September 17, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
Marshall E. Miller, Chairman
Gustave A. Linenberger, Jr.
Dr. Cadet H. Hand, Jr.

In the Matter of UNITED STATES DEPARTMENT OF ENERGY PROJECT MANAGEMENT CORPORATION TENNESSEE VALLEY AUTHORITY (Clinch River Breeder Reactor Plant)	Docket No. 50-537

NATURAL RESOURCES DEFENSE COUNCIL, INC.
AND THE SIERRA CLUB TWENTY-SEVENTH
SET OF INTERROGATORIES AND REQUEST TO PRODUCE
TO STAFF

Pursuant to 10 CFR § 2.740b, and in accordance with the Board's Scheduling Order of August 31, 1982, Intervenors, Natural Resources Defense Council, Inc. and the Sierra Club, submit the following interrogatories related to the Draft Supplement to Final Environmental Statement related to construction and operation of Clinch River Breeder Reactor Plant, NUREG-0139, Supplement No. 1, Draft Report (July 1982) (the "DES"). Intervenors request that the attached

interrogatories be answered fully, in writing and under oath, by one or more officers or employees of the Staff who has personal knowledge thereof or is the closest to having personal knowledge thereof. If the interrogatories are answered by more than one person, whether or not he or she verified the answers, and whether or not he or she is an officer or employee of the Staff, such person's name and title should be set forth together with an identification of which interrogatories he or she is responsible for.

Each answer to an interrogatory shall be preceded by a copy of the particular question to which the answer is responding. Each question is instructed to be answered in six parts, as follows.

Answer to Question _____:

(a) Provide the direct answer to the question.

(b) Identify all documents and studies, and the particular parts thereof, relied upon by the Staff, now or in the past, which serve as the basis for the answer. In lieu thereof, at the Staff's option, a copy of such document and study may be attached to the answer.

(c) Identify principal documents and studies, and the particular parts thereof, specifically examined but not cited in (b). In lieu thereof, at the Staff's option, a copy of each such document and study may be attached to the answer.

(d) Identify by name, title and affiliation the primary Staff employee(s) or consultant(s) who provided the answer to the question.

(e) Explain whether the Staff is presently engaged in or intends to engage in any further, ongoing research program which may affect the Staff's answer. This answer need be provided only in cases where the Staff intends to rely upon ongoing research not included in Section 1.5 of the PSAR at the LWA or construction permit hearing on the CRBR. Failure to provide such an answer means that the Staff does not intend to rely upon the existence of any such research at the LWA or construction permit hearing on the CRBR.

(f) Identify the expert(s) if any, which the Staff intends to have testify on the subject matter questioned, and state the qualifications of each such expert. This answer may be provided for each separate question or for a group of related questions. This answer need not be provided until the Staff has in fact identified the expert(s) in question or determined that no expert will testify, as long as such answer provides reasonable notice to Intervenors.

As used herein, "documents" include, but are not limited to papers, photographs, criteria, standards of review, recordings, memoranda, books, records, writings, letters, telegrams,

mailgrams, correspondence, notes and minutes of meetings or of conversations or of phone calls, interoffice, intra-agency or interagency memoranda or written communications of any nature, recordings of conversations either in writing or upon any mechanical or electronic or electrical recording devices, notes, exhibits, appraisals, work papers, reports, studies, opinions, surveys, evaluations, projections, hypotheses, formulas, designs, drawings, manuals, notebooks, worksheets, contracts, agreements, letter agreements, diaries, desk calendars, charts, schedules, appointment books, punchcards and computer printout sheets, computer data, telecopier transmissions, directives, proposals, and all drafts, revisions, and differing versions (whether formal or informal) of any of the foregoing, and also all copies of any of the foregoing which differ in any way (including handwritten notations or other written or printed matter of any nature) from the original.

The page references in the following interrogatories all refer to the DES, unless otherwise noted.

INTERROGATORIES

I. APPENDIX D

1. On page D-2, the Staff has stated that it used Amendment XIV to the Applicants' CRBR Environmental Report as a basis for its independent assessment of the environmental effects of the CRBRP fuel cycle. What is the basis for the Staff's conclusion that this assessment is independent if the Staff has simply used the numbers reported by the Applicants in the Environmental Report?

2. On page D-3, the Staff has identified the current fuel cycle proposed by the Applicants for the CRBRP (page D-2). Identify any and all reasonably foreseeable alternative fuel cycles for the CRBRP.

3. Identify the CRBRP initial loading (Table D.1) that would be required for the heterogenous core if reactor-grade plutonium from reprocessing commercial reactor fuel were utilized to supply the plutonium for the CRBR.

4. In figure D.1 at page D-3, the Staff has assumed plutonium losses to waste storage of .5% of the plutonium throughput for both the reprocessing plant and the fuel fabrication plant. For each year of operation, or alternatively over the plant lifetime, identify the actual plutonium losses to waste storage (as a percent of plutonium throughput) that occurred at the following plants:

a. the NSF West Valley reprocessing plant,

b. the Savannah River Plant, F Canyon

c. the Hanford Purex plant,

d. the Kerr-McGee MOX Fuel Fabrication plant,

e. the NUMEC Plutonium Fabrication Operations plant

f. the NSF Erwin Plutonium Fabrication plant,

g. The fuel processing or fabrication plant where these data are known to the NRC staff.

5. In Figure D.1 at page D-3, how much plutonium did the Staff assume was initially stored in the facility labelled "Pu Storage Inventory" that would be available for use in the CRBR as initial core and reload materials?

6. At Page D-4, paragraph 4, the staff states that it based its evaluation on the equilibrium mode with burnups shown in Table D.3. How many reprocessing cycles (identified in Figure D.1) are necessary before the plutonium isotopic concentration in fresh CRBR fuel reaches equilibrium under the fuel cycle assumed in Figure D.1?

7. What is the plutonium isotopic concentration in fresh CRBRP fuel at the time after the CRBRP fuel cycle has reached its equilibrium, with regard to fresh fuel plutonium concentration? In other words, identify the plutonium isotopic concentration at equilibrium in weight percent for (a) Pu-236, (b) Pu-238, (c) Pu-239, (d) Pu-240, (e) Pu-241, (f) Pu-242, and (g) Pu-243.

8. What is the plutonium isotopic concentration of CRBR fresh fuel for the fuel cycle in Figure D.1 after 1, 2 and 4 recycles respectively, for each isotope identified in question 7 above.

9. In Table D.3, at page D-6, the Staff has assumed that the fissile plutonium content represents 88% of the total plutonium of each charge to the reactor core. What is the basis for the Staff's assumption that the fissile content will not be substantially lower at equilibrum due to recycling of the CRBR fuel as shown in Figure D.1 at page D-3?

10. On page D-9, the Staff states that the Applicants and the Staff both assumed a clean-up factor of 1.25 E-8 for the atmospheric transuranic releases from the core fuel fabrication operations. For each year of operation, or alternatively, over the lifetime of the facility

a. What clean-up factor was achieved by the plutonium operations at the Kerr-McGee facility that was used to fabricate FFTF fuel?

b. What clean-up factor was achieved by the plutonium operations at the NSF Erwin Facility?

c. What clean-up factor was achieved by the plutonium operations at the NUMEC facility?

d. What clean-up factor was achieved by the plutonium operations at Rocky Flats?

e. In light of the experience at Rocky Flats, what is the basis for the Staff's assumption that, averaged over the lifetime of the plant, accidental releases will not exceed routine releases through the banks of HEPA filters?

11. On page D-14, the Staff refers to alternative reprocessing plants to the DRP. For each isotope element identified in Table D.8 at page D-15, identify the containment factor utilized by the Staff, or by DOE if larger than the Staff assumption, for the DRP and for each of the following plants:

a. The F-Canyon at the Savannah River Plant,

b. The NFS West Valley Facility,

c. The Hanford Purex Plant

d. Any foreign reprocessing plant where the data is know to the NRC.

The results are to be given both for the lifetime operations of these facilities and separately for the last several years during their operation, if different from the lifetime average.

12. On page D-21 the Staff states, "It is estimated that for CRBRP these releases would range from about 6×10^{-5} Ci/yr from a repository in salt to about .5 Ci/yr from a repository in granite (1/100th of values reported in DOE 1980)."

a. What is the basis for the Staff's assumption that 1/100th of the values reported in DOE 1980 should be taken?

b. What independent analysis, if any, has the Staff conducted to verify that the release rate assumed in the reported DOE document are correct; i.e., 6×10^{-3} Ci/yr from a repository in salt and 50 Ci/yr from a repository in granite?

c. Display all calculations that form the basis for the Staff's estimate of this curie release.

d. Identify each and every Staff person and consultant who conducted this independent review. Identify the employer and location of each consultant.

e. Identify when this review took place.

f. Identify and produce all documents examined and relied upon by the Staff in the conduct of this review.

g. Are the above curie releases to the "accessible environment"? If not, what are these releases to?

h. How does the Staff define "accessible environment" in this regard?

13. At page D-21, the Staff states: "The resulting annual dose to the regional populations in the vicinity of the repository would range from about $7x10^{-5}$ person-rems for a repository in salt to about 1 person-rem for a repository in granite."

a. What is the basis for the Staff's assessments of the person-rem calculations presented here? Present all calculations and assumptions.

b. Identify and produce all documents relied upon by the Staff as a basis for these calculations.

c. Identify the Staff personnel and consultants, by name and affilation, that performed these calculations and analyses. Were these calculations performed by DOE or DOE consultants? If so, identify who performed the calculations.

d. Define precisely the "regional populations" referred to in this statement, including the size, i.e., number of people; and extent, i.e., distance from the repository.

e. Identify the time period over which the dose estimates (on an annual basis) are summed.

f. Identify each isotope that was considered in the summation of the dose commitment.

g. Identify the contribution to the total dose commitment from each isotope over the prescribed period of summation or integration.

h. Identify the dose conversion factors utilized in the above calculations.

i. Identify all other important assumptions made in the same calculations.

j. What is the Staff's estimate of the range of uncertainties on both the estimates of the curie values released for each of the isotopes involved (see question 12 above) and for the overall dose committment in person-rems? What is the basis for this estimate? Display all calculations and identify and produce all sensitivity studies, and documents relied upon by the Staff in response to this question.

k. What is the basis for the Staff's reporting the dose commitment in person-rems, presumably meaning whole body dose, given that most of the dose would be to internal organs, such as the bone surface, for both salt and granite repositories.

l. What is the Staff's estimate of the total dose commitment to bone surfaces?

m. What is the basis for this estimate of total does to the bone surfaces? Display all calculations and identify and produce all documentation relied upon by the Staff.

14. On page D-29, the Staff discusses the calculation of the dose committments from blanket fuel fabrication and estimates the total whole body dose committment to be less than 0.1 person-rem annually.

a. Given that the primary radiological effluents from blanket fuel fabrication are U-235 and U-238 (see page D-7), what is the basis for the Staff's view that only the whole body dose should be calculated rather than include internal organ doses for the critical organs for U-235 and U-238 exposure?

b. What are these critical organs and what would be the corresponding organ exposures?

c. What dose conversion factor was utilized in calculating the whole body dose committment of .1 person-rems annually?

d. Identify and produce the documentation used as a reference source for dose commitment factor.

e. Explain in detail how the RABGAD code has been validated and produce all documentation related to the RABGAD validation.

f. Identify each Staff personnel and consultant who conducted the RABGAD (i) validation, and (ii) calculations.

g. Identify and produce all documentation of the RABGAD dose calculations conducted by the Staff.

h. With respect to the environmental dose commitments for both the blanket fuel fabrication and the core fuel fabrication, what is the basis for the Staff's assumption that the integration period should be limited to 100 years? What would the dose estimate be if the integration period were extended to cover (i) halflife and (ii) 6 halflives of the pertinent isotopes?

i. In the Staff's calculation of the dose commitment of less than 0.1 person-rems for core fuel fabrication, provide a breakdown of the dose committment by (i) isotope identified in Table D.4, (ii) pathway identified in the second to last paragraph on page D-29, and (iii) organ, including the whole body.

15. With regard to the estimate of total population dose commitment of less than .1 person-rem, identify the dose commitment factor utilized for each isotope and internal organ, including the whole body, used in this calculation.

a. Identify where these dose conversion factors are documented, and produce any and all such documentation.

16. The following questions relate to the Staff's calculation of the dose commitments from fuel reprocessing, estimated to be 140 person-rems.

a. At page D-30, with respect to the tritium dose calculation, identify the total person-rem dose from tritium exposure within the 50-mile limit,

b. Identify the contribution to the tritium exposure for the U.S. population beyond the 50-mile limit,

c. Identify the tritium dose commitment for the population beyond U.S. boundaries (i.e., remainder of the northern hemisphere).

d. - f. Answer questions a. through c. above for carbon-14.

g. - i. Answer questions a. through c. above for noble gases (e.g. Kr-85).

j. - l. Answer questions a. through c. above for halogens (e.g. I-131, I-129).

m. What is the bone surface dose commitment within the 50-mile limit with respect to each of the dose commitment from fuel reprocessing (Section D.2.4.3)?

17. Provide the answers to questions 14 a.-i. above with respect to the dose commitment calculations for fuel reprocessing rather than blanket and core fuel fabrications.

18. a. Identify by page number and location on the page where the dose estimates cited in D.2.4.3 are found in the RABGAD computer print-out.

b. Supply the computer printout for this purpose.

19. At page D-30, the Staff states that CRBR high-level wastes are projected to occupy less than 1% of the total inventory of a typical high-level waste repository. Identify the total inventory of a typical high-level waste repository for which this estimate was made.

20. At page D-31, the Staff estimates that the cumulative radiation dose to transportation workers and the general population would be approximately 24 person-rems per year for the CRBR and its related fuel cycle. Table D.16 on page D-32 provides a breakdown of the person-rems that, when summed, leads to 24 person-rems per year. With respect to each entry in Table D.16 that exceeds one person-rem per year, provide the underlying analysis, including all input assumptions that were used to estimate these person-rem exposures.

II. APPENDIX J

21. On page J-1, ¶4, the statement is made that

> The results of the staff's analyses of the realistic consequences of design-basis accidents were presented in the FES Table 7.2. The reported values appear to the staff to be reasonable. This conclusion is based upon comparison of realistic dose consequences of the CRBRP design-basis accidents with the corresponding doses for some recently evaluated LWRs such as the Comanche Peak, Callaway, and Palo Verde plants, as shown in Table J.1. [emphasis added.]

Whereas, in the Staff's Response to Interrogatory 45 of Intervenors' Twenty-Fifth Set of Interrogatories, dated June 18, 1982, the Staff stated:

> ... the Staff is currently not depending upon the numerical values of calculated doses presented in Table 7.2 of the FES for its conclusions regarding CRBR accidents:

a. Is the Staff relying on the calculated doses presented in Table 7.2 of the FES for its conclusions regarding CRBR accidents?

b. Is the response to Interrogatory 45 still current? If not, please update it.

22. How can the doses from CRBR design-basis accidents be validated by comparing them against LWR accidents?

23. a. With respect to each CRBR dose calculation in Table 7.2, explain in detail the nature of the similarities between LWR accidents and CRBR accidents that support using the doses from a LWR accident to validate the dose for the corresponding CRBR accident.

b. With respect to each CRBR dose calculation, identify each difference between the corresponding CRBR and LWR accident scenarios, i.e., each input assumption. Here we are seeking quantitative data, not qualitative responses.

c. Explain why each of the differences in "b." would not significantly affect the conclusion that "the reported values [for CRBR in Table 7.2] appear to the Staff to be reasonable." Here we are particularly interested in the comparison between Class 8 accidents and the similarities and differences between "large break LOCA and site suitability source term accidents."

d. Identify and provide all input data, computer codes (if applicable), formulas, notebooks, calculations, details of calculations, and other documentation used by the Staff to calculate the doses appearing in Table J.1 (p. J-2) under the column identified as CRBRP FES.

e. In your answer to "d." above, display (i) all the arithmetic used in the calculations, (ii) each computer code, (iii) each input to computer codes, (iv) each hand calculation, (v) each algebraic equation, and (vi) the value of each parameter of each equation.

The purpose of this interrogatory is to determine if the results in Table J.1 can be reproduced and to validate the results.

If the data requested under "d." and "e." above are made available for inspection and copying, provide a detailed guide (a "road map") that identifies the various pieces of data so that one can readily follow the calculations and distinguish the data from similar calculations that are not relevant to the interrogatory. For example, if "microfiches of all computer runs" are made available, we would like to know which microfiches and which computer runs go with which calculations.

24. The results of the Staff's FES accident analyses are said to be "realistic consequences." Presumably this implies that different assumptions were used to calculate the doses than the assumptions used to perform the SSST analysis in the SSR.

a. Identify quantitatively each specific difference in the assumptions in the two cases.

b. Where possible, identify the sensitivity of the results to the change in the input assumptions.

25. On page J-2, ¶2, the statement is made that:

> ... accidents of the types represented by those described in FES Table 7.2 for Classes 2-8 have a finite and relatively larger likelihood of occurrence during the operating lifetime of the CRBRP than the occurrence of Class 9 accidents.

On page J-3, ¶2, the Staff states:

> The Class 9 accident discussed in the FES involved a sequence and release representative of possible core disruptive accidents.... The frequencies of severe (Class 9) accidents at the CRBRP involving potential core disruption and containment failure...."

a. What is the basis for the Staff's view that the accidents identified as "site suitability source term" in Table 7.2 of the FES are Class 8.5 (design basis) rather than Class 9?

b. Define "core disruption" as used in Appendix J and elsewhere in the DES.

c. Define "core disruptive accident (CDA)" as used in Appendix J and elsewhere in the DES.

d. Define "Class 8 accident" as used in Appendix J and elsewhere in the DES.

e. Define "Class 9 accident" as used in Appendix J and elsewhere in the DES.

f. Define "design basis accident" as used in Appendix J and elsewhere in the DES.

g. If any definition given in response to questions b)-f) above is different from the definition of these terms as used by the Staff in other Staff documentation, responses to Intervenor interrogatories or in the licensing hearings, explain in precise detail (i) any and all differences, and (ii) the significance of these differences.

26. On p. J-3, ¶4, the statement is made that:

> Core disruption could be initiated by ...
> 3) core-wide fuel failures as exemplified by propagation of local fuel faults (FFP).

a. Does the Staff view core disruption as requiring "core-wide fuel failure"?

b. Would partial core fuel failure constitute core disruption in the Staff's view?

c. How many fuel pins or assemblies would have to fail to meet the Staff's definition of (i) core disruption; (ii) core disruptive accident?

d) If core disruption is initiated:

i) would it be reasonable to assume that full core involvement is a likely outcome?

ii) would it be prudent to assume that full core involvement is a likely outcome for purposes of the environmental and site suitability review of a reactor of the general size and type as the CRBR?

iii) If your answer to i) or ii) above is no, explain the reason for your answer.

27. Identify and produce every document that was relied upon for Staff's (and Staff consultants') judgment that "there is sufficient inherent redundancy, diversity, and independence in the SEAHRS and DHRS systems to achieve a core degradation frequency due to LOHS events of less than 10^{-4} per reactor" (p. J-3 ¶6).

28. Identify quantitatively the reliabilities "typical[ly] achievable for PWR auxiliary reactor-year systems" (J-3 ¶6).

29. a. Identify quantitatively the reliability of each of the steam generator auxiliary heat removal system component and each component of the direct heat removal system of the CRBRP and PWR, respectively.

    b. Identify separately the combined reliability of all of these systems taken together for CRBR and separately for PWRs in order to show the margin in terms of overall systems reliability that has been applied to account for common cause and multiple failures.

30. a. At the top of page J-4, identify each and every component of an "effective reliability program."

    b. Identify and produce any and all documents describing such a program.

    c. Identify and produce each document that the Staff has relied upon as a basis for its conclusion that high reliability in the final design and operation of the CRBR can be achieved through an effective reliability program.

31. Quantify and give the uncertainty values for the LOHS probability contribution for CRBR from simultaneous loss of offsite and onsite AC electric power and the steam-driven auxiliary feedwater trains.

32. Identify and produce each and every document that the Staff relied upon for its conclusion that a significant contributor to the LOHS probability for the CRBR would be from simultaneous loss of offsite and onsite AC electrical power and the steam-driven auxiliary feedwater train (J-4).

33. Identify and produce each and every document relied upon by the Staff for its conclusion that "for these reasons LOCAs are not considered credible (i.e., design basis) events at CRBRP" (J-4). Cite the appropriate pages.

34. Identify and produce each and every document the Staff relies upon for its conclusion that "the frequencies assumed for LOHS adequately bounds the LOCA contributions to core disruption frequency" (J-4). Cite the appropriate pages.

35. Identify and produce each and every document the Staff relied upon for its conclusion that "the frequency assumed for LOHS core degradation sequences adequately bounds the flow blockage contribution to core disruptive frequency" (J-4). Cite the appropriate pages.

36. Identify and produce all documentation used as a basis for the Staff conclusion that "although the Staff review of these systems is not complete, it is the judgment of the Staff that

there are sufficient inherent redundancy, diversity, and independence in the overall shutdown system designs to expect an unavailability of less than 10^{-5} per demand" (J-4). Cite the appropriate pages.

37. In the following sentence on page J-4, what did the Staff assume was the unavailability rate for light water reactor shutdown systems? What is the basis for this estimate?

38. a. Identify and produce all documentation relied upon by the Staff for the estimate of the unavailability rates for the light water reactor shutdown systems. Cite the appropriate pages.

    b. How does the Staff reconcile this estimate with the estimate appearing in the proposed ATWS rule?

39. At page J-4, the Staff states "the CRBRP fuel design will be required to have an inherent capability to prevent rapid propagation of fuel failure from local faults."

    a. Identify fully each requirement that will be imposed by the Staff on the CRBR fuel design to provide this inherent capability.

    b. Describe fully the basis for the Staff's view that this inherent capability will in fact prevent rapid propagation of fuel failure from local faults.

c. Identify and produce all documentation relied upon by the Staff for its conclusion that the CRBR fuel design will have the required inherent capability to prevent rapid propagation of fuel failure from local faults.

d. Identify each and every system the Staff relies upon for its statement that systems to detect more slowly developing faults will also be required.

40. a. Quantify the frequency of fuel failure propagation referred to by the Staff in their statement at the top of page J-5: "Therefore, the frequency of fuel failure propagation is considered very low." What is meant by the term "very low" in this regard?

b. What is the uncertainty in this estimate?

41. At the top of page J-5, the Staff states, "... the frequencies attributed to LOHS, UTOP, and ULOF events adequately bound the contribution to core disruptive frequency from fuel failure propagation."

a. What is the analytical basis for this conclusion?

b. Identify and produce all documents utilized by the Staff that form the basis for this conclusion.

42. In the summary in the first full paragraph on J-5, the Staff has summed the frequencies of core disruption and estimates a combined or net frequency of 10^{-4} per reactor

year or less. Since 10^{-4} per reactor year or less was the estimated frequency of each of the classes of initiators identified above, explain how the Staff arrived at the conclusion that the sum of these is no larger than each of the individual contributions.

43. On page J-6, the Staff has assigned conditional probabilities to the primary system failure for categories I, II, and III, and separately for category IV.

a. Explain fully the basis for the Staff's quantification of these failure rates.

b. Identify the uncertainty in each estimate.

c. Identify and produce all documents relied upon by the Staff for its assessment of these failure rates. Cite the appropriate pages.

We are not seeking a response that speaks in generalities. We wish to know the specific documentation that the Staff is relying upon for the basis of these estimates.

d. Did the Staff, for example, consider CRBRP-1 as one of the documents that it relied upon for these estimates?

e. Did the Staff examine and rely in any way on any probabilistic risk assessment, such as risk assessments performed for SNR-300, in reaching its conclusions with regard to these conditional probabilities?

44. a. On page J-7, what is the containment isolation unavailability for operating pressurized water reactors?

    b. What is the unavailability for boiling water reactors?

    c. Identify and produce all documents relied upon by the Staff for these estimates.

45. a. What is the basis for the Staff's estimate that failure to recover AC power before containment failure occurs is estimated to have a frequency of about 10^{-2} per demand?

    b. Identify and produce all documents relied upon by the Staff for this estimate, citing the appropriate pages.

46. a. What is the basis for the Staff's conclusion that an unavailability of less than 10^{-2} per demand is feasible for containment isolation at the Clinch River Breeder Reactor?

    b. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

47. a. What is the basis for the Staff's assumption (on page J-9) that "because there are more than one million pounds of primary coolant sodium a dense aerosol (10-100 micrograms/cc) could be airborne in the RCB."

    b. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

48. What is the basis for each of the bounding frequency estimates of containment release identified in Table J.2 and page J-8 given in units of per reactor year for each of the four CDA classes?

49. a. On page J-9, display the supporting analysis for the conclusion that "leakage from the RCB considering CDA class I involves design leakage at rates of 10^{14} to 10^{15} per hour and filtered venting which is 97-99% efficient."

    b. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

50. a. What is the basis for the Staff's estimate on page J-9 that "in CDA class II, approximately 57% of the RCB atmosphere will be released soon after failure by overpressurization because the RCB pressure drops from about 2.3 atmospheres (abs) to one atmosphere (abs)."

    b. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

51. What is the basis for the Staff's estimate that "the leakage rate to the environment considering failure of the containment to isolate a ventilation supply or exhaust line (CDA classes III and IV) is estimated to be on the order of 10^{-1} to 10^{-2} per hour, similar to the rates after overpressurization failure" (J-9)?

52. a. What is the basis for the Staff's estimate that sodium boiling will occur in a 100-200 hour period and not a longer or shorter period?

b. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

53. a. What is the basis for the Staff's estimates of the head release fractions that were selected in Table J.3 at page J-9?

b. Present all analytical calculations that were used to provide these estimated releases.

c. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

54. On page J-10, the Staff states that "typical analysis for similar sodium aerosol conditions indicate deposition rates in a single chamber of between 0.5 and 1.0 per hour."

a. What analyses are referred to by the Staff here?

b. Identify and produce all documents relied upon by the Staff for this estimate.

c. What size chamber is involved here, and what are the environmental conditions assumed in the chamber for which these estimates are appropriate?

55. Display the subsequent calculations that form the basis for the Staff's conclusions that "considering leakage rates between 10^{-2} and 10^{-1} per hour, therefore indicate that between 1% and 20% of the particulate airborne fission products may eventually be released to the environment."

56. Display the analytical bases for the footnote at page J-10: "Design leakage rates of 10^{-4} to 10^{-5} per hour correspond to 10^{-5} to 10^{-7} long-term release fractions. Filtered venting is 97% to 99% efficient."

57. a. What is the basis for the Staff's assumption that this release would not occur until about 24 hours after the head release and about 14 hours after pool boiling begins (J-10)?

    b. Identify and produce all documents relied upon by the Staff for this estimate, citing appropriate pages.

58. a. Identify and produce all documentation and calculations related to the consequence model referred to on page J-10.

    b. Provide all model calculations related to the CRBR, including all sensitivity studies, performed by the Staff using this consequence model and identify for each the principal changes and assumptions that were

made in order that the outputs for the various sensitivity studies could be distinguished from one another and from the primary calculation used to provide the data in Table J.2 at page J-8.

59. To the extent that each of the estimates of percent of core inventory released to the environment for each of the 4 CDA classes presented in Table J.2 and page J-8 are based on analyses other than that provided in response to Interrogatory 37 above, provide the analysis displaying explicitly all calculations, computer models, and input and output assumptions. If these estimates were performed by computer calculations, identify and produce a copy of the computer code, the computer input data, and the output, and identify for each input and output data sets where the calculated release numbers for core inventory release to the environment are found. That is, on what page and line of the output are these estimates found?

60. With regard to WASH-1400 and NUREG-75/014, cited in footnote 1 of Table J.2 at page J-8, identify the page number(s) where these estimates are made. Identify and produce any other documents relied upon by the Staff for this estimate.

61. What is the core inventory for each of the isotopes of each element identified in Table J.2?

62. a. What is the basis for the Staff's assumption that filtered venting begins at about 24 hours after CDA initiation?

Identify and produce all documents relied upon by the Staff for this estimate.

63. a. Identify and produce the analytical support for the conclusion on page J-11 that "the doses associated with this accident class are not expected to exceed 10 CFR 100 guidelines." Explicitly display all dose calculations and results.

b. Did the Staff calculate the bone surface dose?

c. If so, what dose conversion factor did the Staff use?

d. Over what period of time did the Staff integrate the releases to the environment for purposes of this calculation?

e. What is the basis for the Staff's assumption that this integration period was adequate and covered the entire period of the passage of the cloud?

f. Who performed the radiological consequence modelling? That is, identify the principal experts who were responsible for providing the input assumptions and exercising the codes?

g. Were these calculations performed in-house by the NRC Staff, or by an outside contractor?

h. If outside, produce all documentation between the Staff and the contractor related to these calculations.

64. a. Identify and produce all output data for the consequences modelling discussed on page J-13, unless it has already been provided in response to other Interrogatories above.

b. Identify those calculations that give the peak number of consequences, in terms of both early fatalities and late cancers.

c. By what factor does early evacuation reduce

i) the peak early fatalities, and

ii) the peak number of latent cancers?

d. What assumptions were made with regard to the dose required to produce an early fatality?

e. Display the number of early fatalities as a function of probability for various assumptions of evacuation.

f. Display the number of latent cancers as a function of probability for various assumptions regarding evacuation.

65. Identify and produce the computer code and code users manuals and other relevant documents for the consequence model described at pp. J-13 and J-14.

66. On page J-18, quantify what is meant by the statement "compliance with current NRC siting, structural, and seismic design criteria and with 10 CFR 73 for physical security

provides assurance that reactor-related risks from external events and sabotage are adequately low." In other words, quantify, either by a bounding estimate or a range of estimates, what is meant by the term "adequately low."

67. a. What CDA energetic level is required to produce a containment failure mode caused by either spray fire or missile?

    b. What is the basis for the Staff estimate?

    c. Identify and produce all documents relied upon by the Staff for this estimate.

    d. What is the conditional probability of production of such a spray fire or missile, given the occurrence of a core disruptive accident?

    e. How does the Staff reconcile its statement at page J-18 that "quantification of the frequency of this very improbable nonmechanistic event at this time would involve such large uncertainties that the results would have no real meaning" with the Staff's estimate at page J-6 of a conditional probability of .1 for primary system failure category IV, assuming that a CDA accident occurs?

68. At the bottom of page J-18, the Staff concludes "in summary, from the limited quantitative analysis discussed above, it is the best estimate of the Staff that the frequency

of individual classes of severe accidents resulting in fatalities or even doses exceeding 10 CFR 100 guidelines is less than 10^{-6} per reactor year."

a. What is the Staff's quantitative estimate of the uncertainty in this best estimate result? In other words, what is the standard deviation (1, 2, or 3 sigma) of this best estimate?

b. What is the basis for this Staff estimate of uncertainty?

69. a. At the top of page J-19, what is meant by the phrase "to gain perspective regarding representative system unreliabilities"? In other words, what kind of conclusions does the Staff imply should be drawn from these estimates?

b. How reliable are these conclusions in the Staff's view?

c. What is the basis for the Staff's estimates of the reliability of the Staff's conclusions?

70. At the bottom of page J-19, the Staff concludes "the analysis confirms the FES conclusion that accident risks at CRBR can be made acceptably low."

a. What is meant by the phrase "acceptably low" in this regard?

b. Can the Staff quantify what is meant by acceptably low? If so, provide the quantified result.

c. What is meant by the phrase "the analysis confirms"?

d. Should the reader attach a different meaning to the phrase "the analysis confirms" in the sentence and the phrase "to gain perspective regarding" in the sentence at the top of the page?

e. Does "confirm" mean "prove," or does "confirm" mean "gain perspective?" Please explain.

f. Is the perspective gained from these analyses meant to be any different from the perspectives on light water reactor risk that was gained by the Lewis Committee?

71. a. Identify each Staff person and Staff consultant responsible for, or providing technical assistance in, the preparation of Appendix J.

b. Identify the affiliation of each Staff consultant and their place of work.

c. Identify by subsection each part of Appendix J that each Staff person and consultant worked on and describe the nature of his or her work.

d. Approximately how many hours were spent by each Staff member and consultant in preparing Appendix J?

III. Appendix L and Chapter 9

72. Identify in detail the floodplain area (lowland and relatively flat areas) adjoining the Clinch River in and around the proposed site that is subject to a 0.2 percent chance of flooding in any given year.

a. Provide a detailed map delineating

i. the boundaries of such floodplain;

ii. all CRBR facilities proposed for construction in such floodplain.

73. Provide a detailed map showing the current proposed location of the CRBRP barge unloading facility to the nearest tenth of a river mile.

74. Describe in detail the current status of plans for the construction of a coal gasification plant at the Murphy Hill alternative site.

75. Describe in detail for each of the following alternative sites:

a. Hartsville (the sites of the two cancelled LWR units);

b. Phipps Bend; (the sites of the cancelled LWR units);

c. Yellow Creek (the site of deferred LWR construction); and

d Murphy Hill.

i. The extent to which the CRBR could utilize any water intake facilities that have already been constructed;

ii. the extent to which the CRBR could utilize any water discharge facilities that have already been constructed;

iii. the extent to which the CRBR could utilize any other existing or partially constructed facility at the site. Describe such facility in detail;

iv. the cost of constructing each facility discussed in response to (i)-(iii) above at the alternative sites;

v. the cost of constructing each such facility from scratch at the proposed Clinch River site;

vi. if any of the facilities in (i)-(iii) could be utilized by the CRBRP with some modification, the cost of such modification;

vii. the extent to which the CRBR could be constructed on portion(s) of the alternative site that have already been cleared;

viii. if the answer is yes to (vii), provide a map of the alternative site and indicate in detail the portions of the already cleared site that could be utilized for CRBR construction;

ix. the water quality impacts that would be attributable to the breeder plant if no other LWR reactor or coal gasification plant were located there;

x. the extent to which any terrestrial resources would be disturbed at each alternative site if the CRBR were constructed on already cleared portions of the site;

xi. the boundaries of the floodplain (lowland and relatively flat) area in and around the site that is subject to a 1 percent or greater chance of flooding in any given year;

xii. the breeder reactor facilities that would most probably be located in the 1 percent elevation floodplain;

xiii. the boundaries of the floodplain area in and around the site that is subject to a 0.2 percent chance of flooding in any given year;

xiv. the breeder reactor facilities that would most probably be located in the 0.2 percent elevation floodplain;

xv. the boundaries of any wetlands located on the site.

xvi. any mitigating measures that would probably be necessary to avoid adverse impacts to the 1 percent elevation floodplain;

xvii. any mitigating measures that would probably be necessary to avoid adverse impacts to wetlands;

xviii. the cost of each mitigating measure described in response to xvi and xvii. above.

76. In evaluating the preferability of alternative sites regarding overall socioeconomic impact, explain in detail the relative weight, if any, the Staff gives to each of the following factors:

a. estimated size of the available labor pool;

b. potential impacts on historical areas;

c. potential impacts on archaeological areas;

d. potential impacts on scenic areas;

e. potential impact on recreation areas;

f. potential impact on other protected areas;

g. potential impact on cultural areas;

h. potential displacement of residential activities;

i. potential displacement of economic activities;

j. potential traffic disruption;

k. potential visual intrusion.

77. Provide the Staff's best estimates of:

a. the types of modifications to the CRBRP design that would be necessary if Applicants were required to

restrict their thermal discharges to the Clinch River during periods when the river water temperature is high and zero flow conditions exist (see DES p. L-21);

b. the cost of such modifications.

78. On page 9-10, the Staff states that "[a]n attempt was made to apply CONCEPT to the CRBRP...." Identify and provide:

a. the CONCEPT computer code used by the Staff;

b. the CONCEPT program manual;

c. all input data to the CONCEPT code used by the Staff;

d. all CONCEPT output data for the CRBRP;

e. the results of any sensitivity studies performed on these results.

79. At page 9-14, the Staff presents Table A9.5, which estimates the costs of locating the breeder reactor at a site other than Clinch River. This table contains three entry lines of estimated costs for relocating at TVA alternative sites, including a 4-year delay (high range), a 4-year delay (low range), and a 3-year delay.

a. For each of these three cases, provide a breakdown of estimated delay costs for <u>each</u> of the four TVA alternative sites considered by the Staff.

b. For the 3-year delay case, indicate whether such estimate is considered in the high range or low range.

c. Provide both the high range and the low range estimates for the 3-year delay case.

d. Identify each and every assumption used by the Staff to differentiate its high range and low range estimates for the 4-year delay case.

e. For each of the TVA alternative sites, provide the estimated costs of relocation of the breeder reactor at that site, assuming that:

   i. no other LWR or coal gasification plant is to be built at that site; and

   ii. the CRBR utilizes the existing facilities and cleared site to the fullest extent practicable.

80. In deriving Table A9.5, did the Staff use the Applicants' estimates in Table A9.4 of 45-month delay costs for specific items such as excavation and additional studies?

a. If the Staff revised any of the Applicants' estimates (other than the reduced revenue from sale of electricity), provide the Staff's revised estimates for that factor, and given the reason for such revision.

81. Explain in detail the bases for the Staff's conclusion that revenue from the sale of LMFBR electricity at Hanford would equal $1097 million.

82. Regarding the occurrence of periods of zero flow into Clinch River, describe in detail:

a. the estimated number of days per year of zero flow;

b. the estimated duration of each period of zero flow;

c. the maximum possible number of days of zero flow;

d. the maximum possible duration of any period of zero flow;

e. the stretch of the Clinch River that would be affected by any period of zero flow described in response to (a)-(d) above.

83. Explain in detail the licensing conditions that would have to be imposed in order to:

a. avoid impingement and entrainment losses to aquatic biota at the Hartsville site;

b. avoid disruption of archeological sites at the Yellow Creek site;

84. For each of the following sites:

a. Hanford,

b. INEL,

c. Savannah River:

i. Explain in detail what X/Q values would be utilized for evaluating the impacts of routine and accidental releases.

ii. Identify with particularity the additional licensing costs, if any, that would be required to design the LMFBR against tornadoes at the Clinch River site as compared to these sites.

iii. Identify with particularity the additional licensing costs, if any, that would be required at Clinch River because of less favorable diffusion conditions as compared to these sites.

iv. Identify with particularity the additional costs, if any, that would be required to protect against construction-related impacts to aquatic biota at the Clinch River site as compared to these sites.

v. Identify with particularity the additional costs, if any, that would be required to protect against operation-related impacts at the Clinch River site as compared to these sites.

vi. Identify with particularity the additional costs that would likely be associated with siting the plant at these sites due to "uncertainties about the tectonic regime."

85. Explain in detail:

a. the expected amount of radioactivity that would be released to the INEL site groundwater;

b. the estimated amount of radioactivity that would be released to the INEL site groundwater during a Class 9 accident;

c. any mitigating measures that could reasonably be implemented to avoid or reduce radioactive groundwater contamination;

d. the likely licensing costs that would be necessary to ensure water availability at the INEL site;

e. the extent of any projected future use of the INEL groundwater as a source of public drinking water, including the probable size of the future population affected;

f. the costs of designing a system for waste stream disposal in the groundwater at INEL.

86. Identify with particularity the amount of additional costs that might be required to validate the Savannah River safe shutdown earthquake and operating basis earthquake (L-41).

IV. Contention 5

87. How many days of heavy fog annually would the Staff expect to occur at the Clinch River site, particularly given the increased heat rejection from the current CRBR design?

88. Discuss in detail the extent to which the latest Clinch River meteorological data collected by Applicants differs from the meteorological data collected during the period from February 17, 1977, to February 17, 1978.

V. Contention 8

89. Explain the basis for the Staff's finding in Section 10.2.4.3 that DES estimates of environmental effects are not significantly different from those discussed in the FES.

a. Indicate all sections where decommissioning effects are discussed in the FES, and discuss fully any differences, whether or not considered significant by the Staff.

90. Explain the Staff's Response to Interrogatory 74 of Intervenors' Twenty-Fifth Set of Interrogatories that the CRBR will either be dismantled shortly after final shutdown or dismantled after 50 to 100 years in a SAFSTOR status.

a. Discuss the Staff's reliance on Cobalt 60 rather than Ni-59 or other radionuclides in explaining the safe storage period in ¶5, Section 10.2.4.2 of the DES. Provide a full and complete explanation, including all documents, data, analyses, etc., relied on by the Staff for its choice of Cobalt 60.

b. Explain in detail all possible economic, societal, and environmental costs "being considered in the ongoing development of NRC rules" regarding disposal of components containing long-lived radionuclides.

c. Explain fully the reasons the Staff has deferred the evaluation of these long-lived radionuclides to "the end of the Safe Storage period" (¶6, §10.2.4.2).

91. Discuss the "commitment of resources to ensure continued security at the licensed low-level waste burial grounds" mentioned in the DES, ¶4, §10.2.4.3.

a. Explain fully and identify all documents, analyses, memoranda, calculations, evaluations, assessments, etc., relied on by the Staff in this discussion or in ¶4.

92. Specify the ALARA exposure parameters (¶7, §10.2.4.3) for decommissioning workers. Explain and provide specific data or reports relied upon in:

a. arriving at the ALARA level;

b. applying ALARA to each of the three decommissioning alternatives.

93. Given that the Fermi I reactor core melt experience on or about October 5, 1966, is now providing information directly relevant to CRBRP decommissioning, explain in detail why this event was not discussed in the DES, including how this event could affect the decommissioning of sodium-cooled breeder reactors.

94. Describe in detail the additional costs, change in environmental effects, and uncertainties involved in an early decommissioning at CRBR as opposed to decommissioning after about 30 years of operation.

95. Given that no deep geologic disposal site has yet been determined, discuss fully what alternative plans exist for early waste disposal or management vis-a-vis decommissioning.

a. What additional costs, environmental effects, or uncertainties are involved in alternate plans for waste disposal management?

Respectfully submitted,

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