

September 11, 2015

Mr. James A. Gresham, Manager  
Regulatory Compliance and Plant Licensing  
Westinghouse Electric Company  
1000 Westinghouse Drive  
Cranberry Township, PA 16066

SUBJECT: INPUT TO REGULATORY ANALYSIS FOR THE PERFORMANCE-BASED  
EMERGENCY CORE COOLING SYSTEMS CLADDING ACCEPTANCE  
CRITERIA (TITLE 10 OF THE *CODE OF FEDERAL REGULATIONS* SECTION  
50.46C) DRAFT FINAL RULE

Dear Mr. Gresham:

On behalf of the U.S. Nuclear Regulatory Commission (NRC), I am writing to reiterate the opportunity to provide the NRC with information on the costs for implementing Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46c rulemaking, which would be considered in developing the final regulatory analysis for the 10 CFR 50.46c rulemaking. This opportunity was discussed during the March 17-18, 2015, public meeting on 10 CFR 50.46c implementation and the proposed rule regulatory analysis. The NRC staff could receive this information electronically or in a public meeting. If Westinghouse considers the information to be proprietary, then Westinghouse should submit the information to the NRC in accordance with 10 CFR 2.390. In the final regulatory analysis, cost data provided will be consolidated with other NRC collected estimates and will not be reported directly to protect entities' proprietary cost information.

To facilitate Westinghouse's opportunity to provide information on the costs of 10 CFR 50.46c implementation, enclosed are the NRC's draft preliminary estimates for industry costs associated with implementation of 10 CFR 50.46c.

If you wish to provide cost information or have any questions about this letter, please contact Alysia Bone, [Alysia.Bone@nrc.gov](mailto:Alysia.Bone@nrc.gov). The NRC would appreciate any input by September 25, 2015. Thank you for your consideration

Sincerely,

/RA/

Lawrence E. Kokajko, Director  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Enclosure:  
Draft Preliminary Estimates of Industry  
Costs to Implement 10 CFR 50.4c

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To facilitate Westinghouse's opportunity to provide information on the costs of 10 CFR 50.46c implementation, enclosed are the NRC's draft preliminary estimates for industry costs associated with implementation of 10 CFR 50.46c.

If you wish to provide cost information or have any questions about this letter, please contact Alysia Bone, [Alysia.Bone@nrc.gov](mailto:Alysia.Bone@nrc.gov). The NRC would appreciate any input by September 25, 2015. Thank you for your consideration

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Enclosure:  
Draft Preliminary Estimates of Industry  
Costs to Implement 10 CFR 50.4c

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**Draft Preliminary Estimates of Industry Costs to Implement 10 CFR 50.46c**

	Low estimate	Best estimate	High Estimate	Source or Basis of Estimate
<b>Develop Breakaway Oxidation test and write procedures</b>				
Vendor technical staff hourly rate	\$78.35	\$114.58	\$141.66	BLS.gov tables
Develop test and write procedures (hrs)	144	160	480	NRC estimate
Number of test procedures	1	1	1	NRC estimate
<i>Cost to develop test procedures</i>	<i>(\$11,282)</i>	<i>(\$18,332)</i>	<i>(\$67,997)</i>	Calculation: =-(Hourly Rate x Time (develop test/write procedures) x number of procedures)
<b>Initial Breakaway Oxidation testing to support specified analytical limit</b>				
Vendor technical staff hourly rate	\$78.35	\$114.58	\$141.66	BLS.gov tables
No. of labor hours to conduct test (hrs)	108	120	360	NRC estimate
Number of initial breakaway oxidation tests	Varies by fuel vendor. See basis of estimate.			NRC assumes one test per alloy. NRC estimates 3 alloys for Westinghouse, therefore 3 tests. Cost listed is for one test.
<i>Calculation for initial test</i>	<i>(\$8,462)</i>	<i>(\$13,749)</i>	<i>(\$50,998)</i>	Calculation: =-(Hourly Rate x Duration of Test x number of tests)
<b>Confirmatory Breakaway Oxidation testing</b>				
Vendor technical staff hourly rate	\$78.35	\$114.58	\$141.66	BLS.gov tables
No. of labor hours to conduct test (hrs)	36	40	120	NRC estimate
Number of confirmatory breakaway oxidation tests	Varies by fuel vendor. See basis of estimate.			NRC assumes one test per alloy. NRC estimates 3 alloys for Westinghouse, therefore 3 tests. NRC understands there will be a periodicity, based on ingot production, which will be taken into account in the analysis. Cost listed is for one test.
<i>Calculation for confirmatory test</i>	<i>(\$2,821)</i>	<i>(\$4,583)</i>	<i>(\$16,999)</i>	Calculation: =-(Hourly Rate x Duration of Test x number of tests)
<b>Topical reports</b>				
<b>Topical reports on BWR and PWR Evaluation Models</b>				
Vendor technical staff hourly rate	\$78.35	\$114.58	\$141.66	BLS.gov tables
No. of labor hours to issue Topical report (hrs)	100.8	140	336	NRC estimate

**Draft Preliminary Estimates of Industry Costs to Implement 10 CFR 50.46c**

Number of alloys covered in report	Varies by fuel vendor. See basis of estimate.			NRC estimates 3 alloys for Westinghouse. Cost listed is for one alloy.
Number of topical reports issued per vendor	1	1	1	NRC assumes each vendor issues one topical report on breakaway oxidation
<i>Technical staff subtotal</i>	<i>(\$7,898)</i>	<i>(\$16,041)</i>	<i>(\$47,598)</i>	Calculation: =-(technical staff hourly rate x technical staff labor hours x no. of technical reports)
Vendor administrative staff hourly rate	\$36.48	\$51.88	\$65.49	BLS.gov tables
No. of administrative hours	21.6	30	72	NRC estimate
<i>Administrative staff subtotal</i>	<i>(\$788)</i>	<i>(\$1,556)</i>	<i>(\$4,715)</i>	Calculation: =-(administrative staff hourly rate x administrative staff labor hours x no. of technical reports)
Vendor licensing staff hourly rate	\$74.77	\$109.93	\$131.68	BLS.gov tables
No. of licensing staff hours	14.4	20	48	NRC estimate
<i>Licensing staff subtotal</i>	<i>(\$1,077)</i>	<i>(\$2,199)</i>	<i>(\$6,321)</i>	Calculation: =-(licensing staff hourly rate x licensing staff labor hours x no. of technical reports)
Vendor management hourly rate	\$75.35	\$100.97	\$122.62	BLS.gov tables
No. of management hours	7.2	10	24	NRC estimate
<i>Management staff subtotal</i>	<i>(\$542)</i>	<i>(\$1,010)</i>	<i>(\$2,943)</i>	Calculation: =-(management staff hourly rate x management staff labor hours x no. of technical reports)
<i>Calculation of total cost</i>	<i>(\$10,305)</i>	<i>(\$20,805)</i>	<i>(\$61,577)</i>	Calculation: =sum of subtotals above
<b>Topical reports on Breakaway Ox, Hydrogen Models, and Fuel Mechanical design</b>				
Vendor technical staff hourly rate	\$78.35	\$114.58	\$141.66	BLS.gov tables
No. of labor hours to issue Topical report (hrs)	100.8	112	196	NRC estimate
Number of alloys covered in report	Varies by fuel vendor. See basis of estimate.			NRC estimates 3 alloys for Westinghouse. Cost listed is for one alloy.
Number of topical reports issued per vendor	1	1	1	NRC assumes each vendor issues one topical report on breakaway oxidation
<i>Technical staff subtotal</i>	<i>(\$7,898)</i>	<i>(\$12,833)</i>	<i>(\$27,766)</i>	Calculation: =-(technical staff hourly rate x technical staff labor hours x no. of technical reports)
Vendor administrative staff hourly rate	\$36.48	\$51.88	\$65.49	BLS.gov tables
No. of administrative hours	21.6	24	42	NRC estimate
<i>Administrative staff subtotal</i>	<i>(\$788)</i>	<i>(\$1,245)</i>	<i>(\$2,750)</i>	Calculation: =-(administrative staff hourly rate x administrative staff labor hours x no. of technical reports)

**Draft Preliminary Estimates of Industry Costs to Implement 10 CFR 50.46c**

Vendor licensing staff hourly rate	\$74.77	\$109.93	\$131.68	BLS.gov tables
No. of licensing staff hours	14.4	16	28	NRC estimate
<i>Licensing staff subtotal</i>	<i>(\$1,077)</i>	<i>(\$1,759)</i>	<i>(\$3,687)</i>	Calculation: =-(licensing staff hourly rate x licensing staff labor hours x no. of technical reports)
Vendor management hourly rate	\$75.35	\$100.97	\$122.62	BLS.gov tables
No. of management hours	7.2	8	14	NRC estimate
<i>Management staff subtotal</i>	<i>(\$542)</i>	<i>(\$808)</i>	<i>(\$1,717)</i>	Calculation: =-(management staff hourly rate x management staff labor hours x no. of technical reports)
<i>Calculation of total cost</i>	<i>(\$10,305)</i>	<i>(\$16,644)</i>	<i>(\$35,920)</i>	Calculation: =sum of subtotals above
<b>Licensee Amendment Requests</b>				Cost estimates for combined LARs (e.g., TCD commitment) should only identify incremental costs for 50.46c new requirements. Obligated costs associated with performing calculations to address fuel thermal conductivity degradation and developing a report under existing regulatory commitments should be excluded from these cost estimates.
<b>Licensee Amendment Request for 50.46c compliance, Level 1</b>				
Vendor technical staff hourly rate	\$65.55	\$79.23	\$92.61	BLS.gov tables
No. of technical hours to prepare LAR input	98	133	168	NRC estimate
Number of LAR submittals	1	1	1	NRC estimate, on a per-plant/unit basis, as appropriate
<i>Technical staff subtotal</i>	<i>(\$6,424)</i>	<i>(\$10,538)</i>	<i>(\$15,558)</i>	Calculation: =-(Hourly Rate x technical hours x no. of submittals)
Vendor administrative staff hourly rate	\$36.48	\$51.88	\$65.49	BLS.gov tables
No. of administrative hours to support LAR input	21	28.5	36	NRC estimate
<i>Administrative staff subtotal</i>	<i>(\$766)</i>	<i>(\$1,479)</i>	<i>(\$2,358)</i>	Calculation: =-(Hourly Rate x administrative hours x no. of submittals)
Vendor licensing staff hourly rate	\$74.77	\$109.93	\$131.68	BLS.gov tables
No. of licensing staff hours to support LAR input	14	19	24	NRC estimate
<i>Licensing staff subtotal</i>	<i>(\$1,047)</i>	<i>(\$2,089)</i>	<i>(\$3,160)</i>	Calculation: =-(Hourly Rate x licensing staff hours x no. of submittals)
Vendor management hourly rate	\$75.35	\$100.97	\$122.62	BLS.gov tables

**Draft Preliminary Estimates of Industry Costs to Implement 10 CFR 50.46c**

No of management hours to support LAR input	7	9.5	12	NRC estimate
<i>Management staff subtotal</i>	<i>(\$527)</i>	<i>(\$959)</i>	<i>(\$1,471)</i>	Calculation: =-(Hourly Rate x management hours x no. of submittals)
<i>Calculation of total cost</i>	<i>(\$8,764)</i>	<i>(\$15,064)</i>	<i>(\$22,547)</i>	Calculation: =sum of subtotals above
<b>Licensee Amendment Request for 50.46c compliance, Level 2</b>				
Vendor technical staff hourly rate	\$65.55	\$79.23	\$92.61	BLS.gov tables
No. of technical hours to prepare LAR input	140	175	210	NRC estimate
Number of LAR submittals	1	1	1	NRC estimate, on a per-plant/unit basis, as appropriate
<i>Technical staff subtotal</i>	<i>(\$9,177)</i>	<i>(\$13,866)</i>	<i>(\$19,447)</i>	Calculation: =-(Hourly Rate x technical hours x no. of submittals)
Vendor administrative staff hourly rate	\$36.48	\$51.88	\$65.49	BLS.gov tables
No. of administrative hours to support LAR input	30	37.5	45	NRC estimate
<i>Administrative staff subtotal</i>	<i>(\$1,094)</i>	<i>(\$1,945)</i>	<i>(\$2,947)</i>	Calculation: =-(Hourly Rate x administrative hours x no. of submittals)
Vendor licensing staff hourly rate	\$74.77	\$109.93	\$131.68	BLS.gov tables
No. of licensing staff hours to support LAR input	20	25	30	NRC estimate
<i>Licensing staff subtotal</i>	<i>(\$1,495)</i>	<i>(\$2,748)</i>	<i>(\$3,951)</i>	Calculation: =-(Hourly Rate x licensing staff hours x no. of submittals)
Vendor management hourly rate	\$75.35	\$100.97	\$122.62	BLS.gov tables
No of management hours to support LAR input	10	12.5	15	NRC estimate
<i>Management staff subtotal</i>	<i>(\$753)</i>	<i>(\$1,262)</i>	<i>(\$1,839)</i>	Calculation: =-(Hourly Rate x management hours x no. of submittals)
<i>Calculation of total cost</i>	<i>(\$12,521)</i>	<i>(\$19,822)</i>	<i>(\$28,184)</i>	Calculation: =sum of subtotals above
<b>Licensee Amendment Request for 50.46c compliance, Level 3</b>				
Vendor technical staff hourly rate	\$65.55	\$79.23	\$92.61	BLS.gov tables
No. of technical hours to prepare LAR input	280	490	700	NRC estimate
Number of LAR submittals	1	1	1	NRC estimate, on a per-plant/unit basis, as appropriate

**Draft Preliminary Estimates of Industry Costs to Implement 10 CFR 50.46c**

<i>Technical staff subtotal</i>	<i>(\$18,355)</i>	<i>(\$38,824)</i>	<i>(\$64,825)</i>	Calculation: =-(Hourly Rate x technical hours x no. of submittals)
Vendor administrative staff hourly rate	\$36.48	\$51.88	\$65.49	BLS.gov tables
No. of administrative hours to support LAR input	60	105	150	NRC estimate
<i>Administrative staff subtotal</i>	<i>(\$2,189)</i>	<i>(\$5,447)</i>	<i>(\$9,823)</i>	Calculation: =-(Hourly Rate x administrative hours x no. of submittals)
Vendor licensing staff hourly rate	\$74.77	\$109.93	\$131.68	BLS.gov tables
No. of licensing staff hours to support LAR input	40	70	100	NRC estimate
<i>Licensing staff subtotal</i>	<i>(\$2,991)</i>	<i>(\$7,695)</i>	<i>(\$13,168)</i>	Calculation: =-(Hourly Rate x licensing staff hours x no. of submittals)
Vendor management hourly rate	\$75.35	\$100.97	\$122.62	BLS.gov tables
No of management hours to support LAR input	20	35	50	NRC estimate
<i>Management staff subtotal</i>	<i>(\$1,507)</i>	<i>(\$3,534)</i>	<i>(\$6,131)</i>	Calculation: =-(Hourly Rate x management hours x no. of submittals)
<i>Calculation of total cost</i>	<i>(\$25,041)</i>	<i>(\$55,500)</i>	<i>(\$93,947)</i>	Calculation: =sum of subtotals above
<b>High Temperature Steam Oxidation Chamber</b>	<b>(\$180,000)</b>	<b>(\$200,000)</b>	<b>(\$300,000)</b>	NRC assumes one test chamber per vendor. NRC estimate.
<b>Hydrogen Content Measurement Device</b>	<b>(\$180,000)</b>	<b>(\$200,000)</b>	<b>(\$300,000)</b>	NRC assumes one device per vendor. NRC estimate.
<b>Hydrogen Pre-Charging Equipment</b>	<b>(\$180,000)</b>	<b>(\$200,000)</b>	<b>(\$300,000)</b>	NRC assumes one device per vendor. NRC estimate.
<b>Ring Compression Test Device</b>	<b>(\$90,000)</b>	<b>(\$100,000)</b>	<b>(\$150,000)</b>	NRC assumes one test device per vendor. NRC estimate.

Table notes:

1. The costs above are on a per-vendor, per-alloy basis. The NRC plans to calculate for three (3) current alloys for Westinghouse. Please provide the number of current alloys for Westinghouse and any under development.
2. Per the note in the table above, cost estimates for combined LARs (e.g., TCD commitment) should only identify incremental costs for 50.46c new requirements. Obligated costs associated with performing calculations to address fuel thermal conductivity degradation and developing a report under existing regulatory commitments should be excluded from these cost estimates.

## Draft Preliminary Estimates of Industry Costs to Implement 10 CFR 50.46c

3. In developing new fuel cladding alloys:
  - a. How would you quantify the costs (e.g., the number of tests, the complexity and length of Topical Reports [TRs]) of developing a new alloy to successfully receive a license amendment from NRC under the current regulations compared to that contained in the 10 CFR 50.46c rule and guidance?
  - b. How many TRs does Westinghouse anticipate producing/revising in complying with the 10 CFR 50.46c rule and guidance (see the breakout of TR types in the table above)?
  - c. How do you anticipate the costs to change with the new 10 CFR 50.46c requirements and regulatory guides detailing the Breakaway Oxidation requirements and the Post-Quench Ductility (PQD) requirement
4. Concerning all fuel alloys, how many confirmatory Breakaway Oxidation tests does Westinghouse anticipate performing, annually?