Progress Energy

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United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

SUPPLEMENTAL INFORMATION REGARDING
LOSS OF COOLANT ACCIDENT ALTERNATIVE SOURCE TERM DOSE ANALYSIS

Ladies and Gentlemen:

In a letter dated January 21, 2005, Carolina Power and Light Company, also known as Progress Energy Carolinas, Inc. (PEC), requested NRC review and approval for implementation of the Alternative Source Term (AST) methodology for the Loss of Coolant Accident (LOCA) dose analysis for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2. In a letter dated May 26, 2005, PEC provided a response to a Request for Additional Information (RAI) related to the revised dose analysis. Telephone conversations between NRC and PEC personnel were held subsequent to the May 26, 2005, letter to discuss specific aspects of the RAI response.

Based on those phone conversations, it was determined that two dose calculation input parameters require further justification. The first parameter relates to the diffusiophoresis aerosol removal factor of 0.5 per hour used in the dose analysis. In calculating the diffusiophoresis removal factor, one of the inputs is the density of steam. The density of steam can be calculated using either the total containment pressure or partial steam pressure. In the previously submitted analysis, PEC used steam temperature at saturated steam conditions (equivalent to using saturated steam partial pressure) to calculate the containment steam density. The NRC indicated that use of total containment pressure would be more appropriate.

The second parameter relates to the flashing fraction used to determine the quantity of iodine released from the assumed leakage of recirculated containment sump water outside the containment. The LOCA dose analysis submitted for HBRSEP, Unit No. 2, by letter dated January 21, 2005, was based on an assumed flashing fraction of 5.3%, which is consistent with the current licensing basis. The value of 5.3% is based on the peak sump fluid condition in a constant enthalpy balance, similar to the methodology provided in Regulatory Guide 1.183, Appendix A, Position 5.4. The NRC requested additional information to justify a value less than 10%, in accordance with Regulatory Guide 1.183, Appendix A, Position 5.5.

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PEC is addressing these items by revising the LOCA dose analysis using input parameters consistent with the recommendations described above. Attachment II provides a discussion of each of the revised analysis parameters and the dose analysis results. The No Significant Hazards Consideration and Environmental Impact Consideration provided in the January 21, 2005, letter have been reviewed and it has been concluded that they remain valid, because the revised dose results, as presented in Attachment II, remain within acceptable limits.

Attachment I provides an Affirmation in accordance with the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f).

If you have any questions concerning this matter, please contact Mr. C. T. Baucom at (843) 857-1253.

Sincerely,

Jan F. Lucas
Manager – Support Services – Nuclear

RAC/rac

Attachments: I. Affirmation
II. Revised LOCA Dose Analysis Input Parameters and Results

c: Dr. W. D. Travers, NRC, Region II
Mr. C. P. Patel, NRC, NRR
NRC Resident Inspector

AFFIRMATION

The information contained in letter RNP-RA/05-0097 is true and correct to the best of my information, knowledge and belief; and the sources of my information are officers, employees, contractors, and agents of Carolina Power and Light Company, also known as Progress Energy Carolinas, Inc. I declare under penalty of perjury that the foregoing is true and correct.

Executed On: 19 September 2005

J. W. Moyer
Vice President
H. B. Robinson Steam Electric Plant, Unit No. 2

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

REVISED LOCA DOSE ANALYSIS INPUT PARAMETERS AND RESULTS

The Loss of Coolant Accident (LOCA) Alternative Source Term (AST) dose analysis inputs and assumptions are the same as those provided in the January 21, 2005, letter with the following exceptions:

1. The flashing fraction used to determine the quantity of iodine released from the leakage of containment sump water from Engineered Safety Feature (ESF) systems outside containment is increased from 5.3% to 10%.
2. To compensate for the increased flashing fraction, the assumed leak rate of ESF systems outside containment is decreased from four gallons per hour (gph) to two gph. The previous value of four gph was based on twice the current acceptance criteria of two gph in the leakage control program, which is specified in Technical Requirements Manual 3.23. PEC will revise this acceptance criteria to one gph upon NRC approval of the LOCA AST analysis.
3. The aerosol removal factor used to account for diffusiophoresis is reduced from a value of 0.5 to 0.2 hr^{-1}. Consistent with the approach specified in the January 21, 2005, letter, this additional removal factor is only applied in the sprayed region of the containment and only during periods when the sprays are operating. Sprays are assumed to terminate at 10,000 seconds (2.78 hrs). The revised value for the diffusiophoresis factor is calculated using the same method as previously specified, with the exception of using total containment pressure in determining steam density. The calculated values ranged from a high of 2.7 hr^{-1} at 50 seconds to a low of 0.28 hr^{-1} at 19,219 seconds. Conservatively, a constant value of 0.2 hr^{-1} is used over the entire spray period, rather than using time dependent values.
4. The change in removal factors resulted in a change in the calculated times at which a decontamination factor (DF) of 50 is obtained for particulate iodine. A DF of 50 is now obtained at 2.66 hours for the 'A' Spray Train and at 2.70 hours for the 'B' Spray Train. At those times the aerosol removal factor is reduced by a factor of ten consistent with Regulatory Guide 1.183, Appendix A, Position 3.3.

To summarize the impact of changes 3 and 4 above, the following provides the inputs used in the RADTRAD code for the containment sprayed region for the spray removal factors (including diffusiophoresis):

For 'A' Spray Train:

Time (hr)	Aerosol λ (hr^{-1})	Elemental λ (hr^{-1})
0	0	0
0.05	3.684	20
1.2833	0	0
1.45	3.684	20
2.01	3.684	0
2.66	0.3684	0
2.78	0	0

For 'B' Spray Train:

Time (hr)	Aerosol λ (hr^{-1})	Elemental λ (hr^{-1})
0	0	0
0.05	3.627	20
1.2833	0	0
1.45	3.627	20
2.03	3.627	0
2.70	0.3627	0
2.78	0	0

Additional notes on containment removal mechanisms are provided below to further support NRC reviews:

1. The elemental iodine spray removal factor of 20 hr^{-1} is based on the formula in the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, Updated Final Safety Analysis Report (UFSAR), Section 6.5.2.3.2, which is functionally equivalent to the model in Standard Review Plan (SRP) 6.5.2. Using this model and plant specific input parameters, the calculated elemental iodine spray removal factor is greater than 32 hr^{-1} for both the 'A' and 'B' Spray Trains. However, SRP 6.5.2 states that the elemental iodine removal factor should be limited to 20 hr^{-1}.
2. In addition to the spray and diffusiophoresis factors, a constant natural aerosol deposition removal factor of 0.1 hr^{-1} is also applied in the analysis. This factor is applied continuously in the containment unsprayed region and during periods when the sprays are not operating in the containment sprayed region. The value of 0.1 hr^{-1} was chosen to be consistent with other approved AST submittals (e.g., NRC Safety Evaluation Report (SER) for Indian Point Unit 2, dated July 27, 2000, and NRC SER for Shearon Harris Unit 1, dated October 12, 2001). For comparison, one time dependent model available for use in RADTRAD for natural deposition is provided in Table 2.2.2.1-1 of NUREG/CR-6604, "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation." Evaluating this model for HBRSEP, Unit No. 2, shows that the median confidence model natural deposition removal factors would exceed 0.1 hr^{-1} for essentially the entire duration of the event. The most conservative confidence model would yield results that are only slightly lower than 0.1 hr^{-1} early in the event. By 30,000 seconds (8.3 hours), the 10 percentile correlation result increases to slightly above 0.1 hr^{-1}.

Based on the above described changes, the following table provides the calculated doses for the limiting case ('B' Spray Train). This table replaces the results in Table 7 of the January 21, 2005, submittal:

Item	EAB[1] (REM TEDE)	LPZ[2] (REM TEDE)	CR[2] (REM TEDE)	TSC/EOF[2] (REM TEDE)
Containment Release	23.1	1.37	2.57	1.92
ESF Leakage	1.0	0.21	1.83	0.16
Containment Shine	-	-	0.03	0.03
Plume Shine	-	-	0.03	0.02
Total Dose	24.1	1.58	4.46	2.14
Regulatory Limit	25[3]	25[3]	5[4]	5[4]

NOTES:

(1) Worst two hour integrated dose at the Exclusion Area Boundary (EAB)
(2) 30-day integrated dose at the Low Population Zone (LPZ), Control Room (CR), and Technical Support Center/Emergency Operations Facility (TSC/EOF)
(3) Regulatory Guide 1.183, Table 6, "Accident Dose Criteria"
(4) 10 CFR 50.67 and 10 CFR 50, Appendix A, Criterion 19