

Issue

- (d)(i) *Realistic ECCS evaluation model*. A realistic ECCS evaluation model must describe the behavior of the reactor system during a loss-of-coolant accident in a realistic manner. Comparisons to applicable experimental data must be made and uncertainties in the analysis method and inputs must be identified and assessed so that the uncertainty in the calculated results can be estimated. This uncertainty must be accounted for so that, when the calculated ECCS cooling performance is compared to the applicable specified and NRC-approved analytical limits, there is a high level of probability that the limits would not be exceeded.
- (d)(ii) *Appendix K model*. Alternatively, an appendix K ECCS evaluation model may be developed in conformance with the required and acceptable features of appendix K to this part.
- ***Does Appendix K Apply to Long Term Core Cooling?***

Appendix K and Long Term Core Cooling

Issue

- *If Appendix K itself isn't applicable to Long Term Core Cooling, How do I do anything other than Realistic Evaluations?*

Appendix K and Long Term Core Cooling

Recommendation:

- The Rule Language Needs to Accommodate the Long Term Core Cooling Situation
- (2) *ECCS performance demonstration*. ECCS performance must be demonstrated using an ECCS evaluation model meeting the requirements of paragraph (d)(2)(i) or (d)(2)(ii) of this section, and satisfy the analytical requirements in paragraphs (d)(2)(iii), (d)(2)(iv), and (d)(2)(v) of this section, **or other acceptable method**. Paragraph (e) of this section may be used for consideration of debris in long term cooling as described in paragraph (d)(2)(iii) of this section.(d)(ii) *Appendix K model*. Alternatively, an appendix K ECCS evaluation model may be developed in conformance with the required and acceptable features of appendix K to this part.
- ...or..
- (d)(X?) *Conservative model*. Alternatively, a conservative evaluation model may be developed.
- ...or..
- Some kind of change to Appendix K itself.

Summary

- Short Term vs. Longer Term Fuel Utilization
 - Fuel Procurement / QA Requirement Application
 - BAO Program Schedule Alignment
 - Eliminate the “Doughnut Hole”
- Language Should be Acceptable for Presentation to NRC Commissioners, While Leaving Available an Opportunity to Negotiate a Guidance Document.
 - Long Term Core Cooling
 - Reporting/Configuration Management
- A Significant Change Should not *Automatically* Require Re-analysis.