

January 7, 2013

MEMORANDUM TO: R. W. Borchardt
Executive Director for Operations

FROM: Annette L. Vietti-Cook, Secretary **/RA/**

SUBJECT: STAFF REQUIREMENTS – SECY-12-0034 – PROPOSED
RULEMAKING - 10 CFR 50.46c: EMERGENCY CORE COOLING
SYSTEM PERFORMANCE DURING LOSS-OF-COOLANT
ACCIDENTS (RIN 3150-AH42)

The Commission has approved publication of the proposed rule on Performance-Based Emergency Core Cooling Systems (ECCS) Cladding Acceptance Criteria as presented in Enclosure 1 to SECY-12-0034, and subsequently modified by the staff's June 1, 2012, memo to the Commission, subject to the following comments and edits.

The staff should complete its research on fuel fragmentation, relocation, and dispersal, and incorporate any necessary changes before requesting Commission approval of the draft final rule. The staff should inform the Commission if this action is not practicable or has unintended consequences. In this case, the staff should provide the Commission an information paper containing additional details of the anticipated research into fuel fragmentation, the staff's best judgment of the impact the results of that research could have on the proposed rule, and the staff's best estimate of when final conclusions may be drawn from this work. In addition, this paper should clearly and specifically indicate which elements of the proposed rule, if any, should be deferred pending completion of fragmentation research and which elements, if any, could proceed to implementation without concern that they will be revised based on the anticipated research.

Regarding Generic Safety Issue 191, the 10 CFR 50.46c proposed rule should contain a provision allowing NRC licensees, on a case-by-case basis, to use risk-informed alternatives without an exemption request. Accordingly, the staff should modify relevant sections of the proposed rule. In addition, *Federal Register* Notice (FRN) Section VII, "Specific Request for Comments on the Proposed Rule," should be revised to solicit stakeholder comments on the proposed provision. In the questions for stakeholders, the staff should also inquire as to whether the provision should contain acceptance criteria or if the acceptance criteria should be remanded to regulatory guidance.

The staff should ask in the FRN if the prescriptive 2200⁰F peak cladding temperature limit for zirconium-based fuels should be removed and replaced with a performance-based requirement.

The staff should continue to periodically verify that operating plants are maintaining sufficient safety margins pending implementation of a final § 50.46c rule.

The staff should ensure that the proposed rule and draft final rule consider Watts Bar, Unit 2, as appropriate.

The revised proposed rule and FRN that reflects this SRM should be provided to the Commission 10 business days prior to submitting the FRN to the Office of the Federal Register for Publication.

The following changes should be made to the FRN:

1. Page 4, item V.5, revise to read: “Long-Term Cooling.”
2. Page 17, bullet 5, revise to read: “...post-quench ductility (PQD)....”
3. Page 18, last line of 2nd paragraph, revise to read: “...system for which that the ECCS....”
4. Page 19, line 2, add a comma after “cladding.”
5. Page 19, line 8, revise to read: “...schedule which that would be provided....”
6. Page 19, line 15, revise to read: “...by to applicants....”
7. Page 19, lines 15-16, revise to read: “...The only exception to the rule’s applicability rule would not apply to be for any licensee which that has submitted....”
8. Page 20, 1st full paragraph, line 5, add a comma after “Specifications.”
9. Page 20, last line, revise to read: “...set the specified and NRC approved....”
10. Page 21, line 7, revise to read: “...amended to on April 12, 2000....”
11. Page 21, line 11, revise to read: “...form, then PRM-50-71 would....”
12. Page 21, line 16, revise to read: “...While the principle principal ECCS....”
13. Page 21, lines 17-18, revise to read: “...system capabilities and capacities must be designed to achieve based on specified performance objectives, taking....”
14. Page 21, line 20, revise to read: “...for which that the ECCS....”
15. Page 21, line 20, revise to read: “...the ECCS is intended trying to cool.”
16. Page 22, line 2, revise to read: “...phenomena that which impact....”
17. Page 22, line 8, revise to read: “...principle principal ECCS....”
18. Page 22, line 14, revise to read: “...compliance to with the ECCS....”
19. Page 22, line 15, revise to read: “...requirements, ECCS performance would be evaluated using fuel specific....”
20. Page 22, line 16, revise to read: “...limits which that take into....”

21. Page 22, lines 17-19, revise to read: "...and any unique features... fuel system, ~~would be established, along with...evaluation model, by which to judge the ECCS performance.~~"
22. Page 22, line 22, revise to read: "...cladding ~~by which to judge ECCS performance.~~"
23. Page 23, line 2, revise to read: "...all **known** degradation...."
24. Page 23, line 3, revise to read: "...objectives **have been** defined, and fuel design-specific...."
25. Page 23, line 6, revise to read: "...within its **the** cladding...."
26. Page 23, line 8, add a comma after "performance~~."~~"
27. Page 23, line 11, revise to read: "...~~and~~ minimize hydrogen...."
28. Page 24, line 5, revise to read: "...mechanisms **that** ~~which~~ demonstrated...."
29. Page 24, line 13, revise to read: "...cladding, ~~which provides its overall ductility.~~"
30. Page 24, line 18, revise to read: "...current **regulation** ~~provision~~ limits...."
31. Page 25, line 16, revise to read: "...and ~~does~~ requires knowledge...."
32. Page 25, line 21, revise to read: "...the term **"maximum local oxidation"** with "ITT," which more directly relates to...."
33. Page 26, end of page, the staff should provide one or two summary sentences that explain the phenomenon depicted in Figure 1.
34. Page 27, lines 3 & 6 (after Figure 1), replace "which" with "that."
35. Page 28, line 10, add a comma after "results~~."~~"
36. Page 28, line 11, revise to read: "...analyses **should** ~~must~~ integrate...."
37. Page 28, line 12, revise to read: "...when comparing **analysis results**...."
38. Page 28, line 16, revise to read: "**The** NRC's LOCA...."
39. Page 29, line 8, revise to read: "...model **that** ~~which~~ would...."
40. Page 29, line 9, revise to read: "...onset of **a** LOCA...."
41. Page 29, line 11, revise to read: "...cladding **inside diameter (ID)**...."
42. Page 29, line 13, revise to read: "...As such, ~~the burden of~~ **applicants are responsible for** determining...."
43. Page 29, line 15, revise to read: "...evaluation model, ~~resides with the applicant.~~"
44. Page 30, line 13, revise to read: "...rod ~~which~~ **that** experiences...."

45. Page 30, line 18, revise to read: "...and to report...."
46. Page 32, line 15, revise to read: "...exposure to a high...."
47. Page 33, line 16, revise to read: "...hydrogen-dependantdependent...."
48. Page 34, line 9, revise to read: "...require that a specified...."
49. Page 34, line 10, revise to read: "...established which that...."
50. Page 35, line 7, revise to read: "...errors which that prolong...."
51. Page 36, line 4, revise to read: "...which that were submitted...."
52. Page 36, last line, revise to read: "...Change, error, or operation which that does not result in any predicted response which that...."
53. Page 37, line 4, revise to read: "...with the estimated magnitudes...."
54. Page 37, line 5, revise to read: "...Revise the UFSAR."
55. Page 37, line 7, revise to read: "...Change, error, or operation which that does not result in any predicted response which that...."
56. Page 37, line 11, revise to read: "...estimated magnitudes of changes...."
57. Page 37, line 12, revise to read: "...review the new analysis of record (AOR)."
58. Page 37, line 13, revise to read: "...Revise the UFSAR...."
59. Page 37, line 15, revise to read: "...Change, error, or operation which that results in any predicted response to exceed~~ing~~...."
60. Page 37, line 18, revise to read: "...bring the plant...."
61. Page 37, line 19, add a comma after "error,."
62. Page 37, line 22, revise to read: "...estimated magnitudes...."
63. Page 37, line 24, revise to read: "Revise the UFSAR...."
64. Page 38, line 1, revise to read: "...predictions as a the baselines for the future evaluations."
65. Page 38, line 14, revise to read: "...PRM that which was submitted...."
66. Page 40, line 6, revise to read: "...Should this proposed rule...."
67. Page 40, last line, delete the comma after "Although."
68. Page 41, line 6, revise to read: "...final form, then PRM-50-84...."

69. Page 42, last line, revise to read: "...plant ~~that~~ **which** would require...."
70. Page 43, lines 1 - 3, revise to read: "...evaluation model, ~~revisions to~~ **revising an** existing evaluation model, **performing a** new LOCA break spectrum analysis, **performing a** multiple rod survey..., or making changes to a technical...(COLR), ~~changes,~~...."
71. Page 43, line 4, revise to read: "...updating **the** COLR...."
72. Page 43, line 7, revise to read: "...combined ~~operating~~ licenses...."
73. Page 43, line 7, add a comma after "licenses~~.~~."
74. Page 43, line 11, revise to read: "...submitted to~~,~~ or docketed by~~,~~ the NRC...."
75. Page 43, line 20, revise to read: "...combined ~~operating~~ licenses...."
76. Page 43, line 21, revise to read: "...combined ~~operating~~ licenses...."
77. Page 44, line 9, revise to read: "...operation **for** at least...."
78. Page 44, line 10, revise to read: "...~~that~~ **which** has not been...."
79. Page 44, line 11, delete the comma after "effects."
80. Page 45, line 2, revise to read: "...reactors ~~that~~ **which** have...."
81. Page 45, line 6, delete the extra space after "rules."
82. Page 46, line 6 (after the table), add a comma after "rule~~.~~."
83. Page 46, line 7 (after the table), revise to read: "...to LWRs~~....~~"
84. Page 46, line 10 (after the table), revise to read: "...applicants for ~~certified designs~~ **standard design certifications**...."
85. Page 48, line 4, delete the comma after "accident."
86. Page 48, line 6, delete the extra space after "model."
87. Page 49, line 16, revise to read: "...requirements ~~necessary~~ **that are needed**...."
88. Page 50, line 5, revise to read: "...or operate**ing** the"
89. Page 50, line 17, revise to read: "...change to~~,~~ or error in~~,~~ an evaluation...."
90. Page 51, lines 2, 6 & 11, revise to read: "...change to~~,~~ or error in~~,~~ an evaluation...."
91. Page 51, lines 3 & 7, revise to read: "...model~~,~~ ~~that~~ **which** does...."
92. Page 51, line 4 & 8, revise to read: "...response ~~that~~ **which** exceeds...."
93. Page 51, line 12, revise to read: "...amendment to ~~the~~ **a** design...."

94. Page 51, line 13, revise to read: "...or (m)(1)(iii) **to** be submitted...."
95. Page 53, line 4, delete the extra space after "certifications."
96. Page 53, line 13, revise to read: "...entities **that** ~~which~~ are ~~granted~~ **issued**...."
97. Page 54, line 17, revise to read: "...and ~~to~~ report...."
98. Page 55, line 2, revise to read: "...prevent ~~e~~ **a**ffected...."
99. Page 55, line 4, revise to read: "...ineffective **requirements** and unnecessary burden. Therefore, **O**ther...."
100. Page 55, line 8, change the period to a question mark at the end of the sentence.
101. Page 55, line 16, revise to read: "...approach **that** ~~which~~ takes...."
102. Page 55, line 16, revise to read: "...account ~~various combinations of~~ design certifications**s**,...."
103. Page 55, line 17, add a comma after "manufacturing licenses**.**"
104. Page 55, line 17, revise to read: "...combined ~~operating~~ licenses**s**...."
105. Page 55, line 19, revise to read: "...allow ~~the~~ applicants**s** for...."
106. Page 55, line 21, revise to read: "...combined ~~operating~~ license...."
107. Page 56, lines 5 - 6, revise to read: "...proposal, **including suggestions for alternate approaches** and if there is a simpler approach that could be taken."
108. Page 56, line 9, revise to read: "...long**-**term...."
109. Page 56, line 10, revise to read: "...regulation, § 50.46(b)(5), stipulates...." [KLS would delete this item]
110. Page 56, lines 12 – 13, revise to read: "...**The overall goal of preserving ductility would provide reasonable** ~~Ductility is a favorable material property and its preservation provides a degree of assurance....~~"
111. Page 56, last 3 lines, revise to read "(**see** Topical Report (TR) WCAP-16793-NP, ... Accession No. ML091190484)-" and move to line 5 from the bottom to follow "800 °F."
112. Page 56, last line – to Page 57, first line, revise to read: "...The NRC seeks comment on ~~this~~ **the** acceptance criterion **for long-term cooling** and if **whether** there is justification for a different temperature limit **(other than the 800 degrees provided in the WCAP).**"
113. Page 57, line 11, add a comma after "plan**.**"
114. Page 57, line 14, change semi-colon to a comma after "challenges."
115. Page 57, line 16, add a comma after "requirements**.**"

116. Page 57, create a new paragraph “d.” starting with the 3rd sentence of paragraph “c.”: “d. Please comment on the NRC’s cost....”
117. Page 61, 5th row of table, delete the period after “10 CFR 50.46.”
118. Page 61, line 5 (after the table), add a comma after “Part 50.”
119. Page 62, line 7, revise to read: “...particular State’s administrative....”
120. Page 64, line 13, revise to read: “...criteria ~~that~~ which ensure....”
121. Page 65, line 2, revise to read: “...rulemaking ~~through~~ in....”
122. Page 65, line 6, revise to read: “...§ 50.46e....”
123. Page 65, line 10, revise to read: “...structures, and components ~~that~~ which mitigate....”
124. Page 66, line 14, revise to read: “...Magnuson-Stevens ~~Stevens~~ Act....”
125. Page 66, line 17, add a comma after “systems.”
126. Page 69, line 5, revise to read: “...recordkeeping ~~resulting from eliminating the need for exemptions~~).”
127. Page 69, line 12, add a comma after “models.”
128. Page 69, line 17, revise to read: “...long-term cooling limits”
129. Page 69, line 22, revise to read: “...licensees ~~that~~ which would....”
130. Page 70, line 5, revise to read: “...proposed rule ~~(or proposed policy statement)~~ and...”
131. Page 72, lines 19-21, revise to read: “...health and safety. ~~The proposed rule will ensure that the level of protection intended to be restored that level of protection (i.e., reasonable assurance of adequate protection) which the NRC thought would be achieved (throughout the entire term of licensed operation) by the current rule~~ is maintained.”
132. Page 73, line 2, add a comma after “prepared.”
133. Page 73, line 7, revise to read: “...~~restoring~~ maintaining that....”
134. Page 73, line 8, revise to read: “...NRC ~~previously~~ thought....”
135. Page 73, line 12, revise to read: “...adequate ~~in the future~~ to ensure....”
136. Page 74, lines 4 – 5, revise to read: “...and to ~~ensure that~~ restore the rule to the level of maintains reasonable assurance....”
137. Page 75, line 8, revise to read: “...guides ~~that~~ which would....”
138. Page 76, footnote lines 1 & 3, replace “which” with “that.”

139. Page 78, line 10, revise to read: "...50.120, 50.150, and...."
140. Page 80, line 4, delete the comma after "(LWR)."
141. Page 80, line 9, delete the extra space after "NRC has."
142. Page 82, line 14, revise to read: "...NRC-approved...."
143. Page 83, line 5, replace dash after "*designs*" with a colon.
144. Page 83, line 15, add a comma after "approach."
145. Page 85, lines 7 & 17, replace "which" with "that."
146. Page 86, line 4, replace "which" with "that."
147. Page 87, lines 8, 12, 13, 17 & 18, replace "which" with "that."
148. Page 87, lines 12, 14, 17 & 19, add a comma after "error."
149. Page 87, line 15, add a comma after "change."
150. Page 88, lines 1, 2 & 13, replace "which" with "that."
151. Page 88, line 1, 6 & 7, add a comma after "error."
152. Page 89, line 10, replace "which" with "that."
153. Page 90, line 5, delete the comma after "**RULE]**."
154. Page 90, lines 5 & 10, revise to read: "...section by the time of no later than their renewal."
155. Page 100, paragraph "(4)" line 1, revise to read: "...performance of SSCs...."

The following changes should be made to the Regulatory Analysis prior to the publication of the proposed rule.

1. Page 2, line 16, revise to read: "...permitted by in technical...."
2. Page 2, line 18, revise to read: "...Section IX of the proposed rule Statement of Considerations (SOC)...."
3. Page 3, line 2, replace "which" with "that"; delete comma after "...2003)."
4. Page 5, line 24, revise to read: "...the proposed rule SOC...."
5. Page 7, lines 12 & 13, replace "which" with "that."
6. Page 8, line 7, revise to read: "...the proposed rule SOC...."

7. Page 8, lines 9 – 11, revise to read: "...health and safety. The proposed rule will ensure that the level of protection intended to by restoring that level of protection (i.e., reasonable assurance of adequate protection) which the NRC thought would be achieved (throughout the entire term of licensed operation) by the current rule is maintained."
8. Page 8, line 14, revise to read: "...in § 50.46c;"
9. Page 8, line 16, revise to read: "...for § 50.46c."
10. Page 9, line 6, revise to read: "...provide for the necessary...."
11. Page 9, line 8, revise to read: "...guidance for § 50.46 is desirable, in § 50.46 in order...."
12. Page 10, delete "the" in the Table 1, Column 4 heading.
13. Page 10, delete the last row of Table 1.
14. Page 10, line 3 (after the table), revise to read: "...action to attain maintain adequate protection."
15. Page 11, lines 1, 4, 11, 18, 23, replace "which" with "that."
16. Page 11, line 3, revise to read: "...safety by restoring maintaining...."
17. Page 11, line 4, revise to read: "... the NRC previously thought...."
18. Page 11, line 11, revise to read: "...the proposed rule SOC...."
19. Page 13, delete the first two full sentences.
20. Page 13, line 10, replace "which" with "that."
21. Page 13, line 12, revise to read: "...Given that the rule...."
22. Page 14, line 4, revise to read: "...approval and have has developed...."
23. Page 14, line 5, revise to read: "...design certifications."
24. Page 14, line 7, revise to read: "...future and have has developed...."
25. Page 14, line 19, revise to read: "...Long-Term Cooling...."
26. Page 14, footnote 5, line 1, revise to read: "...combined operating licenses applications submitted...."
27. Page 15, line 14, revise to read: "...data to be included...."
28. Page 15, line 19, revise to read: "...Track 1 and five 5 future...."
29. Page 15, line 21, revise to read: "... (UFSAR)...."

30. Page 15, line 22, revise to read: "...compliance ~~to~~ **with** § 50.46c."
31. Page 16, line 21, revise to read: "...speculative to **evaluate** ~~provide~~ within...."
32. Page 17, lines 6 & 8, replace "which" with "that."
33. Page 17, line 6, revise to read: "...ECCS analysis models**s**."
34. Page 17, line 7, revise to read: "...in Tracks**s** 2 and 3...."
35. Page 17, line 8, revise to read: "unite sites...."
36. Page 17, line 8, revise to read: "...common analyses, **this** total number of AORs **covers** ~~reduced from 39 plants~~)."
37. Page 17, lines 13-14, revise to read: "...~~P~~**p**eriodic ~~B~~**b**reakaway ~~T~~**t**ests."
38. Page 17, line 17, revise to read: "apply **to** ~~for~~ design...."
39. Page 17, line 23m revise to read: "...criteria ~~is~~ **are** restructured...."
40. Page 18, line 3, revise to read: "...**The** NRC...."
41. Page 18, line 9, revise to read: "...annual costs**s** between...."
42. Page 18, line 11, replace "which" with "that."
43. Page 18, line 12, revise to read: "...LOCA ~~analysis~~ **analyses**...."
44. Page 18, line 13, revise to read: "improve **the** ~~their~~ predictions...."
45. Page 18, line 15, revise to read: "...contribute to ~~the~~ regulatory...."
46. Page 18, lines 19-20, revise to read: "level. ~~This corresponds to a decrease in the value of this attribute from the existing actual value.~~"
47. Page 18, line 22, revise to read: "...exposure ~~is now~~ **remains** at...."
48. Page 18, line 23, revise to read: "proposed rule. ~~Again, this corresponds to a decrease in the value of this attribute.~~"
49. Page 18, line 25, revise to read: "~~is now~~ **remains** at...."
50. Page 18, delete the last full sentence.
51. Page 19, lines 1 – 2, revise to read: "...property ~~is now~~ **remains** at...."
52. Page 19, delete the second full sentence.
53. Page 20, line 9, revise to read: "...(**long**-term cooling)...."
54. Page 20, line 18, replace "which" with "that."

55. Page 21, lines 12 & 14, revise to read: "...long-term cooling...."
56. Page 21, line 18, revise to read: "...over a 10-year...."
57. Page 22, line 8, replace "which" with "that."
58. Page 22, line 11, revise to read: "...and the Bellefonte 1...."
59. Page 23, line 8 (after the table), revise to read: "Starting in 2022...."
60. Page 24, line 5, revise to read: "...during refueling reloading fuel."
61. Page 24, line 6, revise to read: "...number of fuel reloads...."
62. Page 24, last line, revise to read: "...cost per reactor/DC or design certification...."
63. Page 25, lines 13-14, revise to read: "...NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition."
64. Page 25, line 20, revise to read: "...Breakaway) is estimated...."
65. Page 25, line 22, revise to read: "... (long-term cooling)...."
66. Page 25, lines 22-23, revise to read: "...over a two-year period...."
67. Page 26, line 4, revise to read: "...break-away breakaway...."
68. Page 26, line 12, insert a space after "\$511,000."
69. Page 26, line 17, revise to read: "...Per Each cladding alloy...."
70. Page 26, line 20, revise to read: "...costs are associated with a result of long-term cooling"
71. Page 27, lines 1 – 2, revise to read: "...over a 10-year period, beginning in 2014) would request an exemption if the proposed rule did not extend applicability to other materials."
72. Page 27, lines 8, revise to read: "This analysis assumes that in 2018, the NRC will conduct a review of the certification license amendment...."
73. Page 27, line 9, revise to read: "...requiring 0.27 FTE each, and providing resulting in an estimated cost...."
74. Page 27, line 11, revise to read: "...certifications ranges from...."
75. Page 27, line 14, revise to read: "...require 0.01 FTE, for and has an estimated cost...."
76. Page 27, line 16, revise to read: "...requiring would require 0.05 FTE, and...."
77. Page 27, line 18, revise to read: "...requiring would require 0.01 FTE, and...."
78. Page 28, line 16, revise to read: "...until 2022, when where all...."

79. Page 29, line 5, add a comma after “estimates” and “NRC.”
80. Page 29, line 14, delete the parenthesis around “beginning.”
81. Page 29, line 16, delete the extra period at the end of the sentence.
82. Page 30, line 1, revise to read: “As shown in Table 18, ~~NRC costs for hypothetical design certification~~, on page 48, the NRC would incur costs in relation to the review of the initial breakaway test and the PQD test **for a hypothetical design certification**.”
83. Page 30, lines 21 -23, revise to read: “...The industry operating costs **for the periodic breakaway test** for the hypothetical operating reactor, ~~the periodic breakaway test~~, would occur during the first reload, ~~would occur during~~ **and** each **subsequent** reload, and would require....”
84. Page 32, lines 13 & 24, replace “which” with “that.”
85. Page 32, lines 15-16, revise to read: “...long-term...” in both instances.
86. Page 32, line 24, revise to read: “...schedules **will be** ~~are~~ necessary....”
87. Page 33, line 1, revise to read: “...breakaway testing one year after....”
88. Page 33, line 2, revise to read: “...Track 2 in ~~y~~**Y**ear 5....”
89. Page 44, Table 11 heading, revise to read: “NRC Implementation Costs: **License Certification** Amendment Reviews: Design Certification.”

cc: Chairman Macfarlane
Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
OGC
CFO
OCA
OPA
Office Directors, Regions, ACRS, ASLBP (via E-Mail)
PDR