May 31, 2011

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
NUCLEAR INNOVATION NORTH AMERICA LLC	)	Docket Nos. 52-012 & 52-013
	)	
(South Texas Project, Units 3 & 4)	)	

PREFILED REBUTTAL TESTIMONY OF RICHARD L. EMCH, JR., JEREMY P. RISHEL, AND DAVID M. ANDERSON REGARDING CONTENTION CL-2

Q1. Please state your names.

A1a. [RLE][1] My name is Richard L. Emch, Jr.

A1b. [JPR] My name is Jeremy P. Rishel.

A1c. [DMA] My name is David M. Anderson.

Q2. Have you previously submitted testimony concerning Contention CL-2 in this proceeding?

A2. [RLE, JPR, DMA] Yes. Our direct testimony was provided in the "Prefiled Direct Testimony of Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson Regarding Contention CL-2" (May 9, 2011) (Exhibit NRC000004) ("Staff CL-2 Direct Testimony"). Statements of our professional qualifications were included as Exhibits NRC000005 to NRC000007.

Q3. Are you familiar with the direct testimony submitted by the Intervenors concerning Contention CL-2, "Direct Testimony of Clarence L. Johnson on Behalf of the Intervenors" (May 16, 2011) (Exhibit INT000021) ("Johnson Direct Testimony")?

A3. [RLE, JPR, DMA] Yes.

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[1] In this testimony, the identity of the witness who supports each numbered paragraph is indicated by the notation of his initials in parentheses.

Q4. In his testimony, what inflation index did the Intervenors' expert, Mr. Johnson, use to adjust the costs of SAMDAs for inflation?

A4. [DMA] Mr. Johnson suggests that the Core Personal Consumption Expenditures (PCE) index is "a more accurate measure of the long term inflation trend."[2]

Q5. What is your opinion on the use of the PCE price index to adjust SAMDA costs for inflation?

A5. [DMA] As explained in Answer 42 of the Staff CL-2 Direct Testimony, while such indices contain rich product detail, ultimately they reflect retail inflation faced by persons and households,[3] not inflation associated with large-scale capital expenditures like those of nuclear power plant construction. Severe Accident Mitigation Design Alternatives (SAMDAs) are design modifications to a nuclear power station and would not feature items typically purchased by persons or households. As such, the Staff believes that the proper inflation index to use for scaling SAMDA costs should be one that is reflective of private capital investment. The Staff identified the Bureau of Economic Analysis' Gross Domestic Product Implicit Price Deflator for Nonresidential Structures as the appropriate index. This index is designed to reflect inflation associated with costs of large buildings and other structures and all related systems.[4] The Staff believes general measures of inflation should give way to specific and more refined estimates when such estimates would be applicable. In his direct testimony, Mr. Johnson does not address any of the issues raised by the Staff regarding the use of the PCE index.

Q6. Did Mr. Johnson include any region-specific adjustments to SAMDA costs?

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[2] Johnson Direct Testimony at 16 (Ex. INT000021).

[3] Bureau of Economic Analysis, NIPA Handbook: Chapter 5: Personal Consumption Expenditures, at 5-2. (retrieved May 4, 2011) (NIPA Handbook available at http://www.bea.gov/national/Index.htm. Chapter 5 specifically available at http://www.bea.gov/national/pdf/NIPAhandbookch5.pdf) (Ex. NRC000021).

[4] Bureau of Economic Analysis, NIPA Handbook: Chapter 6: Private Fixed Investment, at 6-3, Table 6.1 (retrieved May 2, 2011) (NIPA Handbook available at http://www.bea.gov/national/Index.htm. Chapter 6 specifically available at http://www.bea.gov/national/pdf/NIPAhandbookch6.pdf) (Ex. NRC000022).

A6. [DMA] Yes. In discussing use of regional versus generic costs he states that it is appropriate to use “SAMDA costs which are location specific rather than generic."[5]

Q7. What is your opinion on the region-specific adjustments made by Mr. Johnson?

A7. [DMA] Essentially, Mr. Johnson is attempting to show that the scaling of SAMDA costs applicable to STP should be further discounted because a cost of living index for the Houston metro area is roughly 10 percent less than the national average. However, Mr. Johnson does not show why the cost of living index he selected should apply to SAMDA costs. The index Mr. Johnson chose is the ACCRA Cost of Living Index. According to documentation explaining this index, the index authors indicate: “Items on which the Index is based have been carefully chosen to reflect the different categories of consumer expenditures.”[6] The Staff disagrees with the use of inflation indices or regional cost indices designed for consumer goods for the escalation of SAMDA costs because, as explained above in Answer 5, SAMDAs are design modifications to a nuclear power station and would not be represented by items typically purchased by persons or households. In addition, even if SAMDA costs were discounted by an additional 10 percent to reflect consumer cost of living differences from the national average, which would reduce the Staff’s estimate of the least costly SAMDA from $225,000 as reported in Answer 37 of the Staff CL-2 Direct Testimony, to $202,500, the ultimate conclusions of the SAMDA analysis are unchanged – there are no cost-beneficial SAMDAs.

Q8. With respect to the calculation of averted costs in the SAMDA analysis, what discount rate did Mr. Johnson claim should be used?

A8. [DMA] 3 percent.[7]

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[5] Johnson Direct Testimony at 17 (Ex. INT000021).

[6] The Council for Community and Economic Research, “About the ACCRA Cost Of Living Index” (retrieved on 5/23/2011) (available at http://www.coli.org/AboutIndex.asp) (Ex. NRC000059).

[7] Johnson Direct Testimony at 18 (Ex. INT000021).

Q9. Do you agree that a 3 percent discount rate should be used instead of a 7 percent discount rate?

A9. [DMA] No.

Q10. What does NRC guidance provide regarding the use of discount rates in a SAMDA analysis?

A10. [DMA] NUREG BR-0184 suggests[8] that the discount rate mandated by the Office of Management and Budget (OMB) Circular A-94 (1992) be used, which is 7 percent. It further suggests that 3 percent be used to illustrate the sensitivity to the choice of discount rate.

Q11. What does Office of Management and Budget (OMB) guidance provide regarding the default discount rate for cost-benefit analyses?

A11. [DMA] As noted by the Intervenors, and confirmed by the Staff, OMB Circular A-94 (1992) provides guidance about the selection of discount rates to evaluate Federal actions or projects. The Staff also determined that OMB Circular A-4 (2003) reaffirmed the use of Circular A-94 and provided additional, more specific, guidance on this topic. The default interest rate to be used for discounting financial flows from Federal actions is 7 percent.[9]

Q12. Does Mr. Johnson recognize that OMB specifies a 7 percent rate as the default discount rate for cost-benefit analyses?

A12. [DMA] Yes.[10]

Q13. What reasons does Mr. Johnson give to justify the use of a 3 percent discount rate instead of a 7 percent discount rate?

A13. [DMA] The Intervenors indicate that "societal time preference" pertains to such analyses.[11] The Intervenors also suggest that because the applicant would be pursuing Federal

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[8] NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*, Section B.2.1, at B.2 (1997) (ML050190193) (Ex. NRC00008B).

[9] OMB Circular A-4, "Regulatory Analysis," at 33 (Sept. 17, 2003) (retrieved May 17, 2011) (available at http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf) (Ex. NRC000060).

[10] *See* Johnson Direct Testimony at 19 (Ex. INT000021).

[11] Johnson Direct Testimony at 18-19 (Ex. INT000021).

loan guarantees, historic Treasury bill yields should be used as the discount rate.[12] They also suggest that a SAMDA analysis is really a cost effectiveness analysis, and therefore, long-term Treasury bill yields reflect the discount rate that should be used.[13]

Q14. What is your opinion of Mr. Johnson's claim that a 3 percent discount rate should be used to reflect society's time preference for money, rather than the 7 percent rate suggested by OMB?

A14. [DMA] Mr. Johnson advocates using a default discount rate that already is suggested for sensitivity analysis when discounting financial flows from Federal actions. The Staff believes that the default rate of 7 percent, as prescribed by OMB, should be used. The OMB guidance is specific and recommends the use of a 7 percent default rate and also explicitly recommends the use of a 3 percent rate in addition to the 7 percent rate, per an EPA example analysis.[14] The 7 percent discount rate reflects the opportunity cost of private capital[15] (pre-tax expected return on investment in lieu of undertaking the project). This is the appropriate rate to use as a default discount rate because SAMDAs are alternatives in plant design that would be purchased using private (the applicant's) capital construction funding, and it implies that if the funds would be invested elsewhere in lieu of plant construction, at least a 7 percent return would be required. As suggested by the Intervenors,[16] OMB's guidance also allows for discount rates that reflect the rate at which society discounts future consumption flows to their present value.[17] In other words, OMB guidance suggests, and the Staff agrees, that while the discount rate for private capital investment is 7 percent, society (those receiving the

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[12] Johnson Direct Testimony at 19 (Ex. INT000021).

[13] Johnson Direct Testimony at 19 (Ex. INT000021).

[14] OMB Circular A-4 at 33-34 (Ex. NRC000060).

[15] OMB Circular A-4 at 33 (Ex. NRC000060).

[16] Johnson Direct Testimony at 18 (Ex. INT000021).

[17] OMB Circular A-4 at 33 (Ex. NRC000060).

benefits from the proposed action) requires a return of 3 percent. OMB guidance is clear and the Staff agrees that the discount rate is one of the more sensitive variables in the estimation of the present value of benefits and costs, and thus alternative rates should be used to indicate the sensitivity of the results to the choice of discount rate.[18] As stated in previous answers, the Staff has no issue with the use of 3 percent to indicate the sensitivity of the estimates to the choice of discount rate.

Q15. What is your opinion of Mr. Johnson's claim that a SAMDA analysis should be considered a cost-effectiveness analysis and that because the applicant would be pursuing Federal loan guarantees, long-term Treasury bill yields should be the discount rate?

A15. [DMA] The Staff believes that these issues are irrelevant to this proceeding. The Intervenors suggest that the SAMDA analysis should be considered a cost-effectiveness analysis and, therefore, that the default discount rate for the analysis should be 3 percent (based on long term Treasury bill yields). OMB guidance suggests,[19] and the Staff agrees, that because all the costs and benefits are monetized in the SAMDA analysis, the analysis is a true cost-benefit analysis, as opposed to a cost-effectiveness analysis, where some costs or benefits have not been monetized. Mr. Johnson also suggests that because the applicant may receive Federal loan guarantees, long-term Treasury bill yields (3 percent) should be the default discount rate. The Intervenors do not provide any evidence to suggest how the potential for receiving loan guarantees should translate into a need to make the default discount rate 3 percent, rather than the 7 percent favored by the Staff. The guidance recommends that the cost-benefit analysis be conducted using a default discount rate of 7 percent, and the Staff continues to believe that the appropriate default discount rate is 7 percent for SAMDA cost-benefit analyses. The guidance also recommends that analyses should be conducted using a

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[18] OMB Circular A-94, "Guidelines And Discount Rates for Benefit-Cost Analysis of Federal Programs," at 9, 11-12 (Oct. 29, 1992) (retrieved May 26, 2011) (available at http://www.whitehouse.gov/sites/default/files/omb/assets/a94/a094.pdf) (Ex. NRC000061).

[19] OMB Circular A-4 at 10 (Ex. NRC000060).

discount rate of 3 percent to show the sensitivity of the SAMDA analysis to discount rate as was done by the Staff. This illustrates precisely why financial discounting is typically reported using multiple discount rates – so that results can be viewed showing their sensitivity to the chosen discount rate.

Q16. In the Staff CL-2 Direct Testimony, did the Staff perform a refined analysis that evaluated the potential of the SAMDAs to reduce core damage frequency (CDF)?

A16. [RLE, JPR] Yes. In the Staff CL-2 Direct Testimony, the Staff performed an initial screening analysis, which conservatively assumed the lowest-cost SAMDA resulted in a 100% reduction in CDF, and then refined the analysis to include consideration of the actual CDF reduction potential of each SAMDA.

Q17. Why did the Staff consider CDF reduction in its analysis?

A17. [RLE, JPR] As discussed in Answer 86 of the Staff CL-2 Direct Testimony, several of the averted cost components that are considered in a SAMDA analysis, including replacement power costs, require a reduction in CDF in order for there to be any averted cost. The initial screening analysis conservatively assumed that the lowest-cost SAMDA resulted in a 100% reduction in CDF, thereby resulting in the maximum averted costs listed in Table 13 of the Staff CL-2 Direct Testimony. Even with the additional replacement power costs for the other units and consideration of various market factors contributing to price escalation, the lowest-cost SAMDA was still 1.3 times greater than the total maximum averted cost—meaning the screening analysis did not result in the identification of potential cost-beneficial SAMDAs for the STP site. Even though the screening analysis is performed in a manner that maximizes the opportunity for SAMDAs to appear to be cost-beneficial, a refined analysis would typically be performed for SAMDAs as close as 1.3 to the cost-beneficial criterion. Therefore, the Staff refined the SAMDA analysis to consider the actual CDF reduction for each SAMDA. As noted in Answer 86 of the Staff CL-2 Direct Testimony, many of the ABWR SAMDAs, including the

lowest-cost SAMDAs, are mitigative; these SAMDAs do not reduce CDF appreciably[20] and therefore are not beneficial to a significant degree at averting onsite costs, including replacement power costs. Of the 21 potential SAMDAs identified by GE, only 8 SAMDAs are preventative and reduce the CDF by at least 2%. Table 14 of the Staff CL-2 Direct Testimony summarized the percent reduction in CDF, the corresponding averted costs, and the implementation cost for each of these preventative SAMDAs.[21] SAMDA 9b was the closest to being cost-beneficial and it had an implementation cost that was 29.3 times greater than its total averted cost. Clearly, the refined analysis demonstrated that when the actual CDF reduction potential of each SAMDA is considered with respect to the SAMDA's implementation cost, the SAMDAs become even less likely to be cost beneficial to implement.

Q18. What would the results of this refined analysis be if the Staff used a 3 percent discount rate for actual averted costs and adjusted SAMDA costs in the way that Mr. Johnson prefers?

A18. [RLE, JPR, DMA] Table 14 of the Staff CL-2 Direct Testimony used a 7 percent discount rate for actual averted costs and the Bureau of Economic Analysis' Gross Domestic Product Implicit Price Deflator for Nonresidential Structures (i.e., a factor of 2.25) to adjust SAMDA implementation costs to 2009 dollars.[22] The Staff believes these are the appropriate values to use to evaluate costs in the STP SAMDA analysis. Nevertheless, to demonstrate the sensitivity of the analysis to the parameter values suggested by the Intervenor, the Staff has revised the Table 14 values (see Table 15, below) (1) using a 3 percent discount rate for actual

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[20] Table 3 of the Staff CL-2 Direct Testimony lists the reduction in CDF associated with each SAMDA. *See* Staff CL-2 Direct Testimony at A13 (Table 3) (Ex. NRC000004). As discussed in footnote "d" to this Table, GE only estimated averted onsite costs for SAMDAs that reduce CDF. *Id.* Therefore, for SAMDAs where GE estimated an averted onsite cost of $0, the Staff assumed a CDF reduction of 0.0% even though some of these SAMDAs may reduce the CDF by a small amount as assumed in the Applicant's testimony. The Applicant conservatively estimated reductions in CDF for these SAMDAs based on the descriptions of the release categories in GE's analysis that would be impacted by the SAMDAs.

[21] Staff CL-2 Direct Testimony at A86 (Table 14) (Ex. NRC000004).

[22] *See* Staff CL-2 Direct Testimony at A86 (Table 14) (Ex. NRC000004).

averted costs, (2) using the Core PCE to scale for inflation (i.e., a factor of 1.413), and (3) applying a region-specific adjustment based on the ACCRA Cost of Living Index for the Houston area (i.e., the final SAMDA implementation cost is 90.7 percent of the inflation-adjusted SAMDA cost). Even with these adjustments, the closest SAMDA to being cost-beneficial—SAMDA 9b—has an implementation cost that is 14.1 times greater than the total averted cost. Even after adjusting the SAMDA analysis using the discount rate, inflation rate, and cost of living adjustment suggested by Mr. Johnson, there are still no cost-beneficial SAMDAs.

Table 15: Summary of GE ABWR Preventative SAMDA Modifications that Lead to a Reduction in CDF Using Cost Adjustment Preferences from Mr. Johnson's Direct Testimony[23] (Including a 3% Discount Rate for Averted Costs, a 1.413 Inflation Factor for SAMDA Implementation Costs, and a 90.7% Regional Cost of Living Adjustment to SAMDA Implementation Costs).

SAMDA[(a)]	CDF Reduction %	Actual Averted Offsite Cost[(b)] ($)	Actual Averted Onsite Cost[(b)] ($)	Total Actual Averted Cost[(b)] ($)	Implementation Cost[(c)] ($)	Implementation Cost/Actual Averted Cost
2c Suppression Pool Jockey Pump	2.0%[(d)]	$4	$4,201	$4,205	$153,791	36.6
1b Computer Aided Instrumentation	3.0%[(d)]	$6	$6,302	$6,308	$768,955	121.9
8a Additional Service Water Pump	9.0%[(e)]	$19	$18,906	$18,925	$7,689,546	406.3
1c Improved Maintenance Procedures/Manuals	9.0%[(d)]	$19	$18,906	$18,925	$384,477	20.3
2b Improved Depressurization	14.0%[(d)]	$29	$29,409	$29,438	$768,955	26.1
9a Steam Driven Turbine Generator	50.0%[(e)]	$103	$105,031	$105,134	$7,689,546	73.1
9b Alternate Pump Power Source	52.0%[(e)]	$107	$109,232	$109,339	$1,537,909	14.1
2a Passive High Pressure System	52.0%[(e)]	$107	$109,232	$109,339	$2,242,784	20.5

(a) From GE 1994 TSD, Table 6, at 29-30 (Ex. NRC00009A) (Includes only SAMDAs that result in a reduction in CDF).

(b) Calculated using the actual CDF (column 2) and the Staff's maximum averted cost estimates at a 3% discount rate (Staff CL-2 Direct Testimony at A78 (Ex. NRC000004) (last column of Table 12)).

(c) From GE 1994 TSD, attach. A, Section A.5 (Ex. NRC00009B) (GE's estimated minimum SAMDA implementation cost using cost adjustment preferences from Mr. Johnson's direct testimony, including a 1.413 inflation factor and a 90.7% regional cost of living adjustment. Note that in Mr.

[23] Johnson Direct Testimony at 18 (Ex. INT000021).

Johnson's direct testimony, a cost range of $141,300 to $145,000 was cited to scale GE's lowest-cost SAMDA ($100,000) for inflation.[24] The Staff conservatively used the smallest inflation factor ($141,300/$100,000, or 1.413) when scaling the SAMDA implementation costs.)

(d) Reduction in CDF from GE 1994 TSD, Section A.4 (Ex. NRC00009B).

(e) Reduction in CDF estimated by Staff using the method described in Table 3, footnote "f" of the Staff's direct testimony. Staff CL-2 Direct Testimony at A13 (Ex. NRC000004) (Table 3).

[24] Johnson Direct Testimony at 18 (Ex. INT000021).

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AFFIDAVIT OF RICHARD L. EMCH, JR.,
CONCERNING PREFILED REBUTTAL TESTIMONY REGARDING CONTENTION CL-2

I, Richard L. Emch, Jr., do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson Regarding Contention CL-2" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

Richard L. Emch, Jr.
Senior Health Physicist
Environmental Technical Support Branch
Office of New Reactors
U.S. Nuclear Regulatory Commission
Mail Stop T-7-F-27
Washington, DC 20555-0001
(301) 415-1590
Richard.Emch@nrc.gov

Executed at Rockville, MD
this 31st day of May 2011

May 31, 2011

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NUCLEAR REGULATORY COMMISSION

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AFFIDAVIT OF JEREMY P. RISHEL
CONCERNING PREFILED REBUTTAL TESTIMONY REGARDING CONTENTION CL-2

I, Jeremy P. Rishel, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson Regarding Contention CL-2" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

Jeremy P. Rishel
Technical Research Scientist
Engineering and Environment Directorate
Pacific Northwest National Laboratory
Mail Stop K3-54
P.O. Box 999
Richland, WA 99352
(509) 375-6974
jeremy.rishel@pnl.gov

Executed at Richland, WA
this 31st day of May 2011

May 31, 2011

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NUCLEAR REGULATORY COMMISSION

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AFFIDAVIT OF DAVID M. ANDERSON
CONCERNING PREFILED REBUTTAL TESTIMONY REGARDING CONTENTION CL-2

I, David M. Anderson, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson Regarding Contention CL-2" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

David M. Anderson
Senior Research Economist
Energy and Efficiency Directorate
Pacific Northwest National Laboratory
Mail Stop K6-05
P.O. Box 999
Richland, WA 99352
(509) 375-6781
DMA@pnl.gov

Executed at Richland, WA
this 31st day of May 2011