October 18, 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

RESPONSE OF INTERVENORS, NATURAL RESOURCES DEFENSE COUNCIL, INC. AND THE SIERRA CLUB, TO APPLICANTS' SIXTH SET OF INTERROGATORIES DATED OCTOBER 4, 1982

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, hereby respond to Applicants' Sixth Set of Interrogatories, dated October 4, 1982.

DS03

INTERROGATORIES

General Interrogatories

Interrogatory

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

Response

(a) All documents and studies, and the particular parts thereof, relied upon by Intervenors, now or in the past, which serve as a basis for the answer are identified in the answer to the question, unless otherwise noted.

Interrogatory

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

Response

(b) There are no principal documents and studies specifically examined but not cited in (a), unless otherwise indicated herein.

Interrogatory

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

Response

(c) Dr. Thomas B. Cochran, Senior Staff Scientist, Natural Resources Defense Council, Inc.

Interrogatory

(d) Identify the expert(s) if any, which Intervenors intend 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 Intervenors have in fact identified the expert(s) in question or determined that no expert will testify, as long as such answer provides reasonable notice to Applicants.

Response

(d) Dr. Thomas B. Cochran on Contentions 1, 2, 3, 4, 6, 11; his qualifications have already been supplied to Applicants. Dr. Carl Johnson on Contentions 6 and 11; a statement of his professional qualifications will be forwarded as soon as possible. At this time, Intervenors have not determined if any witnesses other than Dr. Cochran and Dr. Johnson will testify on the subject matter questioned. Reasonable notice will be given to all parties

after Intervenors have made this determination. At that time, a statement of professional qualifications will be provided for each witness.

Specific Interrogatories

General Response

As a general matter, Intervenors do not believe that these interrogatories are designed to obtain relevant facts. They seek instead to elicit conclusions or opinions, and in many cases are too general and vague to permit a detailed response. Nonetheless, in the interest of avoiding controversy and furthering the discovery process, the following responses are provided.

Interrogatory

1. State whether NRDC agrees that, for purposes of estimating the number of cancers that may occur during the lifetime of individuals exposed to radiation, the BEIR-III linear estimates are conservative. If NRDC disagrees, state in detail the basis for the disagreement and provide all documents which support NRDC's position.

Response

1. NRDC agrees that the BEIR-III linear no-threshold model gives more conservative estimates than the BEIR-III linear

quadratic model. The BEIR-III cancer risk coefficients derived using the BEIR-III linear no-threshold model are not conservative relative to the cancer risk coefficients which are assumed by Gofman, Tamplin, Morgan, Radford, Mancuso, Stewart and Kneale as cited in their respective works, public and private statements. NRDC has not yet attempted to pull together the relevant citations of these authors.

Interrogatory

2. State whether NRDC agrees with the statement in the Draft Environmental Statement Supplement ("DESS") that of the four alternative TVA sites considered in the DESS, none are substantially better than the proposed site at Clinch River. If NRDC disagrees, identify the TVA site(s) which NRDC believes is substantially better than Clinch River and, for each such site, provide the following:

(a) Describe in detail all characteristics of the alternative TVA site which NDRC believes demonstrates the site is substantially better than the Clinch River site.

(b) Describe the methodology by which NRDC determined that the characteristics of the alternative site demonstrated that such site is substantially better than the Clinch River site.

(c) Identify and provide all documents which support NRDC's analysis.

(d) Identify the person(s) who performed any analysis of alternative sites on NRDC's behalf.

Response

(2)No. Murphy Hill and Yellow Creek.

(a) Murphy Hill: Water quality, thermal impacts, dilution flow, aquatic and terrestrial ecology, population density, and radiological risk. Geology, industrial/military/transportation facilities, hydrology, meteorology and socioeconomic impacts appear comparable.

Yellow Creek: Hydrology, water quality, aquatic and terrestrial ecology, population density, meteorology and radiological risk. Other factors appear comparable or need to be reexamined in light of changed circumstances.

(b) Intervenors depend on information and data provided by Applicants and Staff to determine the adequacy and substantial preferability of alternative sites. Where that data clearly shows substantial preferability, Intervenors can conduct their own analysis using this data. However, the burden should not fall on Intervenors to perform Applicants' data gathering and review, or to perform Staff's review of alternative siting.

(c) FES, ER, DESS and supporting documents listed therein. Our analysis is not yet complete.

Interrogatory

(3) State whether NRDC agrees that the four alternative TVA sites considered in Appendix L to the DESS are representative of the diversity of environmental resources in the TVA service region. If NRDC disagrees, state in detail the basis for the disagreement and, in addition, provide the following information:

(a) Identify all sites in the TVA service region which NRDC believes should have been considered for the location of CRBRP.

(b) As to each site identified in response to 3(a), describe in detail the basis for NRDC's position that the site should have been considered for the location of CRBRP.

(c) Identify and provide all documents which support NRDC's response to this interrogatory.

Response

3. (a)Intervenors have insufficient information at this time to answer this interrogatory. However, Blythe Ferry, Taylor Bend, Rieves Bend, Buck Hollow, Caney Creek, and Lee Valley all appear to be inadequately analyzed for rejection in the FES (p. 9-3--9-6), and should have been "considered" (at least investigated more thoroughly) for the location of

CRBRP. In addition, the proposed rule indicates that the final slate of candidate sites should include one alternative site with the same water source as the proposed site. The Staff's reasoning for ignoring this requirment is inadequate. (DESS 9-8) One should determine the aquatic and other impacts of another Clinch River site in detail using the appropriate criteria, rather than relying on speculation about aquatic impacts as a basis for failure to conduct a complete review. Finally, there is no alternative site selected with the aquatic ecological characteristics of small headwaters, and the Staff's reasons for accepting this deficiency are inadequate as noted above.

(b) See answer to (a) above.

(c) See answer to 2(c) above.

Interrogatory

4. State whether NRDC agrees with the statement in the DESS that of the three alternative DOE sites considered in the DESS, none are substantially better than the proposed Clinch River site. If NRDC disagrees, identify the DOE site(s) which NRDC believes is substantially better than the Clinch River site and for each such site, provide the following information:

(a) Describe in detail all characteristics of the alternative DOE site which NRDC believes demonstrates the site is substantially better than the Clinch River site.

(b) Describe in detail the methodology by which NRDC determined that the characteristics of the alternative site demonstrated that such site is substantially better than the Clinch River site.

(c) Identify and provide all documents which support NRDC's analysis.

(d) Identify the person(s) who performed any analysis of alternative DOE sites on NRDC's behalf.

Response

4. No. INEL, Hanford, Savannah River.

(a) INEL Meteorology, population density, radiological risk, aquatic impacts, terrestrial resources and land use, industrial, military and transportaion facilities. Hydrology, water quality, and socioeconomics appear comparable.

Hanford Hydrology, water quality, meteorology, population density, radiological risks, aquatic and terrestrial ecology, and industrial/military /transportation facilities. Geology, seismology, and socioeconomics appear comparable.

Savannah River Population, meteorology, radiological risk, hydrology, and water quality. Other factors appear to be comparable.

(b) See answer to 2(b) above.

(c) See answer to 2(c) above.

(d) Not applicable.

Interrogatory

5. State whether NRDC agrees that the three DOE sites considered in the DESS are the only feasible sites owned by DOE for location of CRBRP. If NRDC disagrees, state in detail the basis for the disagreement and in addition, provide the following information:

(a) Identify all DOE sites which NRDC believes are better sites for the location of CRBRP.

(b) As to each site identified in response to 5(a), describe in detail the basis for NRDC's position that the site is a feasible site for the location of CRBRP.

(c) Identify and provide all documents which support NRDC's response to this interrogatory.

Response

5. Intervenors have insufficient information to either agree or disagree that the three DOE sites considered in the DESS are the only feasible sites owned by DOE for location of CRBRP. Additionally, we believe the consideration of the New York ESADA site, the Scottsville site, and the Rowe site (FES, 9-1) demonstrate the necessity of site examination beyond DOE-owned sites.

(a)-(b) Nevada Test Site and Central Nevada Test Area should be reconsidered as potentially better sites. Intervenors do not yet have sufficient information to

determine whether these sites are substantially better, but cannot accept rejection of these sites without further demonstration by Applicants that these alternatives do not constitute feasible or better sites for the CRBRP.

(c) See answer to 2(c) above.

Interrogatory

6. State whether NRDC agrees with the DESS's analysis of risks in regard to safeguards for CRBRP. If NRDC disagrees, describe in detail all such risks which NRDC believes have not been adequately analyzed. Provide all documents which support NRDC's position.

Response

6. This question is too vague and general to permit a detailed response. Nonetheless, Intervenors disagree with this statement for reasons set forth in our comments to the Draft Supplement to the 1977 FES, and documents cited therein. Our analysis is not yet complete.

Interrogatory

7. State whether NRDC agrees with the DESS's analysis of risks in regard to safeguards for the CRBRP fuel cycle. If NRDC disagrees, describe in detail all such risks which NRDC believes have not been adequately analyzed. Provide all documents which support NRDC's position.

Response

7. This question is too vague and general to permit a detailed response. Nonetheless, Intervenors disagree with this statement for reasons set forth in our comments to the Draft Supplement to the 1977 FES, and documents cited therein. Our analysis is not yet complete.

Interrogatory

8. State whether NRDC agrees with metabolic and dosimetric models used in the DESS in considering the radiological impacts of CRBRP. If NRDC disagrees, describe in detail the basis for the disagreement, including a description of the metabolic and dosimetric models which NRDC believes should have been used. Provide all documents which support NRDC's position.

Response

8. NRDC disagrees with the metabolic and dosimetric models used in the DESS for the same reasons given in Intervenors' testimony on contentions 1, 2 and 3 at the August 23-27 1982 LWA-1 evidentiary hearings. NRDC has not completed its review of other details of these models.

Interrogatory

9. State whether NRDC agrees with the conclusion in the DESS at 5-21 that:

> the potential risk to the public health and safety from exposure to radioactivity attributable to normal operation of CRBRP and its related fuel cycle will be very small.

If NRDC disagrees with this conclusion, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

9. NRDC disagrees with this conclusion. The basis for the disagreement is three-fold. First, NRDC disagrees with the estimate of the 170 man-rem population dose related to CRBR fuel cycle activities. Second, NRDC does not believe one should report a single value without presenting the underlying uncertainties. Third, NRDC does not believe a comparison against natural background exposure is the most relevant method for assessing whether CRBR-related exposure is acceptable.

Interrogatory

10. State whether NRDC agrees with the analysis of genetic effects contained in Section 5.7 of the DESS. If NRDC disagrees, describe in detail the basis of the disagreement. Provide all documents which NRDC believes support its position.

Response

10. NRDC disagrees with the use of a geometric mean for reporting "best estimates" of the genetic effects. The upper

limit of the BEIR-I estimate of potential genetic effects may be non-conservative (see, for example, BEIR-I and Gofman, Radiaton and Human Health). Our review of this section is still incomplete.

Interrogatory

11. State whether NRDC agrees with the conclusion in the DESS at 7-6 that:

> the probability of successful theft, diversion, or sabotage is low, and therefore, the risks associated with these events do not represent a significant increase over the risks associated with currently operating facilities.

If NRDC disagrees with this conclusion, describe in detail the basis for the disagreement. Provide all documents which NRDC believes supports its position.

Response

11. The staement is too vague. It does not define which "currently operating facilities" are referred to here and consequently without further specificity NRDC can neither agree nor disagree with the statement. NRDC's review of this section is incomplete.

Interrogatory

12. State whether NRDC agrees with the conclusion in the DESS at 7-5 that:

> transportation accidents involving radioactive material from CRBRP present a low risk of fatality or other serious health effects from radiation exposure.

If NRDC disagrees with this conclusion, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

12. "Low risk" is a relative term and consequently without further specificity NRDC can neither agree nor disagree with this statement. NRDC's review of this section is incomplete.

Interrogatory

13. State whether NRDC agrees with the conclusion in the DESS at 7-2 that:

> The overall assessment of environmental risk of accidents, assuming reasonable protective action, shows that it is not significantly different from the risk from light water reactors currently being licensed for operation...

If NRDC disagrees with this conclusion, describe in detail the basis for the disagreement. Provide all documents which support NRDC's position.

Response

13. NRDC disagrees with this statement. The basis for this disagreement is that the analysis in Appendix J is incomplete, inaccurate, and superficial. The analysis in Appendix J is subject to many of the same criticisms as were made of WASH-1400 by the Lewis Panel, the Union of Concerned

Scientists and others. NRDC's review of this section is incomplete.

Interrogatory

14. State whether NRDC agrees with the statement in the DESS at J-18 that:

> Compliance with current NRC siting, structural, and seismic design criteria and with 10 C.F.R. § 73 for physical security provides assurance that reactor-related risks from...sabotage are adequately low.

If NRDC disagrees with this statement, describe in detail the basis for NRDC's disagreement including references to any relevant NRC criteria or regulations which NRDC believes are inadequate to assure that reactor related risks from sabotage are adequately low. Provide all documents which NRDC believes support its position.

Response

14. NRDC disagrees with this statement. NRDC does not believe the residual risks associated with complying with the design basis sabotage threat in 10 CFR 73.1(a)(1) is adequately low. Larger threats are credible; in fact a conspiracy of two insiders sabotaged the VEPCO Surry Plant. Our review of this section is incomplete.

Interrogatory

15. State whether NRDC agrees with the conclusion in the DESS at L-6 that:

> licensing costs with respect to meteorology considerations at all the TVA sites would be comparable to those at the Clinch River site.

If NRDC disagrees with this conclusion as to any of the alternative TVA sites, identify the site and explain in detail the basis for NRDC's disagreement. Provide all documents which NRDC believes support its position.

Response

15. Intervenors can neither agree nor disagree with this conclusion. According to Staff testimony, costs associated with meteorology are presently unknown (Transcript of Deposition of NRC Staff (October 13, 1982) at 109-111). Applicants, not Intervenors, carry the burden of providing such costs for both the Clinch River site and all other potential alternative sites. Staff's responsibility is to perform an independent evalution of such costs.

Additonally, Staff's use of the phrase "comparable to" here is vague, sweeping, and does not provide a meaningful standard of comparison, such as defining a range of equivalent cost values.

Interrogatory

16. In regard to the Hartsville alternative site, state whether NRDC agrees with the conclusion in the DESS at L-8 that:

> the Clinch River site is environmentally comparable or environmentally preferable to the Hartsville site under any plant

> configuration with respect to the impact of construction and operation in the aquatic biota inhabiting the source and receiving water bodies.

If NRDC disagrees with this conclusion, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

16. Intervenors can neither agree nor disagree with conclusion. The Staff uses the term "comparable" which is vague and inadequate (see Response to I-15, above) and further confuses the statement by adding "or environmentally preferable." This implies some standard is applied, but neither delineates the standard nor explains how the sites can be both comparable and unequal. Additionally, the cancellation of the two Hartsville nuclear units in mid-construction leaves the relative impact on aquatic biota in doubt. Our review of this section, and indeed the DESS itself, is incomplete.

Interrogatory

17. State whether NRDC agrees with the conclusion in the DESS at L-9 that:

> assuming the construction of CRBRP on the Hartsville site, either simultaneously or not during the same time frame as any of the commercial units, the staff concludes that the socioeconomic impacts at Hartsville would be comparable with those at Clinch River.

If NRDC disagrees with this conclusion, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

17. Intervenors can neither agree nor disagree with this conclusion, for the reasons stated in the Response to Interrogatories 15 and 16 above. Intervenors note that, in addition to uncertainty regarding the term "comparable," the Staff admits that it must examine the socioeconomic effect of the construction cancellation of two units at Hartsville. (Transcript of Deposition of NRC Staff (October 13, 1982) at 114.)

Interrogatory

18. State whether NRDC agrees with the conclusion in the DESS at L-10 that neither CRBRP nor Hartsville can be considered environmentally preferable in regard to population characteristics. If NRDC disagrees, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

18. NRDC disagrees with this statement. The Hartsville population density, and therfore the actual radiological risk, is substantially preferable, even though both population densities appear to be below the upper limit set

forth in the DESS at L-10. The relevant figures are apparent from the FES and DESS themselves.

Interrogatory

19. State whether NRDC agrees with the statement in the DESS at L-13 that the meteorological considerations for Murphy Hill are similar to those for the Hartsville and Clinch River sites. If NRDC disagrees with this statement, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Interrogatory

20. State whether NRDC agrees with the statement in the DESS at L-19 that the meteorological considerations for Phipps Bend are similar to those for the Hartsville and Clinch River sites. If NRDC disagrees with this statement, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Interrogatory

21. State whether NRDC agrees with the statement in the DESS at L-26 that the meteorological considerations for Yellow Creek are similar to those for the Hartsville, Phipps Bend and Clinch River sites. If NRDC disagrees with this statement, describe in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

19.-20.-21. Intervenors possess insufficient information about meteorological conditions at any of these sites to either agree or disagree with these statements. The meaning of"similar to" is unclear. No numerical range of equivalence or standard of comparison is given. We note the reliance of Staff and Applicants on limited data for meteorology at Clinch River site (Transcript of Deposition of NRC Staff (October 13, 1982) at 78-81), and on even more limited data for other sites (e.g., NUREG-0168, EIS for Phipps Bend).

Interrogatory

22. Identify and provide a complete statement of the professional qualifications concerning meteorology of any meteorologist or individual claiming expertise in meteorology who reviewed the meteorological data in the DESS on behalf of NRDC.

Response

22. Not applicable.

Interrogatory

23. Define in detail the term "nuclear explosion" as used by NRDC in describing hypothetical core disruptive accidents in an LMFBR. In addition, provide the following information which characterize the "nuclear explosion" as defined by NRDC above:

(a) the reactivity insertion rate

(b) the maximum reactivity

(c) the termination mechanism

(d) the time necessary to generate 50% of energy

(e) the maximum temperature

(f) the peak pressure

(g) the expansion

(h) the damage mechanism

Response

23. The Webster's Seventh New Collegiate Dictionary defines "explosion" as "a large-scale, rapid and spectacular expansion, outbreak, or other upheaval." Cook defines an "explosive" as "any substance or device which will produce, upon release of its potential energy, a sudden outburst of gas, therby exerting high pressures on its surrounding" [Melvin A. Cook, The Science of High Explosives (Robert E. Krieger Publ. Co., Huntington, N.Y.) 1971, p. 1.] Cook groups explosives under three fundamental types, mechanical, chemical and atomic (or nuclear).

A nuclear explosion is an explosion in which most or all of the explosive energy is derived from nuclear processes, either fission or fusion, or a combination of both.* [See generally, Samuel Glasstone, The Effects of Nuclear Weapons, 1962 Ed. ¶ 1.10]

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* Fusion does not apply to the LMFBR for reasons that are obvious.

The energetic disassembly of a fast reactor is commonly referred to as an "explosive disassembly [see, for example, Lee, J.C. and Pigford, Thomas," Explosive Disassembly of Fast Reactors," Nuclear Science and Engineering 48, 28-44 (1972))] or "a small nuclear explosion" [Hicks, E.P. and Menzies, D.C., Proceedings of the Conference on Safety, Fuels, and Core Design in Large Fast Power Reactors," Oct 11-14, 1965, ANL-7120, pp. 654-670], a "low-efficiency nuclear explosion" [Stratton, W.R., and Engle, L.B., "Reactor Power Excursion Studies," "Engineering of Fast Reactors for Safe and Reliable Operation" (1973 Karlsruhe Conference), pp 1331-1551].

For the disassembly to be sufficiently energetic for the mechanical loading to challenge the containment, the nuclear excursion in a large Fast Reactor such as CRBR would have to be characterized by a rapid reactivity insertion and the reactivity exceed prompt critical. This will result in a rapid introduction of energy from the nuclear process, a rapid increase in reactor power, elevated fuel temperature and vapor pressure formation. In such an event the core will begin to expand. Core expansion and fuel motion which reduces the material density will produce a negative reactivity feedback. Only a small expansion of the core is required to produce a large disassembly reactivity. The reactor rapidly becomes sufficiently subcritical that any continued external reactivity insertion mechanism has no

appreciable bearing on the ultimate consequences. This marks the conclusion of the neutronic excursion and the disassembly of the accident [Waltar, Alan E. and Albert B. Reynolds, Fast Breeder Reactors (Pergamon Press, N.Y.) 1981, p. 619].

A nuclear explosion in an LMFBR differs from a chemical explosion following detonation of a high-explosive in terms of the pressure-time characteristics of the two. Mechanical damage from an explosion or pressure transient can be caused by both a shock wave, which is transmitted rapidly to a structure, and the more slowly expanding bubble of reaction products or vaporized material. Pressures in a high explosive detonation build up on a microsecond time scale, whereas in a nuclear explosion in an LMFBR the build up is over a millisecond time scale.

As a consequence, much of the damage potential of a high explosive to surrounding structures is likely to come from shock wave effects, whereas long-term bubble expansion (at least in the absence of a vapor explosion driven by a fuel coolant interaction would be the predominant damage mode for the slower time scale pressure build up associated with an LMFBR nuclear excursion. (See, generally, Walters and Reynolds, ibid., p. 664.)

NRDC does not characterize "nuclear explosion" as used to describe energetic CDA by any precise limits on the parameters (a)-(h) offered by the Applicants, and in any case

they would be design and scenario dependent.

Interrogatory

24. State whether NRDC believes a nuclear explosion is physically possible in an LMFBR. If so, describe the precise sequence of events and the values of the parameters set forth in 23(a)-(h) above which NRDC believes would result in a nuclear explosion.

Response

24. Yes. A "Nuclear explosion," as charaacterized in 23 above would be achieved for a wide variety of values for the parameter given in 23(a)-(h), and for no single precise sequence of events.

Interrogatory

25. Provide all documents which NRDC believes support its answers to interrogatories 23 and 24.

Response

25. The primary documents relied upon are those that are generally related to analyses of CDA energetics, and those cited in 23 above.

Interrogatory

26. State whether NRDC agrees with the statement in the DESS at J-19 that:

> The analysis confirms the FES conclusion that the accident risks at CRBRP can be made acceptably low.

If NRDC disagrees with this conclusion, explain in detail the basis for the disagreement. Provide all documents which NRDC believes support its position.

Response

26. No. The analysis is incomplete, inaccurate and superficial and therefore it cannot be used to confirm the conclusion. See generally, criticisms of WASH-1400 and NRDC's comments on the Draft Supplement to the 1977 FES. NRDC's analysis of Appendix J is incomplete.

Respectfully submitted,

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