

DRAFT SUPPORTING STATEMENT FOR PROPOSED RULE

10 CFR 50.46c

“EMERGENCY CORE COOLING SYSTEM PERFORMANCE DURING LOSS-OF-COOLANT ACCIDENTS”

(OMB CLEARANCE NO. 3150-0011)

DESCRIPTION OF THE INFORMATION COLLECTION

The Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to revise the acceptance criteria for the emergency core cooling system (ECCS) for light-water nuclear power reactors as currently required by 10 CFR part 50. The revised ECCS acceptance criteria would reflect recent research findings that identified previously unknown embrittlement mechanisms for fuel rods with zirconium alloy cladding under loss-of-coolant accident (LOCA) conditions. Further, the proposed rule would apply to all fuel types and cladding materials and address concerns raised in two petitions for rulemaking (PRMs). The proposed rule would ensure an acceptable level of fuel rod cladding post-quench ductility (PQD) following a postulated loss-of-coolant accident, and thus would ensure that the level of protection intended to be achieved by the current rule is maintained. The proposed rule would affect all 100 currently operating reactors, applicants for and holders of construction permits, applicants for operating licenses, each applicant for or holder of a combined license under 10 CFR part 52, standard design certification applicants, each applicant for a standard design approval under 10 CFR part 52, and each applicant for manufacturing license under 10 CFR part 52.

Existing regulations in 10 CFR part 50 specify reporting and recordkeeping requirements associated with ECCS used in a nuclear power plant. The proposed rule would revise these regulations as they pertain to ECCS evaluation requirements for LOCAs, meaning those analyses, programs, reporting requirements, and other activities intended to demonstrate that ECCS can perform their intended LOCA safety functions when needed. The proposed rule is intended to extend applicability to all light water nuclear power reactors regardless of fuel design or cladding material used, account for recent research findings that discovered previously unknown cladding embrittlement mechanisms, address a PRM that requested that the effects of crud be considered in ECCS analyses, and allow licensees to use an alternative risk-informed approach to evaluate the effects of debris for long-term cooling. The largest initial burden of this rule is that ECCS models must be updated to account for research findings, and must include improved hydrogen uptake models.

In order to present the new, performance-based requirements in a clear manner, the proposed rule reflects a reorganization and rephrasing of the requirements that are currently in § 50.46 and appendix K to 10 CFR part 50. In the proposed § 50.46c, the requirements applicable to demonstrating acceptable ECCS system performance, are separated from the requirements applicable to establishing fuel system parameters to be used in demonstrating acceptable ECCS system performance.

The current requirements for ECCS systems are provided in § 50.46. When the proposed rule becomes effective, it would be added as § 50.46c. Due to the staged implementation schedule, it would be necessary for both § 50.46 and § 50.46c to be in effect

until all licensees have implemented § 50.46c. Once implementation is complete, § 50.46c would replace § 50.46.

Overview of Implementation

The proposed rule establishes a staged (over a five year period) implementation approach to improve the efficiency and effectiveness of the migration to the new ECCS requirements. As the first step, vendors would develop, and submit to the NRC for review via topical reports, hydrogen pick up models and LOCA model updates. This is expected to occur during the first year following issuance of the proposed rule. Another step in the implementation would be the development of new PQD analytical limits in place of utilizing the acceptable PQD analytical limits provided in the regulatory guidance. For the purpose of this analysis, the NRC assumes that the industry elects to establish new PQD analytical limits for two cladding alloys. The remaining seven cladding alloys will utilize the PQD analytical limits in the regulatory guidance. The NRC assumes that, due to the high cost of establishing a new experimental technique (outside the acceptable experimental technique in the regulatory guidance), no vendor will choose that method. The PQD analytical limits would be submitted for NRC review in the form of a topical report. Finally, during the first year after the rule becomes effective, the vendors would perform initial breakaway testing. The results of the initial breakaway tests would be submitted by the licensee via a license amendment request (LAR).

As part of this implementation plan, operating reactor licensees would be divided among three implementation tracks based upon plant specific information provided by the Pressurized Water Reactor Owners Group and Boiling Water Reactor Owners Group, with Nuclear Energy Institute coordination. The purpose of the staged implementation approach is to bring licensees into compliance as quickly as possible, while accounting for: 1) differences between realistic and Appendix K LOCA models; and 2) the level of effort and scope of analyses required for compliance. Track 1 would contain 64 plants; these plants currently meet the proposed requirement without the use of any credits. As such, these sites would demonstrate compliance by providing a letter report to the NRC. (There is no associated NRC review required.) Track 1 plants would demonstrate compliance within a two year period, and would be in compliance at the end of Year 2.

Tracks 2 and 3 would consist of plants that require a new ECCS evaluation, including adopting a previously approved realistic evaluation model, revisions to existing evaluation models, new LOCA break spectrum analysis, multiple rod surveys, and Technical Specification changes. Those plants would need to submit a new LOCA analysis of record (AOR), and, where applicable a LAR. Track 2 would contain 15 plants, all of which would work over a three year period beginning in Year 2 to ultimately demonstrate compliance at the end of Year 4. Track 3 would contain 21 plants and would work over a three year period beginning in Year 3 to ultimately demonstrate compliance at the end of Year 5. The NRC review of the AORs would require two years of effort, beginning in Year 5 for Track 2 and in Year 6 for Track 3.

Lastly, licensees would begin to conduct periodic breakaway tests one year after they are in compliance. (Track 1 to begin periodic breakaway testing in Year 3, Track 2 in year 5 and Track 3 in Year 6.) (The proposed rule would specify that, for this purpose, "periodic" is considered to be prior to each reload batch.) The results of these tests would be included in the annual ECCS submittal.

The proposed rule would allow licensees to use an alternative risk-informed approach to evaluate the effects of debris for long-term cooling. This analysis assumes that 16 licensees will elect to submit a risk-informed alternative: 14 units (10 AORs) in Track 1, 1 unit (1 AOR) in Track 2, and 1 unit (1 AOR) in Track 3.

This analysis considers burdens imposed by the two design certifications expected to be renewed. This analysis assumes that these are the only design certifications that will be submitted.

This analysis also considers burdens imposed by the proposed rule on future operating reactors (this includes one reactor re-starting construction and 4 new reactor units). The implementation steps for these plants consist of initial breakaway tests, long term cooling tests, and periodic breakaway tests. (The first construction re-start will begin to implement the rule in Year 1, and complete implementation activities in Year 2. The four new reactor units will implement the rule in Years 4 and 5. The second construction restart will complete implementation in Year 6.)

The staged implementation is based on track assignments, which include all 100 operating reactors. In addition to those tracks, the table below identifies which track the activities required for the five design certifications, two construction restarts, four new reactors, and three fuel design vendors most closely follow.

	Track 1	Track 2	Track 3	2020
74 Analyses of Record*	49	12	13	0
4 New Reactors	0	0	4	0
2 Design Certifications	0	2	0	0
2 Construction Restarts	1	0	0	1
3 Fuel Design Vendors	3	0	0	0
TOTAL	53	14	17	1

* There are 100 operating reactors. Of those, Track 1 contains 64 operating reactors, Track 2 contains 15 operating reactors, and Track 3 contains 21 reactors. However, the implementation steps are based on AORs submitted. (The one exception to this is the periodic breakaway tests, which are submitted per operating reactor.) In some cases, one AOR may cover multiple reactors. Track 1 contains 49 AOR, Track 2 contains 12 Analyses of Record, and Track 3 contains 13 AOR.

Additional information about the implementation tracks can be found in Supplement 1, Licensee Staged Implementation of § 50.46c.

Requirements

To support the implementation of the new requirements on individual plant docket, fuel vendors would be encouraged to submit for NRC review alloy-specific hydrogen uptake models and any LOCA model updates no later than 12 months from the effective date of the rule. This submittal would be in the form of a topical report, which would be reviewed by the NRC. Upon

approval, these models and methods would be used by plants in Tracks 2 and 3 to demonstrate the ECCS performance against the new analytical limits. Licensees would be required to update their AORs, and, where applicable, would need to submit a LAR updating the Core Operating Limits Report (COLR) list of approved methods.

When it becomes effective, vendors would either: 1) employ PQD analytical limits; 2) employ the experimental technique provided in the regulatory guide to perform PQD testing and develop analytical limits; or 3) develop a new experimental technique to perform PQD testing and develop analytical limits. Vendors choosing option one would not provide a report to the NRC. The NRC anticipates that one vendor would choose option two, and employ the experimental technique provided in the regulatory guide for two cladding alloys. This requires the submission of a report. Option three would require NRC review of the experimental technique; due to option three's high cost and burden, the NRC does not anticipate that any vendors would elect to use option three on any cladding when the rule becomes effective.

The proposed rule would also require licensees to perform breakaway oxidation testing to develop analytical limits. The NRC would review the analytical limits that result from such testing. The subject rulemaking would require breakaway testing be performed prior to each reload batch, the results of which would be included in routine, yearly ECCS reports required by the current § 50.46(a)(3)(ii), and proposed § 50.46c(m)(1). The proposed rule would also require licensees to establish a limit on long-term peak cladding temperature.

The NRC notes that the proposed rule would require licensees to report significant errors in calculated equivalent cladding reacted (ECR). Therefore, for the purposes of this analysis, the NRC assumes that the cost of reporting ECR is negligible since licensees calculate ECR under the current regulation and are already required to report changes to or errors in ECCS evaluation models with respect to calculated ECR.

The NRC would also incur annual costs as a result of reviewing reported errors in calculated ECR. However, the current regulation requires licensees to report errors in calculated PCT, and the actions the NRC would take for an error in ECR are the same as those actions for errors in calculated PCT. Additionally, errors in calculated ECR would have an associated error in calculated PCT. For all of these reasons, the NRC assumes that the change in annual cost between the current and proposed rule, with respect to reporting ECR, are negligible.

The NRC notes that the proposed reporting criteria is restructured and rewritten to provide clarification on which items need to be reported, and the timeframe for reporting. The proposed language clarifies the intent of the current regulation, i.e., the current regulation accounted for operating experience. As such, the proposed revision does not constitute a change in burden to the NRC or the industry.

The proposed rule would also allow licensees to submit risk-informed alternatives to address the effects of debris during the long-term period. The licensees that choose this approach would submit these alternatives to the NRC for review and approval. Additionally, the licensees would have to update their alternatives every four years and report changes and errors discovered.

A. JUSTIFICATION

1. Need for the Collection of Information

Section 50.12 provides that the Commission may grant exemptions from the requirements of Part 50 under specified conditions, upon application by any interested person or upon its own initiative. Applications under this section are examined by the NRC staff to determine whether the requested exemption is authorized by law and to ensure it will not endanger life or property or the common defense and security, and to determine if it is otherwise in the public interest. The proposed rule would not change the requirement in § 50.12, however, the rulemaking reduces the number of exemptions sought by licensees as a result of the rule's applicable extended beyond that of the current regulation. (The current rule applies to light water nuclear power plants fueled with uranium-oxide pellets within cylindrical zircaloy or ZIRLO cladding only. The proposed rule applies to all light water nuclear power reactors, regardless of fuel design or cladding material.) This analysis assumes 50 plants would apply for an exemption (5/year). Therefore, as a result of the proposed rule, the NRC estimates a reduced reporting burden associated with § 50.12. Also, the proposed rule would allow licensees to use an alternative risk-informed approach to address the effects of debris on long-term cooling. Every alternative submitted obviates the need for four exemption requests.

Paragraph 50.46c(d): This paragraph is the same as the current § 50.46(a)(10(i)) and does not represent additional requirements. There is no increase in burden above the current requirements in 50.46(a). However, the proposed rule, in § 50.46c(d)(2)(iii), would allow licensees to use risk-informed alternatives to address the effects of debris during the long-term post-quench period. The burden for risk-informed alternatives is included under 50.46(e).

Paragraph 50.46c(d)(3) contains the "Required Documentation" section of the current regulation's appendix K to 10 CFR part 50. The rule does not add burden for documentation, as licensees are currently required to maintain this documentation under appendix K to 10 CFR part 50.

Paragraph 50.46c(e): The proposed rule would establish requirements for the alternative risk-informed submittals that evaluate the effects of debris during the long-term. Paragraph 50.46c(e)(2) would require licensees to submit an application under § 50.90, if they choose to use the alternative. Paragraph 50.46c(e)(3) would identify the process by which the NRC reviews and approves the submittals. Paragraph 50.46c(e)(4) would require licensees to review changes to the plant, operational practices, applicable plant and industry operational experience, and, as appropriate, update the PRA and re-perform evaluations to confirm the acceptance criteria continue to be met.

Paragraph 50.46c(g): One objective of the proposed rule is to incorporate recent research findings that identified previously unknown embrittlement mechanisms. A major finding of the research was that hydrogen, which is absorbed in the cladding during the burnup-related corrosion process under normal operation, has a significant influence on the embrittlement during a hypothetical accident. As a result of this finding, vendors would be encouraged to submit for NRC review (via a topical report) alloy-specific hydrogen uptake models and any LOCA model updates no later than 12 months from the effective date of the rule. For the purposes of this supporting statement, the burden for the LOCA models was

estimated in two parts: one for the PQD and breakaway updates, and another for long term cooling updates.

Licensees would also establish PQD analytical limits. This can be done by either 1) using the limits provided in a regulatory guide; 2) using the NRC approved procedure in a regulatory guide to develop the PQD limit; or 3) developing their own experimental procedure for NRC approval and using that to develop a PQD limit. For this collection, the NRC assumed that the analytical limits provided in the Regulatory Guide would be used for seven cladding alloys, and that the vendors would use the experimental method provided in the Regulatory Guide for two cladding alloys. The NRC assumed that no vendor would develop its own experimental method to establish PQD analytical limits due to the cost and burden. The results of the PQD tests would be submitted to the NRC via a topic report for each cladding tested.

Paragraphs 50.46c(g)(1)(ii) and (iii) would require:

- Vendors to submit Topical Reports to NRC for Hydrogen Uptake Models.
- Vendors to submit Topical Reports to NRC for LOCA Models (PQD, Breakaway)
- Vendors to submit Topical Reports to NRC - LOCA Models (long term cooling)
- Vendors to report PQD tests (Redone NRC Experimental Technique), submitted Via Topical Report)
- Licensees to conduct and report initial breakaway tests. This report would be included in the licensee's AOR.

Paragraph 50.46c(g)(1)(v) would require licensees to establish a specified and NRC approved analytical limit on long-term peak cladding temperature which corresponds to the measured ductile-to-brittle transition for the zirconium-alloy cladding material based on an NRC approved experimental technique. This limit would need to be approved by the NRC after being submitted as a license amendment or a letter confirming compliance.

Paragraph 50.46c(m)(1) would require licensees to report a change in cladding oxidation of more than 0.4 percent equivalent cladding reacted (ECR) from the oxidation calculated for the limiting transient, or a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective oxidation changes greater than 0.4 percent ECR. This report would be included in the annual ECCS submittal required under the subject rulemaking's § 50.46c(m)(1). As mentioned earlier, this cost is assumed to be negligible because the current regulation in 50.46(3)(i), (ii) and (iii) requires licensees to report errors in calculated peak cladding temperature (PCT), and the actions the NRC would take for an error in ECR are the same as those actions for errors in calculated PCT. Additionally, errors in calculated ECR would have an associated error in calculated PCT. For all these reasons, the NRC assumes that the change in annual cost between the current and proposed rule, with respect to reporting ECR, are negligible.

Paragraph 50.46c(m)(3) would require the licensees to measure the onset of breakaway oxidation for each reload batch, and report any changes in the time to the onset of breakaway oxidation at least annually. This report would be included in the annual ECCS submittal

required for changes and errors that are not significant under the subject rulemaking's § 50.46c(m)(1) (current rule's § 50.46(a)(3)(ii)).

Paragraph 50.46c(m)(4) would add reporting requirements with respect to the risk-informed submittals that would require licensees to update the PRA models every 4 years and to report errors and changes.

In addition, the proposed rule would move the "Required Documentation" section of Appendix K to Part 50, Section II to the proposed § 50.46c(d)(3).

Recordkeeping Burden: This proposed rule does not require the licensee to create any new reports; instead, the rulemaking adds additional information to those reports, as described above. However, because of the proposed rule's expanded applicability, the proposed rule would reduce the recordkeeping burden by eliminating the need for certain exemption requests:

- The proposed rule would eliminate the need for exemption requests to use materials other than zircaloy and ZIRLO. This analysis assumes that 5 exemptions would be filed per year if this proposed rule was not implemented. Therefore, the proposed rule would result in a reduction in the recordkeeping burden for exemptions submitted under 50.12.
- The proposed rule would allow licenses to use an alternative risk-informed approach to evaluate the effect of debris on long-term cooling. This provision would eliminate the need for exemption requests to use such an alternative. This analysis assumes that 16 units would submit 4 extension requests each (§ 50.46 and General Design Criteria 35, 38, 41) if the alternative were not permitted by the proposed rule. This is an additional burden reduction for exemptions submitted under 50.12.

However, should a licensee choose to submit a risk-informed alternative to address the effects of debris during the long-term period, the licensee would be required to maintain that submittal, which would add recordkeeping burden. Paragraph 50.46c(m)(4) would require the licensee to review changes to the plant, operational practices, applicable plant and industry operational experience, and, as appropriate, update the PRA and re-perform evaluations to confirm the acceptance criteria continue to be met.

2. Agency Use of Information

The information identified will be used to determine licensee compliance with the requirements of appendix K to 10 CFR part 50 and the proposed § 50.46c and, thus, ensure that the reactor operates within the limits required to protect public health and safety. If not in compliance, the information will allow NRC to assess how and when compliance to the applicable requirements will be achieved.

3. Reduction of Burden Through Information Technology

There are no legal obstacles to reducing the burden associated with this information collection. The NRC encourages respondents to use information technology when it could be beneficial to them. NRC issued a regulation on October 10, 2003 (68 FR 58791), consistent with the Government Paperwork Elimination Act, which allows its licensees, vendors, applicants, and members of the public the option to make submissions electronically via CD-ROM, e-mail, special Web-based interface, or other means. The NRC estimates that 100% of these submittals will be filed electronically.

4. Efforts to Identify Duplication and Use of Similar Information

No sources of similar information are available. There is no duplication of requirements. NRC has in place an ongoing program to examine all information collections with the goal of eliminating all duplication and/or unnecessary information collections.

5. Effort to Reduce Small Business Burden

The provisions of this regulation do not affect small businesses.

6. Consequences to Federal Program or Policy Activities if the Collection is Not Conducted or is Conducted Less Frequently

The frequency with which this information is collected is determined by how often the accepted ECCS evaluation model is modified and whether these changes significantly affect the calculated peak clad temperature. Less frequent collection could adversely affect public health and safety.

7. Circumstances which Justify Variation From OMB Guidelines

A licensee would be required to submit a report under the subject rulemaking's § 50.46c(m)(1) within 30 days of discovering any significant change or error so that NRC is apprised of significant safety issues requiring immediate resolution. Although the requirement to report significant changes in ECR would be added by this proposed rule, the time frame of the report is unchanged from the current regulations at § 50.46(a)(3)(ii).

Paragraph 50.46c(m)(4) would require entities electing to use the risk-informed approach for addressing debris to review the analyses, evaluations, and modeling for changes to errors and update the analyses, evaluations, and modeling as appropriate. The retention requirement for this paragraph is to maintain the record for the duration of the license. This is necessary to confirm that the acceptance criteria of § 50.46(e)(1) continue to be met.

8. Consultations Outside the NRC

Opportunity for public comment has been published in the *Federal Register*. An Advance Notice of Proposed Rulemaking (ANPR) on this subject was published in the *Federal Register* on August 13, 2009 (74 FR 40765). A public workshop was held on April 23-24, 2010, to discuss public comments received on the ANPR. As a result of comments received on the ANPR, a proposed staged implementation plan was developed to improve the efficiency and effectiveness of the migration to the proposed ECCS requirements.

9. Payment or Gift to Respondents

Not applicable.

10. Confidentiality of Information

Confidential and proprietary information is protected in accordance with NRC regulations at 10 CFR 9.17(a) and 10 CFR 2.390(b).

11. Justification for Sensitive Questions

This regulation does not request sensitive information.

12. Estimated Industry Burden and Burden Hour Cost

Due to the proposed staged implementation of the rule, only those 49 sites in the first track, the first construction re-start, and the five design certifications will have implemented the rule in the first three years. Therefore, the burden estimated in this supporting statement reflects just one of three tracks. The second track (12 sites) will be implemented in the fourth year after the effective date of the rule, and the third track (13 licensees) and the four new reactor units will be implemented in the fifth year after the effective date of the year. The second construction restart will implement the rule in Year 6. Therefore, additional burden will be incurred during those years.

During the clearance period, there are a total of 70 respondents to the information collection:

- 64 power reactors¹
- 2 Design Certifications
- 1 Construction Restart
- 3 Fuel Design Vendors

The burden estimate is shown in the attached tables. The burden estimates are based on the number of respondents during the first three years of the collection, according to the staggered implementation of the requirements. The total burden is 61,131 hours and \$ \$16,627,620 (61,131 hrs x \$272/hr). The one-time reporting burden results in 64,066.95 hours and \$ \$17,426,211.67. Again, this one-time reporting burden covers only the first three years following the effective date. Annual burden is estimated to be a savings of 2176 hours and \$591.872 (2,176 hours x \$272). There is a reduction in annualized recordkeeping burden due to the proposed rule's resultant reduction in exemption requests under § 50.12. The annual recordkeeping burden is estimated to be reduced by 760 hours, or a savings of \$206,720 (760 hours x \$272).

13. Estimate of Other Additional Cost

This proposed rule does not require the licensee to create any new reports; instead, the rulemaking adds additional information to those reports, as described above. As such, the recordkeeping burden of § 50.46 is not increased by the proposed rule. There are no other additional costs.

14. Estimated Annualized Cost to the Federal Government

¹ 100 power reactor units will submit periodic breakaway oxidation test results in yearly ECCS reports once implementation is complete (61 during the first three years). All other implementation steps are based on 74 AORs, because some of the reactor sites share an analysis of record.

The NRC will incur burden to review (and approve, where necessary) the submitted reports. The current annualized cost to the Federal government for Part 50 is \$90,839,119. The one-time annualized cost to the Federal government resulting from this proposed rule is \$2,618,000. The total annualized cost to the government for Part 50 will be \$90,839,119 + \$2,618,000 = \$93,457,119.

15. Reasons for Changes in Burden or Cost

The current Part 50 burden is 46,176 responses and 4,488,602 hours. The proposed rule would increase this burden by a total of 290.33 responses and 61,130.95 hours (rounded to 290 responses and 61,131 hours), making the new Part 50 total 4,549,733 hours and 46,466 hours

The proposed rule would revise ECCS acceptance criteria to reflect recent research findings which identified new embrittlement mechanisms for fuel rods with zirconium alloy cladding under loss-of-coolant accident (LOCA) conditions. This action is necessary to ensure an acceptable level of fuel rod cladding post-quench ductility (PQD) following a postulated loss-of-coolant accident, and thus to ensure the adequate protection of public health and safety. This burden is associated with one-time and recurring costs to include results of periodic breakaway testing in the yearly ECCS submittals required under the proposed rule's § 50.46c(m)(1) (current rule's § 50.46(a)(3)(ii)). This burden is justified in light of the safety importance of the proposed rule.

The proposed rule adds a recordkeeping requirement to update the risk-informed alternative. However, licensees will not begin to perform those updates until Year 6. As such, they are not calculated in this clearance period. Additionally, the proposed rule reduces the number of exemption requests filed under § 50.12. This results in an annual recordkeeping burden reduction).

Overall, the proposed rule would result in a one-time annualized burden of 64,067 hours in the first three years to implement the changes that would revise the acceptance criteria for the emergency core cooling system for light-water nuclear power reactors. Due to the phased implementation schedule for the proposed rule, one-time burdens would continue to be incurred until year 6. The annual, recurring changes resulting from the proposed rule represent an overall reduction in burden of 2,936 hours annually. Following the implementation phase, the industry will see a reduced burden for ECCS requirements in 10 CFR 50.46c compared to the current requirements under 10 CFR 50.46.

16. Publication for Statistical Use

The collected information is not published for statistical use.

17. Reason for Not Displaying the Expiration Date

The requirement will be contained in a regulation. Amending the *Code of Federal Regulations* to display information that, in an annual publication could become obsolete would be unduly burdensome and too difficult to keep current.

18. Exceptions to the Certification Statement

None.

B. COLLECTION OF INFORMATION EMPLOYING STATISTICAL METHODS

Not applicable.

Table 1: Annualized One-Time Reporting Burden

Information Collection Section	Number of Respondents	Number of responses per respondent	Number of Responses	Burden Hours per Response	Total Annual Burden Hours	Cost @\$72/hour
10 CFR 50.46c(e)						
Licenseses submit alternative risk-informed method for evaluating effects of debris in long-term ¹	10.00	1.00	10.00	1666.67	16666.67	\$4,533,333.33
10 CFR 50.46c(g)(1)(ii)&(iii)						
Vendors Submit Topical Reports to NRC for Review - Hydrogen Uptake Models ²	3.00	3.00	9.00	520.00	4680.00	\$1,272,960.00
Vendors Submit Topical Reports to NRC for Review -LOCA Models(PQD, Breakaway) ²	3.00	4.00	12.00	1040.00	12480.00	\$3,394,560.00
Vendors Submit Topical Reports to NRC for Review - LOCA Models (LTC) ²	3.00	4.00	12.00	693.33	8320.00	\$2,263,040.00
10 CFR 50.46c(g)(1)(iii)						
Vendors report PQD Test (Redone NRC Experimental Technique)(Submitted Via Topical Report) ³	1.00	2.00	2.00	173.33	346.67	\$94,293.33
Licenseses report initial breakaway tests(Reported in the same AOR) ⁴ (49 OR + 1 CR)	55.00	1.00	55.00	27.71	1523.81	\$414,475.78
10 CFR 50.46c(g)(1)(v)						
Licenseses submit letter report to NRC confirming compliance ⁵ (49 OR + 1 CR)	50.00	1.00	50.00	346.67	17333.33	\$4,714,666.67
Licenseses submit License Amendment Requests within Analysis of Record. ⁶	2.00	1.00	2.00	1040.00	2080.00	\$565,760.00
Licenseses establish limits for long term cooling ⁷ (50 OR + 1 CR)	51.00	1.00	51.00	12.48	636.48	\$173,122.56
Totals:	178.00		203.00		64066.95	\$17,426,211.67

Assumption: 1 FTE= 2080 hrs

- AORs in Track 1 will submit the alternative risk-informed method to evaluate the effects of crud during the long-term period in Year 2. 1 AOR in Track 2 will submit the alternative in Year 4. 1 AORs in Track 3 will submit the alternative in Year 5.
- Vendors will submit topical reports once: the first year after the rule becomes effective.
- Vendors will only submit topical reports for those alloys which the vendor chooses to use the NRC experimental technique. The NRC estimates this will be 2 alloys. Vendors will use the analytical limits provided in Regulatory Guidance for 7 alloys, but no cost or burden is associated with that method. The NRC predicts that no vendors will develop their own experimental technique for PQD limits.
- Licenseses will report results of initial breakaway testing within their letter (Track 1) or AOR (Tracks 2 and 3). (The four new reactors (assume 4 AORs) will report initial breakaway testing in Year 5. The second construction restart will demonstrate compliance in Year 6.
- Track 1 plants will demonstrate compliance in Year 2 by sending a letter report to NRC. (50 AORs) The 4 new reactors (assumed 4 AORs) will demonstrate compliance in Year 5. The second construction restart will demonstrate compliance in Year 6.
- Only Track 2 and Track 3 require an AOR to demonstrate compliance. Track 2 plant effort will be 1040 hrs (annualized for the 3 year period) per AOR. Track 2 plants will implement the rule in Year 4. Track 3 plants effort will be 1560 (annualized for the three year period) for each AOR. Track 3 plants will be in compliance in Year 5. (Track 2 - 13 AORs; Track 3 - 14 AORs) Although the 2 design certifications are not part of Track 2, this analysis assumes the same level of effort is required.
- Long term cooling limits will be submitted in the same LARs/AORs as Note 213.

OR = Operating Reactors; CR = Construction Restart; DC = Design Certifications

Table 2: Annualized Recurring Reporting Burden

Information Collection Section	Number of Respondents	Number of responses per respondent	Number of Responses	Burden Hours per Response	Total Annual Burden Hours	Cost @\$272/hour
10 CFR 50.12						
Exemption Requests (Expansion of Applicability)	5	-1	-5	360.00	-1800.00	-\$489,600.00
Exemption Requests (Risk-Informed Alternative for Evaluating Effects of Debris in Long-term) ⁸	4.67	-4.00	-18.67	360.00	-6720.00	-\$1,827,840.00
10 CFR 50.46c(m)(1)						
Licenses report changes in oxidation of > 0.4 ECR (or a cumulation of changes of > 0.4) ⁹	50	1	50	0.00	0	\$0.00
10 CFR 50.46c(m)(3)						
Licenses report Periodic Breakaway Oxidation Tests and include results in yearly ECCS report. ¹⁰ (60 Assumed OR +1 CR)	61	1	61.00	104.00	6344.00	\$1,725,568.00
10 CFR 50.46c(m)(4)						
Licenses report changes in risk-informed submittals ¹¹	0	1	0	100.00	0	\$0.00
Totals:	121		87.33		-2176.00	-\$591,872.00

Table 3: Annualized Recurring Recordkeeping Burden

Information Collection Section	Number of Recordkeepers	Burden Hours per Record	Total Annual Burden Hours	Cost @\$272/hour
10 CFR 50.12				
Exemption Requests (Expansion of Applicability)	5	-40.00	-200	-\$54,400.00
Exemption Requests (Risk-Informed Alternative for Evaluating Effects of Debris in Long-term) ⁸	14	-40.00	-560	-\$152,320.00
10 CFR 50.46(m)(4)				
Updates to PRA and Re-evaluations ¹²	0	100.00	0	\$0.00
Totals:	19		-760	-\$206,720.00

Total Burden Hours
61130.95
Total Burden Hour Cost:
\$16,627,620
Annual Respondents:
70
Responses:
290.33

8. 14 units in Track 1 will submit 4 fewer exemption requests (per unit) in Year 2 as a result of the proposed rule. 1 unit in Track 2 will submit 4 fewer extension requests (per unit) in Year 4 as a result of the proposed rule
1 units in Track 3 will submit 4 fewer exemption requests (per unit) in year 5 as a result of the proposed rule.
9. For the purposes of this report, the NRC assumes that the cost of reporting errors in ECR is negligible. Licensees will begin to report errors in ECR once in compliance:
Track 1 plants in Year 3, Track 2 plants in Year 5 and Track 3 plants in year 6. This requirement will add negligible burden to the current requirement.
10. The NRC assumes that 60 units in Track 1 will conduct periodic breakaway testing in Year 3. In this analysis, the burden in Year 3 was divided equally over the first three years.
In Years 4 - 6, a total of 102 units will conduct breakaway testing. (The four new reactors will conduct breakaway testing in Year 6, then every 18 months thereafter.)
11. This analysis assumes that, beginning in Year 4, one change will be submitted TOTAL per year. That change will require 100 hours to prepare.
12. PRA updates occur every 4 years. 10 AORs in Track 1 will update their PRAs in Year 6.
1 AOR from Track 2 will update its PRA in Year 8. 1 AOR from Track 3 will update its PRA in Year 9.

Table 4: Annualized One-Time NRC Review Burden

Information Collection Section	Number of Respondents	Number of responses per respondent	Number of Responses	Burden Hours per Response	Total Annual Burden Hours	Cost @\$272/hour
10 CFR 50.46c(e)						
NRC Review of Alternative Risk-Informed Submittals ¹	10	1	10.00	229.17	2291.67	\$623,333.33
10 CFR 50.46c(g)(1)(ii) and (iii)						
NRC Review of Hydrogen Uptake Models ²	3	3.00	9.00	101.85	916.67	\$249,333.33
NRC Review of LOCA Models (PQD, Breakaway) ²	3	4.00	12.00	152.78	1833.33	\$498,666.67
NRC Review of LOCA Models (LTC) ²	3	4.00	12.00	76.39	916.67	\$249,333.33
10 CFR 50.46c(g)						
NRC Review of Track 1 Letter Reports ³ (49 OR + 1 CR)	50	1	50.00	0.00	0.00	\$0.00
NRC Review of 2 Design Certification Analyses ⁴	0	0	0.00	141.03	0.00	\$0.00
NRC Review of AORs. ⁵	0	0	0.00	141.03	0.00	\$0.00
NRC Review of Initial Breakaway Oxidation Results within AOR ⁵ (49 OR + 4 DC + 1 CR)	55	1	55.00	55.00	3025.00	\$822,800.00
10 CFR 50.46c(g)(1)(iii)						
NRC Review of Initial PQD Test (Redone NRC Experimental Technique)	1	2	2.00	114.58	229.17	\$62,333.33
10 CFR 50.46c(g)(1)(v)						
NRC review of long term cooling limits ⁶ (49 OR + 1 CR)	50	1	50.00	8.25	412.50	\$112,200.00
Totals:	175		200		9625.00	\$2,618,000.00

Assumption: 1 FTE = 1375 hrs

- The NRC will review 10 alternative Track 1 AORs in Year 3, 1 submittal from Track 2 in Year 5, and 1 alternatives from Track 3 in Year 6.
- Vendors will submit Hydrogen Uptake/LOCA Models in the first year. NRC review will be Year 2/3. One time only requirement.
- Track 1 plants (49 AORs) will send a letter report verifying compliance. There is no NRC review associated with this action.
The four new reactors will demonstrate compliance in Year 5 (NRC review in Year 6). The second construction restart will demonstrate compliance in Year 6. (NRC review in Year 7)
- NRC review of the two design certifications' analyses will begin in Year 4. The NRC assumes the review of the design certifications' analyses will require the same effort as those AORs in Track 2.
- NRC review of Track 2 plants will begin in Year 5, and require 148.42 hours per response. NRC review of Track 3 will begin in Year 6 and also require 138.1 hours per response. This effort is annualized over three years.
- The NRC review of LTC limits will begin in Year 3 for Track 1 plants, Year 5 for Track 2 plants, and Year 6 for Track 3 plants. (NRC review of the four new reactors' LTC limit in Year 6.)
The NRC review of the second construction restart's LTC limit in Year 7.)

OR = Operating Reactors; CR = Construction Restart; DC = Design Certifications

Table 5: Annualized Recurring NRC Review Burden

Information Collection Section	Number of Respondents	Number of responses per respondent	Number of Responses	Burden Hours per Response	Total Annual Burden Hours	Cost @\$272/hour
10 CFR 50.12						
Exemption Request Review (Expansion of Applicability)	5	-1	-5	137.50	-687.5	-\$187,000.00
Exemption Request Review (Risk Informed Submittals) ⁷	4.67	-4.00	-18.67	40.00	-746.67	-\$203,093.33
10 CFR 50.46c(m)(3)						
Annual review of breakaway oxidation tests in the yearly ECCS reports ⁸	0	1	0	3.44	0.00	\$0.00
10 CFR 50.46c(m)(4)						
NRC Reviews Changes in Risk-Informed Submittals ⁹	0	1	0	40.00	0	\$0.00
Totals:	9.67		-23.67		-1434.17	-\$390,093.33

7. 14 units in Track 1 will no longer need to submit 4 exemption requests (per unit) in Year 2, the NRC review of those exemptions would occur in Year 3. 1 unit in Track 2 will not submit 4 extension requests in Year 4, the NRC review would occur in Year 5. 1 unit in Track 3 will not submit 4 exemption requests(per unit) in year 5 as a result of the proposed rule. The NRC review of the Track 3 exemptions would have occurred in Year 6.

8. 50.46c would require licensees to measure periodic breakaway oxidation prior to each reload batch. For the purpose of this supporting statement, a reload batch is assumed to occur every 18 months.

- This burden is the change in burden required by the proposed rule. Yearly ECCS reports are required under current regulations. The subject rulemaking requires licensees to report results of periodic breakaway tests in the report. The NRC estimates the review of the periodic breakaway tests to incur an additional .15 FTE (total). Distributed over the assumed 60 submittals per year (once all licensees have implemented the rule), this is 0.15/60 or .0025 FTE/submittal.

- The NRC would not review any initial breakaway tests in the first 3 years. The NRC would review 61 tests in Year 4, no tests in year 5, 59 tests in Year 6 (including the four new reactors), 44 tests in Year 7, and then 60 tests per year thereafter. (The assumptions vary during the staged implementation period. Once all plants have implemented the rule, the NRC assumes that 60 tests/year will be submitted.

9. This analysis assumes that, beginning in Year 4, one change will be submitted TOTAL per year. NRC review will begin in Year 5, and require 40 hrs/change submitted.

OR = Operating Reactors; CR = Construction Restart; DC = Design Certifications