4/30/82

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF'S ANSWERS TO NATURAL RESOURCES DEFENSE COUNCIL, INC. AND THE SIERRA CLUB TWENTIETH SET OF INTERROGATORIES TO NUCLEAR REGULATORY COMMISSION STAFF

Pursuant to the Licensing Board's Prehearing Confernece Order of February 11, 1982, the Nuclear Regulatory Commission Staff (Staff) hereby responds to Intervenors' Natural Resources Defense Council, Inc. and the Sierra Club Twentieth Set of Interrogatories to the Nuclear Regulatory Commission Staff filed on April 8, 1977. Attached hereto is NRC Staff's Answers to NRDC's and the Sierra Club's Interrogatories together with the affidavits of those individuals who participated in answering the questions.1/

In the April 14th, 1982 Order Following Conference with Parties the Licensing Board renumbered NRDC's contentions When an old contention number appears in the interrogatory question or answer, the new contention number will be indicated in parentheses.

1/ The affidavits of Mr. Stark, Mr. Leech, Mr. Feld, Mr. Kaltman, Mr. Swift, Mr. Thadani, Mr. Long and Mr. Becker are unsigned. However, a copy of their signed and notarized affidavits will be filed shortly.

On March 4, 1982, the parties in this proceeding developed a Protocol for Discovery. NRDC has requested that answers to interrogatory questions be provided in six parts. The following six parts are:

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 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 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.

For all the responses to interrogatories in this set the following are the answers to the requested parts in the Protocol for Discovery.

B) 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 are mentioned in the direct answer to the question unless otherwise noted.

C) There were no principal documents and studies specifically examined but not cited in (b) unless otherwise noted.

D) The name, title and affiliation of the Staff employee(s) or consultant(s) who provided the answer to the question are available in the affidavits unless otherwise noted.

E) The Staff is not presently engaged in nor intends to engage in any further, on-going research program which may affect Staff's answer unless otherwise noted.

F) At this time, the Staff has not determined who will testify on the subject matter questioned. Reasonable notice will be given to all parties after the Staff has made this determination. At that time, a statement of professional qualifications will be provided for each witness.

Respectfully submitted,

Daniel T. Swanson
Counsel for NRC Staff

Bradley W. Jones
Counsel for NRC Staff

Geary S. Mizuno
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 30 day of April, 1982

NRC STAFF'S ANSWERS TO NRDC'S
AND THE SIERRA CLUB'S INTERROGATORIES

The following questions are based upon the Site Suitability Report (SSR) and page references preceding the questions are to that document.

Interrogatory 1

(I-7) In determining whether the state of technology would allow the Staff's design criteria to be met, which if any of the following standards did you apply?

(a) There was an experimentally-proven system for meeting the criteria.

(b) There was a theoretical system for meeting the criteria.

(c) The specific design to meet the criteria was not yet developed but sufficient work had been done to expect that such a design would be developed.

(d) If the above do not completely state all of your standards, please state them.

In answering this question, please provide all the bases for your conclusions and all facts and expert opinions which you rely upon in reaching the conclusions.

Response

A) Page I-7 contains the Summary Conclusions of the SSR, a condensation of much of the material contained in the report. The answer to this NRDC question is found in expanded form on pages II-12 through II-30 where the specific illustrations of subsystems which may not meet the staff's criteria are discussed.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 2

Explain the technique used to survey the state of the technology. For instance:

(a) Did you speak to persons actually involved in the research work to obtain their judgments on the technology development?

(b) Did you read research proposals in the area?

(c) Did you hire outside consultants to evaluate the technology?

If your answer to (a), (b) or (c) is yes, please list the persons contacted and attach copies of all documents provided by those persons and memoranda of the conversations with them.

Response

A) The staff has relied largely on its own experience and judgement, supplemented by the documents referenced in the SSR and FES, to determine whether the state of technology would allow the staff's design criteria to be met.

B) Final Environmental Statement, NUREG-0139 February 1977.

CRBR Site Suitability Report, March 1977.

Interrogatory 3

What are the principal architectural and engineering criteria for the design of the CRBR and what are the major features or components incorporated in the CRBR for the protection of the health and safety of the public? In your answer, explain the standards used for deciding what is principal and what is major.

Response

A) The principal architectural and engineering criteria for the design of the CRBR are published in the SSR as Appendix A, Clinch River Breeder Reactor Plant Design Criteria. Although

the CRBR Design Criteria do not specfically describe design features, such features must conform to these criteria. Therefore, the CRBR Design Criteria describe in a general manner the features and components necessary for the protection of the public health and safety. The Standard Format and Content of Safety Analysis Reports For Nuclear Power Plants, LMFBR Edition, prepared by the AEC Staff in February, 1974, contains a list of safety-related features and components which must be reviewed for a LMFBR.

B) None

Interrogatory 4

Identify specifically which present designs for the CRBR will require further technical or design information to complete the safety analysis and for which information will not be available until after the Staff completes the SER. For each item so identified, provide the complete factual and other basis for your conclusion that it can be reasonably left for later consideration.

Response

A) These questions cannot be answered at this time as the staff's review has not been completed of safety features and components.

B) None.

Interrogatory 5

Identify specifically each safety feature or component which requires research and development and as to each identified item, provide

the complete factual and other basis for your conclusions regarding whether the R&D program is reasonably designed to resolve any safety questions associated with the identified item.

Response

A) See response to Interrogatory 4.

Interrogatory 6

As to each of the items identified in answer to questins 4 and 5, please provide the complete factual and other basis for your conclusion regarding whether there is reasonable assurance that the safety questions will be resolved satisfactorily at or before the latest date in the application for completion of construction of the CRBR. In your answer, provide the detailed factual bases for your conclusions as to each identified item.

Response

A) See response to Interrogatory 4.

Interrogatory 7

(I-8) Describe specifically the subsequent modifications which you have considered with respect to each item for which the Staff believed that present Applicants' design may not meet the design criteria. Specifically identify as to each modification considered:

(a) Whether the modification will be more or less expensive based upon when the modification is made and, if so, define the critical time periods.

(b) Whether the modification will cause more or less delay in the completion of the project and, if so, identify the critical time periods.

(c) Whether the modification will at some time become unavailable due to economic or delay considerations or generally due to the advanced state of construction of the CRBR and, if so, when that will occur.

Response

A) The specific items referred to in this summary are those addressed in pII-12 to II-30 of the SSR. Of these items, the dual

shutdown system is an option to which the applicant is already committed. No redesign or delay is involved. The potential need for surveillance and inspection has been anticipated in the piping so that the incorporation of such features is not a cause for delay or appreciable added expense. Installation of instrumentation in connection with fuel failure propagation can be deferred until late in the course of reactor vessel completion. Modifications to the residual heat removal system can be installed or modified quite late in the construction period. The basic structures of the containment features required by the staff should be committed to by the applicant prior to the start of construction. Provisions for sacrificial beds for core melt accidents should be committed to before proceeding to a construction phase which would preclude these options, unless they can be shown to be not required, or unless it can be shown that they can be later added without undue cost or delay.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 8

(II-2) Inasmuch as the design criteria for the CRBR are not intended to be generally used for LMFBR's, if the CRBR should be licensed, what will that demonstrate about the licensability of commercial LMFBR's in general?

Response

A) The design criteria for CRBR are based on relevant reactor experience up to the time of their formulation. The

experimental base at some future time when a commercial LMFBR is committed would have to be likewise examined to determine its suitability for the formulation of design criteria for commercial LMFBRs. This experimental base would, of course, include CRBR Design, licensing and operation.

B) None.

Interrogatory 9

(II-6) How has the Staff been able to conclude that the site is adequate as provided by 10 CFR § 100.11 if it has not yet completed its consideration of the effects of the negative differential pressure in the annulus as well as the potential for leakage that could bypass filtered pathways?

Response

A) The calculations do include these features. For the calculations completed up to this time, the method of inclusion of the noted features is described on pages III-16 and III-17 of the SSR.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 10

(II-7) Describe in detail the process and procedures by which the Staff anlayzed the operating history of domestic and foreign breeders. In particular, emphasize how the Staff independently verified that all favorable reports were accurate and all unfavorable reports were provided.

Response

A) The staff has relied heavily on its own personal experiences in order to reach its independent conclusions in regard to the operating history of domestic and foreign reactors. This experience has included previous assignments connected with the design, research, operations and regulation of domestic reactors and some visits to foreign reactors.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 11

(II-8 to II-9) What are the critical design differences between the CRBR and the foreign reactors which would affect operating reliability of safety?

Response

A) The staff does not claim to possess the degree of familiarity with foreign reactors that would be achieved if these reactors had undergone the U.S. licensing procedure. We have a general familiarity with the major features of the foreign systems, and we use this knowledge to generate suggested modifications for evaluation in U.S. reactors. References used for this familiarization are listed in section 8.4.6. of the FES. Each modification must be evaluated in relation to the system for which it is proposed; its effectiveness in its original system does not guarantee that it would be advantageous in another system. Consequently, the staff does not believe it is necessary to make the evaluations of particular features in

foreign reactors suggested by these questions and has not done so.

B) Final Environmental Statement, NUREG-0139 February 1977.
CRBR Site Suitability Report, March 1977.

Interrogatory 12

(II-8 to II-9) Which designs in each foreign reactor are likely to make it safer than the CRBR?

Response

A) See response to Interrogatory 11.

Interrogatory 13

(II-8 to II-9) Which designs in each foreign reactor are likely to make it less safe than the CRBR?

Response

A) See response to Interrogatory 11.

Interrogatory 14

(II-8 to II-9) Which designs in each foreign reactor are likely to make it more reliable than the CRBR?

Response

A) See response to Interrogatory 11.

Interrogatory 15

(II-8 to II-9) Which designs in each foreign reactor are likely to make it less reliable than the CRBR?

Response

A) See response to Interrogatory 11.

Interrogatory 16

(II-10) If there were no reliable evidence of the performance of foreign reactors, how would that affect the Staff's judgment about the ability of the CRBR to implement the Staff's design criteria?

Response

A) There is reliable evidence of the performance of foreign reactors, and the staff has conceded on pII-10 of the SSR that this has provided part of the assurance that it is reasonable to expect that the implementation of its design criteria can be met, and that the state of technology is available to assure that the CRBRP can be built and operated successfully as planned.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 17

(II-11) In what respects did the Staff conclusions on the probabilities and consequences of CDA's in the FFTF differ from its conclusions on those subjects for the CRBR? Explain in detail each difference and the factual justification for the difference.

Response

A) A Safety Evaluation Report with two supplements has been prepared for FFTF (docket no. 448). These reports provide the information requested regarding that review. The staff has not

made a systematic quantitative analysis of differences between the assessments for FFTF and CRBR.

B) Final Environmental Statement, NUREG-0139 February 1977. CRBR Site Suitability Report, March 1977 SER, FFTF, Suppl. 1&2, NUREG-0358, May 1979.

Interrogatory 18

(II-11 to II-12) Explain in detail the bases for your conclusion that the May 6, 1976, Denise letter and the August 20, 1976, ACRS letter are consistent. Compare in particular the precise language used in each and explain how the language differences are not substantive differences.

Response

A) The pertinent passages from the two letters are quoted below. The May 6 letter states that "the probability of core melt and disruptive accidents can and must be reduced to a sufficiently low level to justify their exclusion from the design basis accident spectrum. Nevertheless... prudence dictates that additional measures be taken to limit consequences and reduce residual risks form potential CRBR accidents having a lower probability than design basis accidents..."

The ACRS letter of August 20, 1976 states "the Committee concludes that at present consideration of the core disruptive accident must be included as a part of the safety evaluation of a liquid metal fast breeder. Protective measures against its consequences should take appropriate account of the probability

that large excursions are much less likely than smaller ones, and should consider the consequences of various postulated events."

The staff believes that both these statements express the thought that some design considerations must be given to core melt and disruptive accidents without necessarily including them in the design basis.

The May 6 letter requirement for "measures... to include protection containment system integrity within the specified 24 - hour period" is a part of the response to the ACRS requirements for "provisions for dealing with a molten mass, consisting of a significant fraction of the core, in such a way that public health and safety are not compromised."

B) See A)

Interrogatory 19

(II-11 to II-12) How does the CRBR design which the Staff believes is required fully protect the public from all of the consequences of a molten core mass?

Response

A) The general size and type design being considered for the LWA stage of review of CRBR addresses core melt in a degree comparable to the protection provided against core melt accidents in LWRs, as explained in the May 6th letter.

B) None.

Interrogatory 20

(II-12 to II-13) In the paragraph beginning on II-12 and ending on II-13, provide the quantitative and/or objective definiton of the following words phrases:

(a) "low"

(b) "adequate degree of diversity"

(c) "adequate . . . redundancy"

(d) "adequate . . . reliability"

(e) "proper impelentation"

(f) "sufficiently likely"

Response

A) The word "low" is used with reference to the fact that the general aiming point for these probabilities of core melt and disruptive accidents whose consequences exceed the guidelines of 10 C.F.R. Part 100 is 10^{-6} per reactor year, as in LWRs. "Adequate diversity, redundancy and reliability" are required to meet the above aiming point. The phrases "proper implementation" and "sufficiently likely" are also used in the general context of the 10^{-6} aiming point. See also the responses to Interrogatory Sets 11 and 14.

B) CRBR Site Suitab lity Report, March 1977.

Interrogatory 21

(II-13) Provide a complete list of all of the key safety features and aspects of design for which the Staff is exphasizing and requiring the achievement of an adequate degree of diversity, redundancy and reliability.

Response

A) These are evident from the design criteria (Appendix A of the SSR).

B) CRBR Site Suitability Report, March 1977.

Interrogatory 22

As to all key safety features and designs other than the four identified in the SSR, describe in detail the function it will serve, how it will achieve that function, the status of the Applicants' commitment to use it, the bases of any Staff conclusions on the acceptability of the feature or design and, if no conclusions have been reached, the status of the Staff review and the bases for its belief that the site is suitable even though the Staff review is not completed.

Response

A) The applicant is committed to the CRBR design criteria. The detailed descriptive information on the features required as a result of these criteria constitute a major part of the PSAR and are not repeated here. Safety review of these features is proceeding via the question/response procedure of the NRC. It is the staff's view that the CRBR site can be reviewed for suitability for a general size and type facility that meets the design criteria and the requirements of the May 6th letter, as well as other requirements in 10 C.F.R., the Regulatory Guides and applicable codes and standards.

B) See A)

Interrogatory 23

(II-14) Inasmuch as the Staff and the Applicants have not reached agreement on several significant safety issues, what is the basis for the conclusion that feasible engineering solutions will be adopted in each area identified?

Response

A) The staff has concluded that feasible solutions in the four key areas are available. Their adoption to the extent required in 10 C.F.R. 50 will be a prerequisite for the issuance of a construction permit.

B) Final Environmental Statement, NUREG-0139 February 1977.

CRBR Site Suitability Report, March 1977.

Interrogatory 24

(II-17) Does "appears to have the potential" mean the Staff is not yet convinced that the system has the potential and even if it had the potential it is not yet convinced that it will comply with the requirement? If not, what does the quoted phrase mean in terms of the degree uncertainty in the Staff conclusions?

Response

A) The quoted phrase means that although the staff's review is not complete, we have examined the principal features of the applicant's development program. The goals of the applicant's out-of-pile testing program appear achievable. It also is the belief of the staff that a satisfactory in-pile surveillance program can be devised to assure the continued adequate operation of the dual system during the life of the reactor.

B) None.

Interrogatory 25

(II-14 to II-17) Describe in detail any systems now being, or previously, used in foreign or domestic breeders and in LWR's, the operating experience of which provides any support for the Staff position on the apparent potential for the adequacy of the CRBR reactor shutdown system design.

Response

A) There is a strong similarity between CRBR shutdown system and FFTF as well as many commercial pressurized water reactors throughout the world. Comparison, however, on a one to one basis has not been done by the staff as such a comparison is not considered to be relevant as comparing design methods, approaches and standards relevant because these systems have many subcomponents which are not identical, but design-specific.

B) None.

Interrogatory 26

As to each system described, explain thoroughly its operating experience and how and why that is relevant to the Staff conclusions on the CRBR. In discussing operating experience, identify each abnormal occurrence or other report identifying any departure by the system from its intended method of operation and explain the bases for the Staff conclusions as to the relevance of that experience for its conclusions.

Response

See Response to Interrogatory 25 A).

Interrogatory 27

(II-19) Inasmuch as the double-ended rupture of the primary cold leg piping is a DBA for an LWR, explain in detail the bases for the exclusion of such a break from the DBA for the CRBR. In particular, but not exclusively, be responsive to the following considerations:

(a) Identify the critical aspects of LWR design which prevent exclusion of the cold leg break as a DBA and compare them to the CRBR. Quantify the significance of each identified difference in terms of actual impact on the piping integrity.

(b) Describe in detail the pre-service and in-service inspection program, material surveillance program and verification of each detection system performance for the CRBR, compare them to the LWR and quantify the difference in terms of actual impact on the piping integrity.

(c) Describe in detail the nature of the research and development to verify material degradation processes, how these compare to similar LWR programs, and quantify the difference in terms of actual impact on piping integrity.

Response

A) The only similarity between the cold leg piping of an LWR and that of an LMFBR is in the nomenclature. The analyses of the two systems are done entirely independently, and use the appropriate methods in each case. The conclusions drawn by the staff for the two systems are also entirely independent, and hence points a, b and c of the question have not entered into the staff's evaluation and cannot be answered.

B) None.

Interrogatory 28

(II-19 to II-20) Explain in detail the bases for the Staff conclusions that the requirements of 10 CFR § 50.35(a)(3) and (a)(4)(i) have

been met with respect to R&D yet to be done related to cold-leg and hot-leg breaks.

Response

A) The staff review of the hot and cold leg sodium piping is continuing. The evaluation of the piping integrity questions vis-a-vis the requirements of 10 C.F.R. 50 will be covered in the SER.

B) Final Environmental Statement, NUREG-0139 February 1977.

CRBR Site Suitability Report, March 1977.

Interrogatory 29

(II-17 to II-21) Describe in detail any systems now being, or previously, used in foreign or domestic breeders and in LWR's, the operating experience of which provides any support for the Staff position on the apparent potential for the adequacy of the CRBR piping integrity. As to each system described, explain thoroughly its operating experience and how and why that is relevant to the Staff conclusions on the CRBR. In discussing operating experience, identify each abnormal occurrence or other report identifying any departure by the system from its intended method of operation and explain the bases for the Staff conclusions as to the relevance of that experience for its conclusions.

Response

See response to Interrogatory 28.

Interrogatory 30

(II-21 to II-22) Describe in detail the questions still to be answered by the ongoing analytical and experimental work, the status of the work as applied to answering those questions, and bases for the Staff conclusions regarding the anticipated results of the ongoing work. In particular, but not exclusively, discuss the following considerations in your answer:

(a) Who is conducting the analytical and experimental work and the methods by which the Staff is verifying the quality, thoroughness and integrity of the work.

(b) The extent to which those who are conducting the analyses and experiments agree with the Staff conclusions regarding the present and probable results of their work.

(c) The identification and contents of proposals and presentations made by those doing the work describing the nature of the work, its preliminary results, and the need for additional work.

Response

A) As indicated in the SSR, p.II-22, investigations are underway concerning the effects of dimensional changes, wire wrap failure, fission gas release from pin failures and other similar conditions which could lead to local flow disturbances or mechanical loadings. Although much of the analytical and experimental work is being carried on under DOE sponsorship by Argonne, NRC is also sponsoring some confirmatory research in these areas at Los Alamos and Sandia. The NRC work is reviewed by periodic presentations of the results. The DOE work is reviewed largely by reference to the published reports of the experimenters, but also by more intensive reviews of oral presentations of the work as required. Agreement is not always reached between the staff and the experimenters, the staff often adopting a more conservative view of the applications of the research. These proposals and presentations are summarized in the periodic reports of the various projects.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 31

(II-23) Describe in detail the operating experience for each LWR reactor using a loose parts monitoring system where loose parts have been detected or are known to exist. As to each, provide the facts as to each event where loose parts have been detected or are known to exist and time for detection and then compare those results to a comparably efficient system in the CRBR and the potential for flow blockage prior to detection.

Response

A) The information requested may be found in Reg. Guide 1.133, "Loose-Part Detection Program for the primary system of Light-water-cooled Reactors", NUREG: OR-0524, Loose-Part Monitoring Systems in U.S. Commerical Power Reactors", R.C. Kryter and C.W. Ricker; and "Report on Operational Experience with Commercially Marketed Loose-Part Monitoring Systems", Division of Operating Reactors, NRR. Design criteria for the CRBR loose parts monitoring system will be described in the SER.

B) See part A).

Interrogatory 32

(II-23 to II-24) What level of fuel rods failure (loss of fuel pin integrity) is the maximum permissible to meet the Staff standards? What operating experience exists in any reactors and in sodium-cooled reactors to justify a conclusion that this level will be met and will not be met?

Response

A) The staff's concern about operating with failed fuel is focused on the possibility that the progressive accumulation of failure debris may lead to more serious consequences such as flow blockages. Sufficient operating experience with failed fuel has been accumulated at EBR-2 and Rapsodie to provide assurance

that initial core operation is safe. Surveillance during the initial operations will determine what levels of failure can be tolerated in the longer term. The applicant is committed to monitoring the fuel content of the primary sodium to assure that this factor does not reach excessive levels.

B) None.

Interrogatory 33

(II-24) Describe in detail the ongoing R&D work on monitoring systems, the questions still to be answered, the status of the work with respect to answering those questions and the bases for the Staff conclusions regarding the anticipated results of the ongoing work. In particular, but not exclusively, discuss the following considerations in your answer:

(a) Who is conducting the analytical and experimental work and the methods by which the Staff is verifying the quality, thoroughness and integrity of the work.

(b) The extent to which those who are conducting the analyses and experiments agree with the Staff conclusions regarding the present and probable results of their work.

(c) The identification and contents of proposals and presentations made by those doing the work describing the nature of the work, its preliminary results, and the need for additional work.

Response

A) It is believed that this question is a misinterpretation of the statement "depends on the outcome of ongoing research and development work..." The statement referred not to R&D work in monitoring systems, but in local fuel failure and possible flow

blockage. There is no NRC sponsored R&D work being performed on CRBR monitoring systems.

B) None.

Interrogatory 34

(II-24) Explain in detail the bases for the Staff conclusions that the requirements of 10 CFR § 50.35(a)(3) and (a)(4)(i) have been met with respect to R&D yet to be done related to monitoring systems.

Response

A) The conformance of R and D Programs proposed by the applicant to the requirements of 10 C.F.R. 50 will be evaluated in the SER.

B) None.

Interrogatory 36

(II-24) What are the practical consequences of a Staff decision to prohibit operation with the degree of failed fuel proposed by Applicants? In your answer, explain how the decision is expected to affect fuel design, plant capacity factors, fuel burn-up, and operating costs.

Response

A) A decision to operate with less failed fuel than presently contemplated might require more frequent shut-downs to locate and remove failed fuel. No study has been made on how the overall costs or plant factor might be affected by such a decision. Note however that EBR-II is not permitted to operate with any failed fuel, and yet has achieved capacity factors in the neighborhood of 75%. Also note that, as indicated on p.8-6

of the FES, suitable allowances can be made for shutdowns that are due to the developmental nature of the project when judging the CRBRP as a demonstration of the reliability of commercial plants.

B) Final Environmental Statement, NUREG-0139 February, 1977.

Interrogatory 37

(II-25) Describe in detail the more restrictive conditions under which the plant might operate. How would operation under these more restrictive conditions affect the ability of the CRBR to meet the program objectives?

Response

A) The details of any operating restrictions imposed as a result of R and D work disclosing a susceptibility to failure propagation would have to depend on the nature of these disclosures. These are not known at present and, as indicated on p.II-25, are not even anticipated to occur. Consequently the appropriate operating restrictions cannot be specified at this time.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 38

(II-25) Does the Staff believe that instrumentation to reliably detec ubassembly flow disturbances can be developed and, if so, when? Describe in detail the bases for your belief.

Response

A) Reviews to date have not indicated a need to develop an option to monitor local subassembly flows to preclude flow reduction due to fuel failure propagation. If may be inferred, however, that if the need to monitor individual subassembly behavior were to arise, successful instrumention has a high development potential because it could be based on any of three signals: radioactivity, flow, or temperature. Staff evaluations are on going in the area of local undercooling of the fuel. Final conclusions will not be available until the SER is completed.

B) None.

Interrogatory 39

(II-25) Does your statement regarding what Applicants' R&D plans appear to do indicate that you have not finally concluded that 10 CFR § 50.36(a)(3) and (a)(4)i) have been met as to this R&D? If not, what do you mean by the use of the word "appear" and what are your bases for your conclusion?

Response

A) Yes.

B) None.

Interrogatory 40

(II-21 to II-26) Describe in detail any systems now being, or previously, used in foreign or domestic breeders and in LWR's, the operating experience of which provides any support for the staff positon on the apparent potential for the adequacy of the CRBR's "systems to cope with fuel failure propagation."

Response

A) The staff, at page II-25, describes the fuel failure propagation events under consideration. We know of no such events which have occurred at operating reactors.

B) SSR.

Interrogatory 41

As to each system described, explain thoroughly its operating experience and how and why that is relevant to the Staff conclusions on the CRBR. In discussing operating experience, identify each abnormal occurrence or other report identifying any departure by the system from its intended method of operation and explain the bases for the Staff conclusions as to the relevance of that experience for its conclusions.

Response

See response to Interrogatory 40.

Interrogatory 42

(II-29) Describe in detail the Staff problems with the safety adequacy of dependence of the DHRS on the PHTS loop and pony motor and discuss the impact on CRBR costs and schedule of ultimate rejection of the system.

Response

A) The problems with reliance on the PHTS loop is described on p.II-29 of the SSR. The problem with reliance on the pony motor is its reliability and the assurance of its power supply. This matter is under review. Since the system represents a small fraction of the primary heat transfer system, its redesign, if necessary, would not be expected to represent a large fraction of the total cost, nor would it significantly impact the schedule.

B) CRBR Site Suitability Report, March 1977.

Interrogatory 43

(II-29) What are the available alternatives?

Response

A) Considerable information from and experience with FFTF has been amassed since the issuance of the SSR. The relative merit of natural circulation is under evaluation for the SER. It is also possible to have similar dedicated systems which take their intake and return at some point that would not suffer from the same disadvantages as the DHRS, if it is found necessary to devise a new approach.

B) Letter form A.J. Rizzo to D. Eisenhut dated 7/21/81 regarding FFTF decay heat removal capability, with attachment.

Interrogatory 44

(II-29 to II-30) Will the Staff reviews identified on these pages be completed before issuance of the SER?

Response

A) Yes.

B) None.

Interrogatory 45

Describe in detail any systems now being, or previously, used in foreign or domestic breeders and in LWR's, the operating experience of which provides any support for the Staff position on the apparent potential for the adequacy of the CRBR residual heat removal system. As to each system described, explain thoroughly its operating experience and how and why that is relevant to the Staff conclusions on the CRBR. In discussing operating experience, identify each abnormal occurrence or other report identifying any departure by the system from its intended method of operation and explain the bases for the Staff conclusions as to the relevance of that experience for its conclusions.

Response

A) The rather substantial body of world and demonstrated LMFBR operating experience would give assurance that decay heat can be readily removed under all normal and many off normal conditions. Because the concerns are actually design specific, it does not give global assurance however for all reactor designs. In addition to this operating experience, experimental verification of the natural circulation capabilities in LMFRs has been demonstrated in SEFOR and FFTF.

B) See attachment to letter identified in response to #43(b) above, entitled: "Summary of Natural Circulation Testing In FFTF" dated July 1981; and "Natural Circulation Testing of the SEFOR Cooling Loops" by General Electric Co. (undated and unnumbered), Docket No. 50-231.

The following questions are based on the FES and page references preceding the questions are to that document.

Interrogatory 46

(7-1) List completely all of the "other LMFBR-related source material" used by the Staff and indicate precisely the portions (by sentence) of Chapter 7 to which that material is related.

Response

A) The statement referred to appears in the first introductory paragraph of Section 7.1 The detailed reference to actual portions of the literature used are provided in the subsequently portions of the text.

B) CRBRP Final Environmental Statement, Chapter 7. NUREG-0139, 2/77

Interrogatory 47

In the event of a conflict between language or statements in Chapter 7 and language or statements in the SSR, is the SSR the controlling statement for purposes of the safety review for the CRBR? Fully explain your answer, including any different assumptions used in the two documents for purposes of any safety analysis.

Response

A) No conflict is intended between language or statements in Chapter 7 of the FES and the SSR. There is some difference in

functions of the two reports, and the different authors may have used different phrases. The staff believes that they are consistent with each other, and with the the May 6th letter. The differences between the conservative calculations (SSR) and the realistic calculations for (FES) for CRBR, are consistent with those used in SERs and FESs for LWRs.

B) CRBRP Final Environmental Statement, Chapter 7, NUREG-0139. CRBRP Site Suitability Report, denied March 4, 1977.

Interrogatory 48

(7-1) Explain fully the basis for your belief that doses computed for the CRBR in the SSR are conservative and provide the realistic calculation of the same doses. In your answer provide the detailed site specific analyses of why you believe certain values are conservative or realistic to the same extent the Staff provided such data in response to questions from the Licensing Board in Seabrook. In addition, discuss fully how any conservatively-calculated value can be converted to a "realistic" value in light of the fact that the conservative value was established due to the lack of definitive data to reliably set the value less conservatively. Finally, discuss how the probability of the occurrence of the realistically-calculated accident doses is increased over the probability of occurrence of the conservatively-calculated accident doses. For the purposes of this question, focus only on the Class 8 and Class 9 accidents.

Response

A) The Staff evaluation of design basis accidents presented in the staff's site suitability report is based on conservative assumptions regarding the release of the radionuclides and the atmospheric dispersion factors used for the purpose of evaluating the adequacy of the plant's safety features in conjunction with the distances to the plant's exclusion

boundary and low population zone. The FES discusses the realistic design basis accidents consequences, calculated by making realistic assumptions regarding the releases of the radionuclides and their dispersion in the atmosphere. These calculations do not involve explicit consideration of the probabilities of their occurrence. The staff response to questions from the licensing board in Seabrook was not related to accident source terms and does not apply to the case in point.

The staff's use of conservative assumptions in the evaluation of the Plant/Site safety features is not based on the lack of a reliable realistic value. Instead the staff deliberately selects a set of conservative parameters in order to test the adequacy of the margin of safety in the plant/site safety features to cope with the postulated design basis accident.

In the FES, the staff has discussed accident probabilities only in connection with Class 9 accidents. In the discussion of Class 9 accidents, the Staff gives equal consideration to the probabilities of occurrence of these accidents, and to their realistic consequences based on reasonbaly realistic assumptions regarding the release of radionulcides and their dispersion in the environment. The dose conversion models are the same for both the conservatively calculated and realistically calculated consequences. The use of conservative

assumptions in the absence of reasonable realistic assumptions does not affect the probabilities of accident sequences, but only tends to increase the measurements of the severity of the consequences.

B) None.

Interrogatory 49

(7-2) Describe in detail those portions of the design which are expected to progress and for which the Applicants' design review and R&D program might result in modification of the design. As to each portion so identified, provide the following:

(a) Latest date on which design would be modified without disturbing the construction schedule.

(b) Range of costs that could be caused by such changes.

(c) Range of delay that could be caused by such changes. (Table 7.2) Provide a complete list of every assumption used in calculating the doses for Class 8 and Class 9 accidents.

Response

A) We don't have a current tally of the ongoing progress, some have been completed others may still be active. A complete list will be complied by the time that the FES and SSR updates are issued. A list of assumptions used by the staff in calculating the doses in Class 8 and 9 accidents is attached.

B) PSAR

Interrogatory 50

(Table 7.2) Provide all of the factual and other support relied upon by the Staff for the assumptions used in calculating all of the Class 8 and Class 9 assumptions and explain why (with full disclosure of all bases and facts) any assumptions used in the SSR calculation of doses.

Response

A) The assumptions are listed in the FES footnotes 9, 10, and 11 to Table 7.2, to be found on p. 7-6. (Also see response to 49)

B) CRBRP Final Environmental Statement, NUREG-0139.

Interrogatory 51

(7-8) On August 27, 1974, the Commission published an Interim General Statement of Policy on Protection Against Accidents in Nuclear Power Reactors in which it stated (31 Fed.Reg. 30964):

> Accordingly, it is the interim position of the Commission that, pending completion and detailed evaluation of the final [Reactor Safety Study] study, including public comment thereon, (1) no changes in the Commission's safety or environmental regulations pertaining to nuclear power plants are now warranted, (2) the Commission's existing requirements should not be realized, and (3) the contents of the draft study are not an appropriate basis for licensing decisions.

Explain your reliance on the WASH-1400 (RSS) as a basis for gaining perspective on risks of very severe accidents in the CRBR in light of the Commission statement.

Response

A) The methodology of the WASH-1400 study was used as a basis for gaining perspective regarding of CRBR accidents as reported but the conclusions of WASH-1400 are not being relied on as a basis for licensing decisions. This usage is not inconsistent with the quoted section of the Policy Statement,

and has indeed been staff practice since publication of the Interim Policy Statement.

B) None.

Interrogatory 52

In your use of WASH-1400, did you consider the following criticism of that report:

(a) Nuclear Power Issues and Choices, Report of the Nuclear Energy Policy Study Group, Ford Foundation, 1977, pp. 222-242.

(b) Frank Von Hippel -- various public statements including Invited Talk at the 1975 Spring Meeting of the American Physics Society (April 30, 1975) and Invited Talk to the New York State Legislature, May 5, 1976.

(c) Joel Yellin, as printed in The Bell Journal of Economics, Vol. 7, No. 1 (Spring 1976), p. 317, and Vol. 7, No. 2 (Autumn 1976), p. 711.

(d) Henry Kendall and Sidney and Moglewer -- Preliminary Review of the AEC Reactor Safety Study (November 1974), and Henry Kendall (Comments on the RSS WASH-1400 (NUREG-75/L04), published by Union of Concerned Scientists (June 11, 1976).

If not, do you now consider those criticisms relevant and if not, why not? If you do now consider those criticisms relevant, discuss in detail your bases for continued reliance on WASH-1400 without taking into account the criticisms.

Response

A) Yes.

B) None.

Interrogatory 53

(7-11) Describe in detail what is not known about the contribution of radioactive sodium to the event discussed in Table 7.2, what specific work is left to be done, how the NRC confirmatory studies will be conducted, and what the result would be for the CRBR if the further work did not confirm the Staff assessment.

Response

A) The staff is not aware of any uncertainties regarding the contribution of radioactive sodium to the event discussed in table 7.2.

The question is unclear. It implies that the contribution of radioactive sodium has not been accounted for, or not known for an event in table 7.2. It is unclear which event is in question. Table 7.2 represents many events involving radioactive sodium. Footnote 8 clearly states that for the event 7.2, e.g., "Radioactive concentrations in the aerosol are based on end of life (30 years) coolant activity based on operation with 0.5% failed fuel."

B) FES.

Interrogatory 54

Explain in detail, revealing all of the bases and assumptions upon which you rely, all documents analyzed and accepted or rejected, all experts consulted and the opinions obtained from them, and all facts upon which you rely for the underlined statements contained in the portions of the FES attached as an appendix to this set of interrogatories.

Response

A) The underlined statements are generally summary or conclusory statements derived from the arguments presented in the text. The staff conclusions are based on their independent judgements and evaluations of the materials presented or referenced in the FES. The specific calendar dates specifying the timing of various actions are no longer valid.

Interrogatory 55

(7-13) Does the last sentence of the text of this page reflect an examination of classified materials made available to selected persons at NRC or does it merely reflect the view of those NRC authors of this section of the CRBR analysis? Describe in detail the procedure used by the author of this sentence to gather the data necessary to make the statement. Is the statement true as of the date this interrogatory is answered?

Response

A) The referenced sentence does reflect an examination of classified materials made available to selected persons at NRC. It also reflects other analyses conducted by the NRC safeguards staff in fulfillment of its continuing threat assessment mission (see response to Interrogatory 20, Set 23).

The staff member who authored the referenced sentence in the original FES is no longer available to describe the details of the procedure used to gather the data necessary to make the statement. Current procedures for gathering threat data include: (1) memoranda of understanding or agreements under which NRC receives pertinent intelligence information;

(2) in-house or contractual studies, usually based on analog methodologies, aimed at assessing the threat to the licensed nuclear industry (these rely on open-source data, classified information and personal interviews); (3) intra-agency distribution of event data reported to NRC by its licensees and inspection reports filed by NRC's regional personnel; (4) arrangements for daily receipt of open-source literature of interest, e.g., newspapers, journals and government/non-government reports; and (5) liaison with DOE and DNA.

The referenced statement is valid as of the date of this interrogatory response.

D) Sarah A. Mullen, Safeguards Analyst, Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided the answer to the question.

Interrogatory 56

If the CRBR is to meet what safeguards requirements are imposed by NRC and if those requirements are not now known, how does the Staff know that the cost of adequate safeguards, added to other costs of the CRBR, do not outweigh the benefits of the CRBR? In your answer, consider the following statement by the CEQ in a letter to Chairman William Anders on January 20, 1975, and explain why its reasoning is or is not applicable to the CRBR. In your answer, focus on the objective of the CRBR as a demonstration plant and the impact on achieving that objective if it is licensed without full consideration of safeguards alternatives which consideration might later require rejection of the LMFBR technology:

> The potential impacts of the diversion and illicit use of special nuclear materials are well recognized. This threat is so grave that it could determine the acceptability of plutonium recycle as a viable component of this Nation's nuclear electric

power system. Thus, we believe that the NRC, the Executive Branch, the Congress, and the American people should have the benefit of a full discussion of the diversion and safeguards problem, its impacts, and potential mitigating measures, before any final decisions are made on plutonium recycle.

The National Environmental Policy Act requires that, in preparing an environmental impact statement, the agency develop and describe appropriate alternatives where unresolved conflicts exist. Alternative safeguards programs for dealing with the threat of diversion of special nuclear materials have not yet been developed. As such, the information necessary to make sound and reasoned decisions on plutonium recycle was not available for governmental and public consideration in the draft GESMO. Because of this, the Council believes that the draft environmental impact statement does not meet the requirements of the National Environmental Policy Act.

To bring the draft statement into conformance with NEPA we recommend the following:

- The NRC should identify alternative safeguards programs which could protect the public from the unauthorized use of special nuclear materials.

- The impacts - environmental, economic, social, legal and institutional - of each alternative safeguards program should be fully analyzed.

- The NRC should present these alternative safeguard programs, including its proposed, preferred alternative, in an addendum to the draft environmental impact statement (GESMO) which should be circulated for review and comment according CEQ guidelines and existing NRC procedures for draft environmental impact statements.

- After considering the comments received on both the initial draft environmental statement and the addendum, the NRC should proceed with preparation of the final environmental impact statement.

- Only after these steps have been cared out should a final decision be made on whether to permit the commercial recycling of plutonium in light water reactors.

Response

A) Safeguards requirements for nuclear power reactors have been established in the regulations 10 C.F.R. 73.55 and the CRBR will be required to meet those safeguards regulations.

B) Code of Federal Regulation, Title 10 (Energy), Part 50, 70, 73.

D) R. Davis Hurt, MC&A Program Analyst, Division of Safeguards provided the answer to the question.

Interrogatory 57

(7-15) Has the Staff completed its review of the Applicants' submittal to cope with the two identified risks? If not, what if any tentative conclusions have been reached on the following:

(a) The Applicants' ability to cope with a force of 10 well-armed (armored vehicles, mortars, automatic weapons, high explosives) persons intent on sabotage and not concerned about detection after breaking the outer security fence. Explain assumptions used regarding fire power of on-site personnel and reaction time and fire power of on-site assistance.

(b) The Applicants' ability to cope with a force of 10 well-armed (armored vehicles, mortars, automatic weapons, high explosives) persons intent on "hijacking" the reactor for a ransom and not concerned about detection after breaking the outer security fence. Explain assumptions used regarding fire power of on-site personnel and reaction time and fire power of on-site assistance.

Response

A) The Staff has not completed its review of the Applicant's submittal to cope with theft or diversion of SNM from the reactor site or sabotage of the reactor. No conclusions have been or will be reached during the environmental review regarding the Applicants' ability to cope with the stated

scenarios. The adequacy of CRBR's safeguards program will ultimately be judged against the regulatory requirements in 10 C.F.R. The design basis threat that must be used by all power reactors in the design of their safeguards programs are specified in 10 C.F.R. 73.1(a). The Staff has determined that a safeguards program that meets the requirements of 10 C.F.R. provides adequate protection against theft and sabotage.

D) Sarah A. Mullen, Safeguards Analyst, Division of Safeguards, Nuclear Material Safety and Safeguards provided the answer to the question.

Interrogatory 58

(7-22) How low is the probability of the explosiion of multi-kiloton illicit weapon and how did you calculate the probability? If you didn't calculate a probability, then how did you know it was low?

Response

A) The Staff Member who prepared the original Environmental Statement is no longer available to clarify the meaning of the wording of p.7 - 22. The Staff's current position is that it is inappropriate to take credit for any reduction in risk to the environment or the public resulting from possible difficulties that a non-national group might encounter in designing and building a crude nuclear explosive after obtaining an amount of special nuclear material equal to the five kilogram formula quantity.

D) John W. Hockert, Senior Safeguards Scientist, Division of Safeguards and Paul Baker, Research and Technical Assistance Project Manager, Division of Safeguards provided the answer to the question.

Interrogatory 59

To what extent is your safeguards analysis affected by the following assumptions:

(a) The SNM is stolen by one group but sold to a foreign nation for fabrication into a weapon.

(b) The purpose of theft of the SNM is to blackmail rather than to actually detonate a nuclear weapon.

(c) The persons involved are essentially unconcerned about their own deaths.

Response

A) (a) Our safeguards analysis will exclude from consideration any reduction in the risk to the environment or the public resulting from possible difficulties that might be encountered in designing and fabricating a crude nuclear explosive device. Scenario details related to design and fabrication of such a device do not affect the safeguards analysis.

(b) Our safeguards analysis will exclude from consideration any reduction in the risk to the environment or the public resulting from possible difficulties that might be encountered in designing and fabricating a crude nuclear explosive device, and since the consequences of a blackmail threat are no more sever than those associated with the detonation of a nuclear

explosive device, this difference in the purpose of the theft has no effect on the safeguards analysis.

(c) Insofar as analysis of the consequences of a successful theft of special nuclear material is concerned, this has no effect for the reason mentioned in part (a) of this response. Insofar as analysis of the likelihood of successful theft or sabotage is concerned, the degree of dedication specified in the design basis threats contained in 10 C.F.R. § 73.1 includes individuals essentially unconcerned about their own deaths. Therefore this has no impact on the safeguards analysis.

D) Sarah A. Mullen, Safeguards Analyst, Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided the answer to the question.

Interrogatory 60

(7-23) Quantify the concept "extremely low" and explain how you calculated the CRBR will meet the level. Explain how you took account of the unquantifiable factors in reaching your conclusion about probabilities.

Response

A) The Staff Member who prepared the original Environmental Statement is no longer available to clarify the meaning of the wording on p.7-23. As explained in the response to interrogatory 58 of this set, the Staff's current position is that credit will not be allowed for possible difficulties that

a non-national group might encounter in designing or fabricating a crude nuclear explosive after obtaining five or more formula kilograms of special nuclear material.

D) John W. Hocket, Senior Staff Scientist, Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided the answer to the question.

Interrogatory 61

(7-25 to 7-26) Inasmuch as the precise standards for safeguards at the CRBR and for transportation have not been determined, what are the ranges of costs of safeguarding the CRBR and transporting fresh fuel which are possible? Explain and disclose the assumptions and facts used in your analysis.

Response

A) The Staff will issue a revised Environmental Statement on the CRBR fuel cycle that will contain updated estimated safeguard costs.

D) R. Davis Hurt, MC&A Program Analyst, Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided the answer to the question.

Interrogatory 62

(7-26) What happens to the Staff analysis if there is later determined to be a specific threat to nuclear reactors? Discuss in detail how this would alter each of your assumptions and conclusions.

Response

A) To date, NRC has no information suggesting the existence of a threat to U.S. power reactors in general or to the CRBR in particular. Should this situation change, a number of options for maintaining a prudent level of protection are available.

In the event of a specific threat to the CRBR (for example, a civil disturbance or a confirmed protected area intrusion), the Applicant could introduce interim protective measures and heighten its security posture in accordance with this approved contingency plan. The NRC has a variety of safety and safeguards options at its disposal in this type of situation; for example, the NRC could order a change in plant status or call off-duty security personnel.

Should continuing threat assessment by the NRC staff reveal a precipitous increase in the potential threat to all licensed power reactors, NRC would issue an immediately effective rulemaking modification to upgrade their physical security. If the imminent threat were localized, site-specific license conditions would be issued.

Should the Staff perceive a gradually escalating level of threat, perhaps resulting from analysis of safeguards-related events over time, the NRC would initiate a rulemaking modification through normal channels. If the NRC is convinced that a plant cannot operate without posing an unreasonable risk

to public health and safety, or without endangering the common defense and security, the plant would be closed temporarily, or permanently, as appropriate.

D) Sarah A. Mullen, safeguards Analyst, Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided the answer to the question.

Interrogatory 63

Explain fully and disclose all facts, bases and assumptions of, the Staff position on the issue of the impact on United States efforts to limit the proliferation of plutonium to foreign nations of continued development of the CRBR which is designed to provide significant information leading to the wide-scale use of plutonium as a fuel for United States reactors.

Response

A) The scope of the Staff review is limited to the Environmental effect of the CRBRP and its fuel cycle and Safeguards. Any international nonproliferation issues are outside the bounds of the staff evaluations. The staff regards the CRBRP as a technological demonstration to increase the factual information on which to base the decision about commercialization of the program. As such, the CRBRP project itself is not a part of the program which may or may not follow it, and which should be organized to have minimum proliferation susceptibility. The project is a device on which the later decision about entering the program will in part be based. The staff therefore does not regard the CRBRP as impacting on the proliferation problems

of foreign weapons programs. The staff does believe that the U.S. Administration policy on proliferation can be factored into a breeding reactor program of which CRBRP is a part. Proposals to increase the flexibility and versatility of CRBRP which were under study (1977-79) could perhaps ensure a role for CRBRP in the demonstration of a wider variety of breeding cycles, but these have not yet been submitted to or evaluated by the staff.

D) R. Davis Hurt, MC&A Program Analyst. Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided part of the answer to the question.

Interrogatory 64

To what extent does the President's statement of April 7, 1977, on nuclear proliferation and the future of plutonium use as a fuel, speaking on behalf of the entire Executive Branch, including ERDA, alter any of the assumptions or conclusions contained in the FES, particularly Chapters 7, 8, 9 and 10?

Response

A) Environmental statements are essentially non-political documents that to the extent practical assess health and environmental effects of proposed action. Presidential or Administration statements on national or international policy are political statements that the staff does not feel should impact on the factual material in environmental statements. In fact the reference 4/7/77 statement by a former president has

been superceded by the present president's statement on nuclear power.

The Staff has no information to indicate that the goals and mission of the project are different in any significant way (except as to their timing). We are thus able to sustain the general conclusions of chapters 7-10, except for those related to specific calendar dates.

D) R. Davis Hurt, MC&A Program Anayst, Division of Safeguards, Office of Nuclear Material Safety and Safeguards provided part of the answer to the question.

Interrogatory 65

(8-5) In looking to whether the CRBR will provide useful information for the Administration, how did the Staff determine the value of the usefulness and how did it weight and take into account the relative usefulness of the information to be obtained balanced against the cost of obtaining it and alternative ways of obtaining that information? Answer this question with respect to each individual conclusion reached by the Staff as to the "usefulness" of information to be obtained.

Response

A) Instructions from the Commission and from the ASLB have required that the staff regard the need for and timing of a demonstration reactor as given. Within the framework need, the staff considered the alternatives described in section 8.4. The factors considered in evaluating the various alternatives

are discussed in sections 8.4.1 through 8.4.6 and the updates to these sections.

Interrogatory 66

(8-5) If foreign difficulties with demonstration plants nonetheless made development of 1000 MWe plants attractive and if that is relevant here, then why aren't the foreign demonstrations sufficient proof of technical performance to warrant moving on directly to the commercial-scale breeder?

Response

A) Although the staff has considered various sizes of plants, it has done so within the context of the Commission's and ASLB's instructions that the need for a demonstration plant be regarded as given. Within this context, the staff has found no substantial advantage in choosing different sizes, and has recognized considerable risks in proceeding from the present state-of-the-art directly to commercial sizes (FES, 8.4.3). The staff does not believe that foreign experience in which this nation has not actively participated is an acceptable substitute for the development of our own experience. The foreign programs do offer an illustration that our own demonstration program ought to be able to be managed in such a way as to achieve at least an equivalent degree of success.

Interrogatory 67

(8-5) Explain in detail how the Staff considers the comparable technical problems of foreign breeders and potential technical problems of the CRBR as the basis for its reliance on the foreign experience as evidence that building the CRBR even if has technical problems would be significantly useful.

Response

A) It is somewhat exaggerated to suggest that the staff has relied on foreign experience. The staff has had a limited contact with foreign programs, has tried to keep aware of their major developments and problems, and to be alert to possible applications to our own programs. The subject under discussion in Q.67 is the nature of an adequate demonstration of technical performance. Mindful of foreign experience in this regard, the staff has nevertheless independently proposed its own criteria for a successful demonstration (final paragraph of the Technical Performance Section, FES, p8-5) and has evaluated the possibilities of their achievement based on past technical performance.

Interrogatory 68

Inasmuch as the CRBR is but one plant which will be presumably more closely reviewed in design, construction and operation, how will it provide any significantly useful information about reliability, safety, maintainability or technical performance of LMFBR? Why isn't the data base simply too narrow to draw the kind of conclusions which the Staff believes warrant the operation of the CRBR?

Response

A) The staff finds it difficult to conceive how a project of the magnitude of CRBR can be regarded as providing too narrow a data base for further development of the LMFBR program. Certainly, in a developing program, each reactor provides some base of experience for those to follow. On the other hand, CRBRP is not expected to answer all the questions of the LMFBR

program, but only to make its own significant contribution (letter, Roisman to Boyd, 10/12/76, p3).

Interrogatory 69

(8-7 to 8-8) How will the goal of operation in a utility environment be achieved, given the extensive scale contemplated for ERDA? Compare the role of a utility in construction and operation of an LWR or of anticipated commercial LMFBR's and explain why the difference between that and the ERDA/utility arrangement for the CRBR are not significant.

Response

A) The staff believes that the extensive role contemplated for DOE will not reduce the value of the "demonstration in a utility environment" because of the extensive role assumed by utility personnel in the design, construction and operation phases of the project.

Interrogatory 70

(Chapter 9) Describe in detail the process by which the Staff independently evaluated alternative sites. In particular, but not exclusively, address the following as related to each of the principal sites considered:

(a) To what extent did the Staff canvass possible alternative sites?

(b) To what extent did the Staff conduct direct examination of the sites and independently gather data on such sites?

(c) How did the Staff verify that the data presented on sites by Applicants did not understate benefits and overstate disadvantages, particularly where the data was subjective or not easily susceptible to objective verification?

Response

A) In considering alternative sites, the staff begins by reviewing the information submitted in the Applicants' Environmental

Report to assure that the potential sites within an appropriate geographical region have been identified, that a logical screening process was employed to arrive at a reasonable number of candidate alternative sites which are among the best that can be found, and that sufficient reconnaissance-level information is available about those sites for comparison with the Applicants' proposed site. Regulatory Guides 4.2, "Preparation of Environmental Reports for Nuclear Power Stations," and 4.7, "General Site Suitability Criteria of Nuclear Power Stations, " identify the types of information needed by the staff and the general criteria by which alternative sites are considered. Those guides were followed generally by the Staff in preparing Section 9.2 of the FES.

Since publication of the FES in 1977, additional guidance has become available in Section 9.2 of the staff's Environmental Standard Review Plan ("ESRP") (NUREG-0555, rev. 1 dated November 1981) and a proposed rule as part of 10 C.F.R. Part 51; (45 Fed. Reg. 24168, (April 9, 1980), which would provide procedures and performance criteria for the review of alternative sites for nuclear power plants under NEPA. Since those documents represent the current Staff position with respect to conducting alternative site reviews, the Staff is generally following those procedures in updating the FES. A copy of the ESRP is attached.

(a) The Staff examined the Applicants' submittal to assure that potential alternative sites had been identified and considered by TVA throughout its service area. As directed by the Commission decision relative to other TVA and ERDA (DOE) properties, the Staff also reviewed the submittal to assure that those properties had been made appropriately screened to identify potential sites which might be "substantially better" than the Applicants' proposed site.

(b) During 1976, members of the Staff visited the Widows Creek and John Sevier coal-fired plants, where "hook-on" of the breeder reactor was considered, and the Clinch River, Phipps Bend and Murphy Hill sites. During 1981 and 1982, Staff members have visited the Clinch river, Phipps Bend, Hartsville, Yellow Creek and Murphy Hill sites within the TVA service and also the DOE properties at Hanford, Washington, and Savannah River, Georgia. These visits provided an opportunity for the Staff specialists in various technical subjects to verify data provided in the Applicants' submittal and also to make their own determinations from first-hand observation. Considerable data, such as lists of endangered species, are available form other state and federal agencies. Those agencies

also provided comments on the Draft Environmental Statement when it was issued for public comment in 1976.

(c) For verification of data, Staff specialists reviewed the open literature, the environmental statements previously prepared by NRC for nuclear projects at or near the alternative sites, and data form otehr agenices, as indicated above. Other Staff specialists with knowledge of the TVA and DOE properties were also available for consultation.

B) The prinicpal documents relied upon for preparation of Section 9.2 of the 1977 FES are cited in the FES and in the above response. Additional references may be cited in the forthcoming FES update.

Interrogatory 71

(9-14) Why couldn't TVA personnel operate the plant at a site outside the TVA service area much as Commonwealth Edison personnel will participate at the CRBR site?

Response

A) The staff knows of no reason why TVA personnel could not participate in operating the plant at a site outside the TVA service area if TVA authorizes such participation and provides appropraite funds. In the staff's opinion, it would not be practical for TVA to undertake the sole responsbility for operation of the plant at a site very remote from supporting

personnel and facilities on its own system. However, if one or more utilities in the site vicinity would take the lead responsibility for operating the plant, arrangements could probably be made for TVA participation.

Interrogatory 72

(9-14) How are conclusions on scheduling affected by the current status of the CRBR as expressed in the President's statement on April 7, 1977?

Response

A) The schedule dates in FES Section 9.2.6.1 became obsolete because of the project postponement which resulted from the President's statement of April 7, 1977. These will be adjusted in the staff's forthcoming update of the FES.

Interrogatory 73

(9-14 to 9-17) Fully disclose all of the bases and assumptions used for determining the length of each step which will allegedly cause delay. In your answer, assume the change is given the highest priority by the Administration and Congress, which assumption is consistent with the conclusions in WASH-1535 and the Commission's August 27, 1976, order.

Response

A) The bases and assumptions for the applicants' analysis of delays associated with a change of site, which is summarized in FES Section 9.2.6.1, are presented in the letter from A. R. Buhl of ERDA to R. S. Boyd, NRC, dated December 29, 1976. The bases and assumptions made by the staff in analyzing that submittal are also disclosed in FES Section 9.2.6.1. We believe that the staff's analysis is consistent with the

assumption presented in Interrogatory 73 that a change of site for the CRBR would be given the highest priority by the Administration and Congress.

Interrogatory 74

(9-22 to 9-23) What are the comparative values in man-rems and dollars of the differences between the CRBR site and three principal non-TVA sites for routine and accident releases disregarding probability of accident occurrence?

Response

A) Table 7.2 of the FES gives the estimated whole body dose to population in a 50 mile radius from the plant to be 5.4×10^4 man-rem from the representative Class 9 accident release. If one were to use the value of $1000 per man-rem population dose suggested for compliance with the Appendix I to 10 C.F.R. Part 50, the estimated cost of the accident population dose would be $54 million. As stated in the FES (page 9-22), "The radiological doses at the alternate ERDA (DOE) sites would be roughly a factor of 10 less than at the Clinch River site; thus, the population dose at the other sites could be 5,000 man-rem and the corresponding dollar value could be about $5 million.

The majority of the routine exposure is expected to be to the plant staff. If the routine exposure to the general public amounts to about one man-rem/yr (Table 5.3 of the FES), at $1000 per man-rem ERDA (DOE) sites it would imply a cost of

$1000 per year at the CRBR site; at one of the three ERDA (DOE) sites it would be about a factor of ten less or about $100 per year. The exposure to the plant staff would be expected to be about the same at any of these sites; at 1000 man-rem/yr and $1000 per man-rem, the value would be about $1 million per year.

B) Final Environmental Statement, NUREG-0139.

Interrogatory 75

What are the values after consideration of probabilities?

Response

A) For the purpose of discussion, it may be aribitrarily assumed that the representative Class 9 accident release (FES, Table 7.2) at the CRBR site has a probability of accident occurrence of one chance in one million per year. Taking the risk to be a product of accident probability and the associated consequences, the CRBR risk of population exposure would be 0.054 man-rem per year or at $1,000 per man-rem a dollar risk of $54 per reactor-year. The corresponding risks for other DOE sites would be 0.005 man-rem per reactor-year or a dollar risk of $5 per year.

The probability of the routine exposures to plant staff and general public is considered to be 1.0, and thus the dollar

values are the same as given in the response to Question No. 74.

B) FES.

Interrogatory 76

What are all of the bases, facts and assumptions upon which the Staff reaches the judgment that the radiological benefits are outweighted by economic and other costs of alternate sites? Quantify the costs and benefits and provide the rationale for the use of any non-quantified values.

Response

A) As stated in the first paragraph of FES Section 9.2.6.4, "none of the alternative sites has an important advantage over the Clinch River site from the standpoint of routine releases, since the resultant radiological doses to individuals and to the population at any site wuld be inconformance with Appendix I of the Commission's regulations."

The bases, facts and assumptions invovled in the staff's judgment relative to radiological risk from potential accidents at the CRBR site vs. the three remote sites are included in Sections 7.1 and 9.2 of the FES. In the discussion of radiological risks (Sect. 9.2.6.4), the staff indicated that radiological doses at the alternative ERDA sites would be roughly a factor of 10 less than at Clinch River, in terms of overall population exposures (as man-rem) out to 50 miles. The staff also recognized that the risks of radiological

consequences from postulated accidents at the CRBR site are expected to be acceptably low and comparable with LWRs.

It would be difficult to quantify all of the factors considered in Section 9.2.7 on a common basis, particularly the effects of relocation on achieving the demonstration plants objectives. For that reason, the staff's overall judgment was necessarily subjective. However, if dollar values were assigned to radiological benefits of relocation to the more remote sites, as in our response to question #75, those benefits would be valued at $949 per year ($54 minus $5 due accident risks plus $1000 minus $100 due to routine exposure to the general public). That amount is insignificant and far less than the $26-74 million cost of relocation estimated by the staff in the 1977 FES.

Interrogatory 77

(10-3) Does the first sentence of ¶10.2.2 mean the Staff believes that LMFBR's cannot be developed unless the CRBR is built and operated? Fully explain your answer and particularly relate the word "necessary" to the objectives of the CRBR.

Response

A) No. That is not what the sentence says. The sentence expresses the thought that some of the parameters necessary to LMFBR commercial development will be demonstrated in CRBR. Section 8.3 of the FES contains the details of how this result is expected to be achieved.

Interrogatory 78

(10-7) Would your conclusions about the benefits of the CRBR still be valid if the goals of CRBR changes? Explain your answer fully.

Response

A) A change in the goals of CRBR would probably be reflected in some changes in design. It is not clear whether the same beenfits would accrue for a changed design. Obviously there is interaction among goals, design and benefits; the designer attempts to maximize benefits within a given set of goals. The same as they were in 1977, except for (1) details of the timing, and (2) the increased emphasis on demonstrating an attractive breeding ratio.

The following questions are based on the FES and page references preceding the questions are to that document.

Interrogatory 79

(10-7 to 10-8) Why doesn't the use of tax revenues as a benefit involve double counting?

Response

A) Strictly, taxes are transfer payments and not benefits to society at large. In considering local socioeconomic impact from construction, increased tax revenues help offset increased local costs.

Interrogatory 80

(10-7 to 10-8) Why are the employment values benefits without evidence that but for the CRBR there wouldn't be other employment for these people?

Response

A) In periods of high unemployment productive resources are un-utilized or under-utilized. Projects initiated in such periods employ labor which would otherwise not be used to the benefit of society.

Interrogatory 81

If the CRBR is not built and Congress appropriates the money saved for a more labor-intensive project -- i.e., energy conservation retro-fitting -- why wouldn't the employment benefits be greater than those projected for the CRBR?

Response

A) The employment benefits could be greater from a program of conservation retrofitting than from CRBRP. However, the evaluation of CRBRP should be in terms of a number of attributes. Moreover, the Staff believes that maximizing employment benefits is best considered within the framework of federal employment policy not national energy policy.

Contention 2 (renumbered as 1)

Interrogatory 82

In response to NRDC request for admission #94 related to Contention 2 (renumbered as 1), the Staff responded:

94. Staff's response to Interrogatory III of the 14th set addressed the NRDC concern regarding the manner in which CDAs can be excluded as DBAs, and the quantification associated with such a

determination. The role of probability assessments in the licensing process is further addressed by the Staff in NUREG-0138 "Staff Discussion of Fifteen Technical Issues Listed in Attachment to November 3, 1976 Memorandum From Director, NRR to NRR Staff," specifically issue 8, "Use of Probalistic Assessment of Reliability." To the extent that probabilistic and reliability methods are used where appropriate as one of a number of techniques to aid in the "deterministic" safety evaluation, the Staff admits that it is possible to estimate the probability of a CDA. Therefore, the Staff denies the statement that "it is not possible to quantify the probability of the occurrence of a CDA."

(a) We ask again, what is the probability of the occurrence of a CDA in the CRBRP?

(i) Please identify the basis for this probability estimate by indicating all of the determinative quantitative inputs to the estimate and all of the determinative qualitative or judgmental inputs.

(b) Are we to imply from the above-quoted response of the Staff, and their response to other requests for admissions on this contention, that, while the Staff could estimate the probability, it did not make the effort to do so?

Response

A) (a)&(b) This question has been answered in the responses to interrogatories 98 through 100, interrogatory set 11.

Contention 3 (renumbered as 2)

Interrogatory 83

Is is the Staff's position that it is not necessary to determine whether Phenix design features or other foreign LMFBR design options are superior to those incorporated in the Applicants' CRBR design for the purposes of meeting:

(a) Safety objectives?

(b) NRC licensing requirements?

(c) NEPA requirements?

(d) CRBR Program objectives?

(e) In (a) through (d) above, if this is the Staff position, please give the rationale. If it is not, please explain how the foreign designs were included in the Staff's determinations. Isn't the control design and layout an important feature relative to overall plant safety and as a deterrent to sabotage?

(a) Has the Staff reviewed the design and layout of the control room, its equipment and consoles?

(i) Have they been determined to be adequate?

(ii) Please supply all reports, memoranda and correspondence that relate to this review.

(iii) What are the sabotage deterrent features incorporated into the control room?

On page II-48 of the SSR, the Staff indicates that it has examined workable designs to implement the Staff's containment protection requirements.

(a) Please supply all documents, memoranda and correspondence relating to this review.

(b) Precisely how can the present head shear ring be redesigned?

(i) Could it be made into a continuous ring and still be installed on the reactor?

(c) What would be the cost of these modifications and what would be the affect on the schedule?

Response

A) The answer to this question has been covered the responses to question 10, 11-15 and 16.

Contention 7

Interrogatory 84

In response to NRDC request for admission #16 on Contention 7, the Staff responded:

STATEMENT 16: The historical descriptions of these lesions are suggestive of an incipient carginogenic response.

RESPONSE: The staff denies this statement.

(a) Considering the histological description of the particle produced lesions (see NRDC Supplemental Submissions to the EPA hearings, pp. 4-9), what is the precise basis for the Staff's disagreement with the statement that these descriptions are suggestive of an incipient carginogenic response?

(i) Isn't the description of the lesions in hamster lungs consistent with the description of the histogenesis of bronchiolo-alveolar carinoma and even with the histological features of this carcinoma?

(ii) Aren't the hamster lesions considered by many to be neoplastic precursors? (See Smith, D.M., et al., Biological Effect on Focal Alpha Radiation on the Hamster Lung, in Biological and Environmental Effects of Low-Level Radiation, Vol. II, p. 124).

(b) Consider the following:

If the particles are sequestered, either intra- or extracellularly, continued local injury would result, with eventual repair by fibrosis. Epithelial cell proliferation could result from continued radiation-induced cell death, or more likely, secondary to the focal fibrosis and chronic inflammation. Epithelial cell metaplasia in association with focal interstitial fibrosis attributed to lungworm infection has been reported in beagle dogs (Hirth and Hottendorf 1973). Similar atypical of dysplastic epithelial cells have been observed secondary to fibrotic lesions resulting from a variety of known and unknown causes in man. In some cases, transition to carcinoma has been reported (Fraire and Greenberg, 1973). It is interesting and perhaps of significance that one-third of the lung carcinomas in man reported to be associated with fibrosis have been classified as bronchiolo-alveolar cell types, whereas this type accounts for only 3-6% of total lung tumors in man (Frairie and Greenberg 1973). This is the predominant tumor observed in the Pu-exposed dogs. The stimulus for epithelial cell proliferation and transformation in association with fibrosis is not known and, at present, the existence of such a stimulus is only speculative. The possibility that fibrosis may render the proliferating epithelial cells more susceptible to chemical or physical carcinogenesis cannot be excluded. (Dagle, G.E., J.E. Lund and J.F. Park, 1976. Pulmonary Lesions Induced by Inhaled Plutonium in Beagles, pp. 161-168. In: The Health Effects of Plutonium & Radium (W.S.S. Jee, ed.). The J.W. Press, Salt Lake City, UT.)

(i) Isnt' this consistent with the hot particle hypothesis as discussed on pages 7-8 of NRDC Supplemental Submission to the EPA hearings?

(b) Is is not possible that the tumor induction period by the hot particle mechansim exceeds the life span of the hamsters and that this is the reason why the tumor response was so low? (See 41 Fed. Reg. 15375, column 2, April 12, 1976.)

Response

A) The Staff now admits Statement 16 (See Staff's revised response to NRDC's July 28, 1976 Request for Admissions on Contention 7, Statement 16). Therefore, this interrogatory is irrelevant.

Interrogatory 85

In response to NRDC request for admission #11 on Contention 7, the Staff responded:

> STATEMENT 11: Tamplin and Cochran's hot particle corollary as stated in No. 10 above does not contain a reference to, and is not based on, the existence of a particular susceptible type of tissue in the lung (Cf. Comments by NRDC on the NRC's Denial of Petition for Rule Making [Docket No. PRM-20-5.]).
>
> RESPONSE: The staff denies this statement.

(a) Considering the NRDC Comments on the Fed. Reg. Notice of Denial (as referenced in the question), considering the NRDC Supplemental Subsmission to the EPA Hearings, considering the transcript of the NRDC meeting with the NAS-NRC ad hoc Committee on Hot Particles and NRDC comments on the draft report of that committee (W.J. Bair was a member of that committee), these answers, in addition to being nonresponsive, appear to be recalcitrant. The staff should explain the basis for these answers by reference to the papers cited above.

(b) Dose the staff fell that this issue is crucial to the support of the Fed. Reg. Notice of Denial?

i) If so, in what manner?

ii) If not, why not?

(c) The NRDC position is that a critical tissue means is a mass of tissue of sufficient size to have the ability to trigger a carcinogenic response when subjected to a high level of ionizing radiation. In this respect we have offered the particle produced lesion as empirical evidence that hot particles do irradiate a critical tissue mass.

i) Does the staff deny that this is the proper interpretation of NRDC's use of the term critical tissue mass? If not, why not?

ii) Didn't NRDC, through use of the particle produced lesions, define the critical tissue mass (volume) in terms of empirical observations of these lesions?

Response

A) a) The Staff need not respond to this Statement, since it does not ask a particular question to which the Staff can respond.

b) This interrogatory is too vague for the Staff to respond to in a meaningful manner for the following reasons. First, it is not clear what is referred to in the term, "this issue." Second, the Staff objects to the use of the term "feel" in the preceding statement.

(i) See response to (b).

(ii) See response to (b).

c) (i) The Staff cannot respond to the interrogatory in a meaningful manner unless the specific passages where NRDC discusses the term, "critical tissue mass", are cited.

(ii) The staff cannot respond to this interrogatory in a meaningful manner unless the specific passages in which NRDC defines the term, "critical tissue mass volume", are cited.

Interrogatory 86

In response to NRDC request for admission #23 on Contention 7, the Staff responded:

> STATEMENT 24: If the minimum activity to constitute a hot particle is 0.2 pCi, and the tumor risk per hot particle is 1/2000, and the particle size distribution in the lung of case 7-138 is representative of the particle size distribution in the 24 Manhattan workers reported by Hemplemann, et al. [LA-5148-MS, LASL, Jan. 1973], then the observation of no lung tumors in the Manhattan workers would not be inconsistent with the hot particle hypothesis of Tamplin and Cochran.
>
> RESPONSE: The staff admits this statement to the extent that it is recognized that the assumptions regarding a minimum activity quantify and tumor risk are not deemed to be correct by the staff.

The NRC used the Manhattan Workers as a partial basis for their denial (41 Fed. Reg. 15371-15379, April 8, 1976). We discussed this in some detail in our comments on the Fed. Reg. notice on pages 15-19. The staff should respond to these comments in detail since they relate directly to a totally incorrect use of Manhattan Workers in the Fed. Reg. notice. NRDC requests for admissions #'s. 21-24 were directed to this matter.

i) Allowing the assumption, isn't the statement correct?

ii) Why didn't the NRC use the material and approach contained in the NRDC supplemental submission to the EPA hearings (see NRC comments on the Fed. Reg. Notice of Denial, p. 18) in its analysis of the Manhattan Workers?

iii) Is the NRC Fed. Reg. Notice of Denial meant only to apply to particles of 0.07 and 0.14 pCi of alpha activity? If not, why not?

Response

A) (i) The Staff cannot respond to this interrogatory in a meaningful manner because it is not clear which specific assumption is referred to in the interrogatory.

(ii) This interrogatory is too vague for the Staff to respond to in a meaningful manner. It is not clear what specific material or what specific approach is referred to in the interrogatory.

(iii) The Staff understandards the Commission's action in the Deniel of NRDC's Petition for Rulemaking, 41 Fed. Reg. 15374 (April 12, 1976) as a denial of NRDC's request that rulemaking for "hot particles" (defined by NRDC as those particles with .07 picocuries or greater alpha radiation) be instituted by the Commission. The scope of, and basis for, the Commission's action is contained in the Notice of Denial of NRDC's Petition. Since the Staff does not interpret the Commission's rulemaking decisoins on behalf of the Commission, the Staff refers NRDC to the Commission's Notice of Denial for the scope of the Commission's decision.

Contention 8c (renumbered as 11)

Interrogatory 87

In response to NRDC request for admission #16 on Contention 8c (renumbered as 11), the Staff responded:

> STATEMENT 16: Accepting this higher rate of turnover in the dog, the q value for ^{239}Pu should be further corrected by a factor of 1/10.
>
> RESPONSE: The staff denies this statement. Marshall and Lloyd (1973), taking other considerations into account, state that the RBE (Pu/Ra) for bone sacroma in man should be 17±6, approximately a factor of 3 greater than the value of 5 presently used for the relative damage factor, N. Mays (1975) has pointed out that "man lives 5 times longer than dog, and, therefore, has 5-fold more time in which the burial process can take place." He then considers the appropriate reduction factor for q to be 2.
>
> 1. If the Staff does not accept the factor of 1/10, what factor does the Staff suggest should be used?

(a) Please describe in mathematic terms, the basis for the Staff's value.

(b) Please describe the mathematical basis for both acute and chronic exposure.

Response

A) See revised response to Statement 16 on Contention 8(c).

Interrogatory 88

In response to NRDC request for admission #18, the Staff responded:

> STATEMENT 18: There is a possibility that lesion similar to produced in hamster lungs by Pu microspheres, if produced by PuO_2 particle deposited in the periphery of human lungs, could develop into pulmonary carcinoma.
>
> RESPONSE: The staff admits this statement to the extent that there is a possibility that any cell can become cancerous.

(a) Precisely what is the meaning of the Staff's answer?

(i) Supply the supporting evidence for the answer.

(b) Is the Staff implying that the scientific evidence indicates that all cancer originates from the transformation of a single cell?

Response

A) (a) Unless the interrogatory identified a specific fact of the previous response which is not stated "precisely", the Staff is of the opinion that the previous response is adequate.

(i) No response necessary.

(b) No.

Interrogatory 89

In response to NRDC request for admission #19, the Staff responded:

> STATEMENT 19: It is possible that a lesion in the human lung, similar to those produced by microspheres in hamster lungs, could represent a risk of 1/2000 of developing into a cancer.
>
> RESPONSE: The staff denies this statement. (See 41 Federal Register 15376, April 12, 1976.)

(a) By their answer, does the NRC Staff mean to imply that these lesions are benign and do not represent any carcinogenic risk?

(i) If yes, what is the basis for the answer?

(ii) If the Staff feels they do have some risk, what is the Staff's estimate of the chance that such a lesion will develop into a cancer?

Response

A) (a) The Staff cannot respond to interrogatory (a) in a meaningful manner for the following reason. It is not clear which lesions are referred to in the statement "these lesions." Statement 19 refers only to the possibility of "a lesion," not to specific lesions.

(i) No response necessary.

(ii) See response to Interrogatory (a) above.

Interrogatory 90

With respect to every question which you did not answer because you had not done the work required to answer the question, fully explain the bases for your failure to do the work and why you believe your review is adequate without it.

Response

For those interrogatories which have been answered, a review is being adequately performed for a reactor of the general size and type as the CRBR which will be adequate for the LWA stage of this proceeding. The staff's safety reviews for these matters are currently in progress, and results will be fully documented in the SERs for the construction permit and operating license stages for the CRBR. Pursuant to the Board's April 22, 1982 Order, the staff need not respond to discovery at this time which pertains to construction permit-related safety reviews.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF EDWARD F. BRANAGAN, JR.

I, Edward F. Branagan, Jr., being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Radiological Physicist, Radiological Assessment Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #84 through #89 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

EDWARD F. BRANAGAN, JR.

Subscribed and sworn to before me
this day of April, 1982.

NOTARY PUBLIC
My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF PAUL LEECH

I, Paul Leech, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Project Manager, Clinch River Breeder Reactor Program Office, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #70 through #73, #76 and #90 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

PAUL LEECH

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF SIDNEY FELD

I, Sidney Feld, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as an Economist, Antitrust and Economic Branch, Division of Engineering, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatory #78 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

SIDNEY FELD

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF MICHAEL KALTMAN

I, Michael Kaltman, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Regional Planning Analyst, Siting Analysis Branch, Division of Engineering, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #79, #80 and #81 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

Michael Kaltman

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF JERRY J. SWIFT

I, Jerry J. Swift, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Reactor Engineer, Clinch River Breeder Reactor Program Office, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #74 to #76 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

Jerry J. Swift

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF MOHAN C. THADANI

I, Mohan C. Thadani, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Nuclear Engineer, Accident Evaluation Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #46, #47, #48, #49, #50, #51, #52, #53, #74, #75 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

MOHAN C. THADANI

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF JOHN K. LONG

I, John K. Long, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Nuclear Engineer, Research Systems Branch, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #1 through #45, #49, #53, #54, #63, #64, #65, #66, #67, #68, #69, #77, #78, #82 and #83 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

JOHN K. LONG

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF ROBERT J. DUBE

I, Robert J. Dube, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Section Chief of Regulatory Activities and Analyses Section, Fuels Facilities Safeguards Licensing Branch, Division of Safeguards, Office of Nuclear Material Safety and Safeguards.

2. I am duly authorized to participate in answering Interrogatories #55 through #64 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

Robert J. Dube
ROBERT J. DUBE

Subscribed and sworn to before me
this 28th day of April, 1982.

Robert F. Abbey, Jr.
Notary Public
My Commission expires: July 1, 1982

ROBERT F. ABBEY, JR.
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires July 1, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF RICHARD BECKER

I, Richard Becker, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Reactor Engineer, Clinch River Breeder Reactor Program Office, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #1 through #45, #49, #53, #82, and #83 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

RICHARD BECKER

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF RICHARD M. STARK

I, Richard M. Stark, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Project Manager, Clinch River Breeder Reactor Program Office, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatory #90 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

RICHARD M. STARK

Subscribed and sworn to before me
this day of April, 1982.

Notary Public

My Commission expires:

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF PAUL LEECH

I, Paul Leech, being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Project Manager, Clinch River Breeder Reactor Program Office, Office of Nuclear Reactor Regulation.

2. I am duly authorized to participate in answering Interrogatories #70 through #73, #76 and #90 of the 20th Set and I hereby certify that the answers given are true to the best of my knowledge.

PAUL LEECH

Subscribed and sworn to before me
this day of April, 1982.

Notary Public
My Commission expires:

ATTACHMENT FOR INTERROGATORY #49C

DRAFT

Class 8.2 STEAM LINE BREAK

Accident Scenario:

Realistic Assumptions:

a) The main steam line fails between the MSIV and the manifold.

b) Tritium concentration of 0.25 uci/gm in the steam is the same as that in the steam generator. This concentration is based on EOL.

c) About 479,000 pounds of steam are assumed released over 1.5 hours; 9,000 pounds before the isolation valve closes and 470,000 pounds through the power relief valves.

d) Accident releases terminate when the reactor heat load reaches 45 Mwt and the SGAHRS can handle the load.

e) Meteorology assumptions--X/Q values used are 1/10 those given in NRC Regulatory Guide 1.4.

Conservative Assumptions:

LMFBRB says that a DBA for Class 8.3 has not yet been established.

Appl. in PSAR 15.3.3.1. covers 5 different breaks in the system to discover the break in the saturated steamline between steam drum-superheater has the most severe transient

DRAFT

CLASS 8.3 - LARGE PRIMARY SYSTEM RUPTURE (PARALLEL DESIGN ONLY)

Accident Scenario:

Realistic Assumptions:

a) There is no loss of in-place coolable geometry and no gas ingress to the primary coolant.

b) A failure occurs in the hot leg elevated piping which sprays sodium for at least 30 seconds. (Pump coastdown to natural circulation or 3% flow is estimated to be 45 seconds.) After pump coastdown, the sodium continues to leak but not as a spray.

c) A total of 200,000 pounds of Na is spilled to a cell.

d) The Na reacts with the oxygen in the cell. ~~600 pounds of Na react with O_2~~.

e) The radioisotope concentrations in the aerosol are the same as the initial concentrations in the primary coolant and are based on operation with 0.5% failed fuel. (See ER Table 7.1-13)

f) All resultant sodium vapor or suspended aerosols leak from the cell to the outer containment at 100%/day and from the containment to the environment at 0.05%/day.

g) Meteorology assumptions - X/Q values used are 1/10th the values in NRC Regulatory Guide 1.4.

Conservative Assumptions:

a) Same

DRAFT

CLASS 8.3 - LARGE PRIMARY SYSTEM RUPTURE (PARALLEL DESIGN ONLY) (Continued)

Accident Scenario:

Conservative Assumptions: (Continued)

b) A failure occurs in the hot leg elevated piping which sprays sodium for 45 seconds (time for pump coastdown to natural circulation). After pump coastdown, Na continues to leak but not as spray.

PSAR says <1 minute for pump coastdown 45 sec from LMFBR Breach

c) Same.

d) The oxygen content of the cell is higher than for the realistic case. More Na reacts (?).

f) All resultant sodium vapor or suspended aerosols leak from the cell to the outer containment at 100%/day and from the outer containment to the environment at 0.1%/day.

g) On-site meteorology data are used to calculate 5 percentile X/Q values.

e) The radioisotope concentrations in the aerosol are the same as the initial concentrations in the primary coolant and are based on operation with 1% failed fuel. (See PSAR Table 15.6.1.5-2

DRAFT

8.4 Cold Trap Fire - Realistic Dose Evaluation

Assumptions

1) The Na reacts with the available oxygen in the inerted cell. The burning releases Na_2O aerosol.

2) The radionuclide concentrations in the Na are established assuming entire cold trap radioactive inventory is evenly distributed in the 5,000 lbs. Na spill.

3) Cold trap inventory is based on continuous operation for 15 years, with .5% failed fuel.

4) A total of 30 pounds of radioactive Na aerosol is generated during the 5 hours of combustion.

5) The activity of the iodine and volatile solid fission products will be higher in the aerosol than in the Na pool by a factor of 3 (released fraction therefore would be 90/5000) per information in response to Q310.12 on partitioning.

6) Radioactive decay during the accident is neglected.

7) No credit for retention, plate-out, or settling of the aerosol in the cold trap is taken. All the aerosol generated during combustion is released directly to the RCB.

8) Leakage of aerosol from the RCB to the environment was computed using a leak rate of .032% volume/day. No filtering system was used.

9) The short term X/Q was 3.8×10^{-4}. The long term X/Q was 3.5×10^{-6}.

TACT Run by
Don Miller
8/17/76

8.5 Site Suitability Source Term - Realistic Dose Evaluation

DRAFT

Assumptions

1) 100% noble gases, 50% iodines, 1% solid fission products and 1% plutonium reactor inventory released to RCB.

2) 50% plateout of iodines is assumed.

3) Iodine split is 91% elemental, 4% organic and 5% particulate.

4) Credit for fallout in RCB was given. HAA code was used with parameters alpha = .5, epsilon = .5.

5) Containment leakrate of .032% vol./day based on 1 psig overpressure was used.

6) Bypass leakage was 1%.

7) 99% efficiency filters were used for halogens and solids including plutonium.

8) The short term X/Q was 3.8×10^{-4} and the long term X/Q was 3.5×10^{-6}.

TACT RUN BY
DON MILLER
6/17/76

DRAFT

CLASS ~~8.5~~ 8.4 - LOSS OF FLOW W/O SCRAM (PARALLEL DESIGN ONLY)

Accident Scenario:

Realistic Assumptions:

a) A loss of flow occurs without scram and the following fractions of the core inventories of elements are released to the sealed head access area (SHAA):

100% of Kr, Xe, I, Br, Cs, Rb, Te, Se, Sb, As, In, Sn, Ge

11% of Sr, Ba, Ra

8% of Ru, Mo, Pd, Tc, Ag, Cd

1.3% of La, Y, Ce, Nd, Pr, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Zr, Nb, Th, Pa, U, Np, Pu, Am, Cm

10% of Cr, Co, Fe, Ni, Mn

b) Realistic HAA calculations for aerosol agglomeration in the SHAA and the reactor containment building (RCB).

c) Leakage of aerosol and gas particles from the SHAA to the RCB at 100%/day.

d) Leakage of aerosol and gas particles from the RCB to the environment at 0.05%/day.

e) Meteorology assumptions - X/Q values used are 1/10th the values in NRC Regulatory Guide 1.4.

CLASS 8.5 - LOSS OF FLOW W/O SCRAM (PARALLEL DESIGN ONLY) (Continued)

Accident Scenario:

Conservative Assumptions:

a) A loss of flow occurs without scram and the following fractions of the core inventories of elements are released to the sealed head access area (SHAA):

100% of the noble gases, halogens, and volatile fission products

11% of the solid fission products

10% of the plutonium and uranium

No Na is released to the SHAA or RCB.

b) Conservative HAA calculations for aerosol agglomeration in the SHAA and RCB.

c) Same.

d) Leakage of aerosol and gas particles from the RCB to the environment at 0.1%/day.

e) On-site meteorology data are used to calculate 5 percentile X/Q values.

ATTACHMENT FOR INTERROGATORY #50

DRAFT

CRBR Class 9 Accident Assumptions

1) Release from Core:
at $t = 0$

75 Kg of fuel + 69 Kg of Na
is released in containment building.
This includes: 100% NG
10% of volatiles -I, Bc, Cs, Rb, Te, Se, Sb
1% of solid FP's
1% of Pu

at $0 < t < 24$ hrs.

Na is continuously being released from core. Fission products are attached to the coolant in the following ratio: Na/Na total. Except, however, for volatiles which are released at a rate 3 times greater.

2) Engineered Safety Features are working during the $0 < t < 24$ hrs time period.

1) all filters were assumed to be 99% efficient.

2) aerosol depletion is taken into accound during this time period by HAA calculations.

3) at $t = 24$

1) containment ruptures

2) everything which has not fallen out is instantaneously released to environment

Leakrates during the 24 hours were assumed to be proportional to square root of pressure. The range is from 4.029×10^{-2}%/day at .35 hours to 1.726×10^{-1}%/day at 24 hours.

X/Q's based on 50% meteorology:

ER 3.8×10^{-4} sec/m^3
LPZ 3.5×10^{-6} sec/m^3

ATTACHMENT FOR INTERROGATORY #70

ENVIRONMENTAL STANDARD REVIEW PLAN*

FOR ES SECTION 9.2 ALTERNATIVE SITES

REVIEW INPUTS

Environmental Report Sections

9.2	Alternatives Requiring the Creation of New Generating Capacity
9.3	Cost-Effectiveness Analysis of Candidate Site-Plant Alternatives

Environmental Reviews

2	Environmental Descriptions
4	Environmental Impacts of Construction
5	Environmental Impacts of Station Operation
8.1	Description of the Power System

Standards and Guides

Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations"
U.S. Department of Interior, "Threatened and Endangered Species List"
State rare and endangered species lists
Advisory Committee on Historic Preservation, "National Register of Historic Places"
Federal, State, and local Acts, ordinances, requirements, and standards for land use, water use, water quality, and air quality
State siting laws

Other

Responses to requests for additional information
Consultation with local, State, and Federal agencies
Site visits to candidate sites

REVIEW OUTPUTS

Environmental Statement Sections

9.2	Alternative Sites

Other Environmental Reviews

10.4.3	Benefit-Cost Balance: Summary

*The objective of Revision 1 is to make this ESRP consistent with proposed Appendix A to 10 CFR Part 51. (see 45FR 24168 dated April 9, 1980)

I. PURPOSE AND SCOPE

The purpose of this Environmental Standard Review Plan (ESRP) is to direct the staff's analysis and evaluation of alternatives to the applicant's proposed site for the construction and operation of a nuclear power plant. The purpose of the review is to determine whether the proposed site is a reasonable choice from a slate of candidate sites representative of siting resources available to the applicant and identified through an environmentally sensitive selection process. The scope of the review directed by this plan will include making the following determinations:

(a) whether the information submitted by the applicant is sufficient to support the analyses necessary to reach reasoned conclusions;

(b) whether the region of interest considered was of sufficient size to reflect reasonably available environmental diversity of water bodies and associated physiographic units;

(c) whether the candidate sites are the best that could reasonably be found. This will be based on examination of either: (1) the merits of the candidate sites against a set of environmentally oriented criteria, or (2) the selection process against a set of methodological quality criteria;

(d) whether one or more alternative site is obviously superior. This will be based on a sequential two-part analytical test. The first stage of the test will determine whether there is an environmentally preferred site. The second stage of the text will consider economics, technology, and institutional factors to determine whether any environmentally preferred site is obviously superior to the proposed site.

II. REQUIRED DATA AND INFORMATION

III. ANALYSIS PROCEDURE

The staff analysis of alternative sites is a critical element of the environmental review inasmuch as a staff conclusion that an alternative site is obviously superior to the applicant's proposed site must be translated as a recommendation that the application be denied.

Under the general guidance and direction of the project manager, the reviewer* will analyze the sites and procedures selected by the applicant. The reviewer will not develop nor pursue a self-developed site selection program. Therefore, the objectives of this analysis procedure are to accomplish the following:

A. Analyze the reconnaissance-level information used throughout the site selection process so that an eventual evaluation of completeness and a staff determination of whether the information was adequate for the level of screening for which it was used can be made.

B. Review and analyze the region of interest selected by the applicant so that an eventual evaluation of the appropriateness of its size can be made. The main determinant consideration regarding the size of the region of interest is environmental diversity of the types of water bodies available within the region of interest and the associated physiographic units.

C. Analyze the slate of candidate site proposed by the applicant so that an eventual evaluation can be made whether they are among the best that could reasonably be found. This can be shown by either

*The environmental review of alternative sites will include all major aspects of environmental impacts of construction and operation and economic costs (including economic costs related to safety consideration). Accordingly, the activities and inputs of reviewers for all of the above technical disciplines will be required in the conduct of this review and "reviewer" as used in this ESRP refers to any such discipline as may be affected.

(1) a demonstration (according to criteria for site selection procedures set forth in the rule) that the site selection methodology is a reasonable, environmentally sensitive site screening process that provides a diligent search for sites that are among the best that could reasonably be found, or (2) a demonstration that the slate of candidate sites meets the prescribed environmentally sensitive threshold criteria (set forth in the rule) and are, therefore, among the best that could reasonably be found.

D. Analyze the comparison of proposed site with alternative sites in the detail needed to be able to make an eventual evaluation that no alternative site within the region of interest could be judged to be obviously superior to the applicant's proposed site. The analysis will follow the sequential two stage test specified by the rule: First, analyze the environmental comparison to be able to make an eventual evaluation whether any alternative site is environmentally preferable to the proposed site. Second, analyze the comparison of economic, technological and institutional factors to make an eventual evaluation whether an environmentally preferred site is, in fact, obviously superior.

The second analysis need not be performed if the first stage yields an evaluation that none of the alternative sites is environmentally preferable to the proposed site.

E. Recognize that there will be special cases where the proposed site will not have been selected on the basis of a systematic site selection process. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a State government from a list of State-approved power plant sites. For such cases the reviewer will analyze the

applicant's site selection process only as it applies to candidate sites other than the proposed site, and the site comparison process may be restricted to a site-by-site comparison of these candidates with the proposed site.

The following analysis procedure will be used:

A. General

The analysis procedure employed is designed to yield minimum information necessary for the reviewer to arrive at evaluations regarding the following elements specified by Appendix A to 10 CFR Part 50:

1. Information Requirements (leading to evaluation whether it is sufficient to support conclusions).

2. Region of Interest (leading to evaluation whether it is of adequate size).

3. Candidate Sites (leading to evaluation whether they are among the best that could reasonably be found).

4. Comparison of the Proposed Site with Alternative Sites (leading to evaluation whether any alternative site is obviously superior to the proposed site).

B. Informational Requirements

The analysis of informational requirements is conducted throughout the whole process of the review and reflects the totality of provided information considered in the light of case-specific circumstances.

In general, reconnaissance level information (see Appendix A for definition) or analyses is normally adequate as a basis for reasoned decision. The reconnaissance level information is not to mean reliance on limited data and subsequent superficial analysis. If in some cases the reconnaissance level information, on any particular subject, is not sufficient to support reasoned decision, the reviewer will inform and consult with the principal reviewer (project manager) so that the NRC staff can advise the applicant of any additional informational requirement as early as possible.

The reviewer will analyze applicant's submittal, in consultation with appropriate environmental and safety reviewers, and identify all information addressing various aspects of siting that led to applicant's decision. Alternative site analysis of both the identification of the slate of candidate sites and the selection of the proposed site shall, as a minimum, address the following subjects:

a. hydrology, water quality, and water availability

b. aquatic biological resources, including endangered species

c. terrestrial resources and land uses, including endangered species

d. transmission corridors (approximate length and general location) and resources affected

e. socioeconomics, including aesthetics, and archeological and historic preservation

f. population distribution and density

g. facility costs

h. institutional constraints, as they affect site availability

i. public concerns in the above subject areas, where such have been provided to the applicant or NRC in writing.

C. Region of Interest

In order to later determine whether the region of interest employed by the applicant is of suffucient size the reviewer will conduct the analysis according to the following procedures:

1. Identify the geographic area within which the search for sites was conducted.

2. Compare this area to the applicants service territory.

3. Compare this area to the state in which the proposed site is located.

4. In the areas lying within and outside the region of interest identify major diverse environmental qualities:

a. major types of water resources such as: upper or lower reaches of large rivers, small rivers, lakes, bays and oceans; (in areas of critical water supply, ground water and waste water are also appropriate water sources for diversity considerations)

b. major types of associated physiographic units.

5. Identify any constraints on the applicant's siting options (e.g., legal, institutional, political, economic) such as:

a. costs of generating electricity in areas not included in the region of interest,

b. state and local laws governing nonradiological health and safety aspects of utility siting,

c. costs of developing information to demonstrate whether sites within those areas not included would likely be acceptable from the standpoint of safety.

D. Selection of Candidate Sites

The reviewer will identify which of the two options, provided by Section VI, Appendix A, 10 CFR Part 51, was employed by the applicant in demonstrating that the slate of candidate sites is reasonably representative of all of the major diverse environmental qualities present in the region of interest and that they are among the best that could reasonably be found.

The candidate sites used in the subsequent site-specific comparison of alternatives must be one of the following:

a. Be identified through the use of a site selection methodology that (1) includes an environmentally sensitive site screening process (i.e., considers the same environmental parameters that are addressed by the criteria in VI.2.b., although not necessarily in the same way) resulting in a slate of candidate sites that are among the best that could reasonably be found and (2) meets the criteria presented in Section VI.3 Appendix A, 10 CFR Part 51; or

b. Meet the criteria presented in Section VI.2, Appendix A, 10 CFR Part 51 in which case there shall be no further review of the site selection process.

If the approach used to demonstrate that the candidate sites are among the best that could reasonably be found relied on site selection

methodology, the reviewer will analyze the site selection process to the degree necessary to evaluate whether the process meets the following criteria contained in Section VI.3, Appendix A, 10 CFR Part 51:

a. The overall objectives of the siting study and all initial constraints and limitations (including the geographic area, i.e., region of interest, which is the subject of the study) shall be explicitly stated giving the basis and rationale for all choices.

b. The proposed ways of meeting the state objectives shall be described, including the general approach to the site selection process.

c. The study shall explicitly state factors (e.g., aquatic biology) under consideration, parameters (e.g., spawning grounds and nursery areas) by which these factors were measured, and criteria (e.g., no significant impact) that define levels of achievement.

d. The site selection study shall be interdisciplinary and shall include natural, social, and environmental sciences. The range of the responsibilities of the study team shall be clearly defined and the methods employed in resolving differences within the group or of arriving at the consensus shall be explicitly stated.

e. The process that led to the identification of candidate sites including all specific methodologies shall be explicitly stated in detail.

1. Where preemptive screening is used all limiting or exclusionary criteria employed shall be explicitly stated, the bases for each criterion given, and the ways in which they are applied explained.

2. Where comparative analysis is used, all methodologies used involving importance factors, preference functions, utility functions, weighting factors, ranking scales, scoring schemes, and rating systems shall be explicitly described; the basis for the selection of each methodology given; and the ways in which each is applied explained.

f. The study shall contain detailed description of administrative means used to support the site selection study, including any quality assurance program commensurate with the objectives of the study and a data management system for handling technical files, maps, and other information.

g. Definitions of terms used in the study shall be included.

If the approach used to demonstrate that the candidate sites are among the best that could reasonably be found relied on merits of the site attributes, the reviewer will analyze the candidate sites to the degree necessary to determine whether:

a. there are a minimum of four sites selected from the region of interest to provide reasonable representation of the diversity of land and water resources,

b. at least one alternative site is associated with each type of water source and physiographic unit reasonably available within the defined region of interest,

c. at least one alternative site has the same water source as the proposed site,

d. the sites meet the following criteria specified by Section VI.2, Appendix A, 10 CFR Part 51 (technically appropriate and economically reasonable cooling system mitigative measures may be assumed for each candidate site):

1. Consumptive use of water would not cause significant adverse effects on other water users.

2. There would not likely be any further endangerment of a State or Federally listed threatened or endangered plant or animal species.

3. There would not likely be any significant impacts to spawning grounds or nursery areas of significance in the maintenance of populations of important aquatic species.

4. Discharges of effluents into waterways would likely be in accordance with State or Federal regulations (e.g., avoidance of discharges to waters of the highest State quality designation) and would not likely adversely affect efforts of State or Federal agencies to implement water quality objectives (e.g., additional discharges to waters of currently unacceptable quality as determined by a State).

5. There would be no preemption or likely adverse impacts on land uses specially designated for environmental or recreational purposes such as parks, wildlife preserves, State and National forests, wilderness areas, flood plains, Wild and Scenic rivers, or areas on the National Register of Historic Places.

6. There would not likely be any significant impact on terrestrial and aquatic ecosystems, including wetlands, which are unique to the resource area.

7. The population density, including weighted transient population, projected at the time of initial operation of a nuclear power plant, would not exceed 500 persons per square mile averaged over any radial distance out to 30 miles from the site (cumulative population at a distance divided by the area at that distance), and the projected population density over the lifetime of the nuclear power plant would not exceed 1,000 persons per square mile (similarly weighted and measured).

8. The site is not in an area where additional safety considerations (geology; seismology; hydrology; meteorology; and industrial, military, and transportation facilities) or environmental considerations for one site compared to other reasonable sites within the region of interest would result in the reasonable likelihood of having to expend substantial additional sums of money (cumulative expenditures in excess of about 5% of total project capital costs) to make the project licensable from a safety standpoint or to mitigate unduly adverse environmental impacts.

The reviewer should keep in mind that if a site does not meet one or more of the threshold criteria provided in VI.2.b., the site may be acceptable as a candidate if it can be reasonably shown that further examination of that particular type of water source and physiographic unit would not likely identify a site that would meet those same threshold criteria.

E. Comparison of Proposed Site With Alternative Sites

As part of the review leading to determination whether one or more alternative sites are obviously superior to the proposed site, the first part of the two part sequential analytical test required by Section VII.1, Appendix A, 10 CFR Part 51,[1] calls for a determination

[1] In applying both parts of the test, the NRC will give consideration to the inherent uncertainties of cost-benefit analysis techniques and, where applicable, to the disparity in the data base between the proposed and alternative sites.

whether any alternative sites are environmentally preferred to the proposed site. The reviewer will analyze the environmental attributes of candidate sites giving primary consideration to hydrology, water quality, aquatic biological resources, terrestrial resources, water and land use, socio-economics, and population.[2]

If subsequent evaluation determines that no alternative site is environmentally preferred to the proposed site the review of alternative sites stops and a conclusion is drawn that there is no alternative site obviously superior to the proposed site. If, however, one or more alternative sites are judged to be environmentally preferred, the second part of the analytical test takes place.

For that part, the reviewer will analyze economic, technological, and institutional considerations. The following factors, specified by Section VII.1, Appendix A, 10 CFR Part 51, will be analyzed in the second part of the test.

a. The environmental and safety[3] considerations in terms of technology and costs of construction and operation of nuclear power plants at the sites.

[2]This requirement will be modified as approriate to conform to revisions to 10 CFR Part 100.

[3]There are some site safety issues for which a cost-effective means for successful mitigation is not state-of-the-art engineering. For the purposes of alternative site analysis, these site safety issues are considered in terms of site acceptability, i.e, where successful mitigation is considered outside the state of the art, the site would be considered unacceptable. However, where the mitigation of the safety issues are considered to be within the state of the art, the site would be considered acceptable but still must undergo the comparative test, which includes the impact of the mitigation on overall project cost, to determine whether there is an obviously superior alternative. Even though the proposed site successfully passes the early evaluation of alternative sites, it could still be found unacceptable in the later detailed safety review of that site.

b. The forward costs[4] at the proposed site compared to the alternative sites.

c. Other considerations, such as possible institutional barriers. The applicant's proposed site will be rejected solely based on NRC review of alternative sites only when the NRC determines that, considering both parts of the test, there is an environmentally preferable alternative which also is obviously superior, i.e., the NRC is confident that the applicant's proposed site should be rejected.

[4]For cases where the portion of the construction permit application containing facility design is filed 3 years or more after the effective date of this rule, and an early site review application for the review of alternative sites had not been filed at least 2½ years earlier, the costs of moving to another site, including costs of delay, will be given no weight in any consideration of alternative sites or in any decision whether to reopen a previous decision on this subject.

IV. EVALUATION

A. General

Appendix A to 10 CFR Part 51 requires a number of determinations to be made in order to either accept or reject the site proposed by the applicant on the basis of consideration of alternative sites. The rule specifies siting parameters that must be considered in the review and establishes criteria that must be met. Through the evaluation process the reviewer will determine whether the requirements of the rule were met.

The reviewer's evaluation of the consideration of alternative sites and the site-selection procedure will require conclusions with respect to the following:

- Reconnaissance - level information (whether it is complete and sufficient to support conclusions).

- Region of Interest - (whether it is of sufficient size).

- Candidate Sites - (whether they are among the best that could reasonably be found).

- Site Comparison - (whether there is an alternative site that is environmentally preferable which is also obviously superior to the proposed site).

Based on these conclusions the reviewer will determine if any alternative site is environmentally preferable to the applicant's proposed site. If no environmentally preferred site is identified the review of alternative site stops and the proposed site is accepted from the standpoint of alternate sites. If environmentally preferable sites are identified, the reviewer will extend the analysis and evaluation procedures of this ESRP to determine, on a benefit-cost basis, if any such alternative is obviously superior to the applicant's proposed site.

The following general guidance is provided for the reviewer in arriving at conclusions:

B. Reconnaissance - Level Information

Reconnaissance level information, i.e., information or analyses that can be retrieved or generated without the performance of new, comprehensive site-specific investigations, is normally adequate as a basis for identifying candidate sites and for selecting a proposed site. The reviewer in consultation with the individual technical discipline reviewers, will determine whether the reconnaissance-level information used throughout the site-selection process was complete enough and of sufficient depth commensurate with the level of screening to support the decisions that were made.

C. Region of Interest

The initial geographic area for determining the region of interest for NRC regulatory review purposes may be either the State in which the proposed site is located or the service areas of the applicant. The actual region of interest must be longer or may be smaller depending on the environmental diversity, institutional factors and cost considerations.

The reviewer will refer to Section V., Region of Interest, Appendix A, 10 CFR Part 51, for criteria which specify when the initial geographic area may be diminished or must be enlarged. The use of service areas coupled with performance criteria for expansion or contraction is judged to be sufficient to provide a substantial range of environmental alternatives from which to choose in making the final siting decision. Unlimited expansion of the areas to be searched likely would not yield significant additional new alternatives for limiting of environmental impacts that would already be present in a reasonably bounded area. As a practical matter, utilities may initiate their searches within their service areas. In many cases this will lead to the identification of the required diversity

of resources. Where service areas are small, the requirement could cause an expansion that would extend the region of interest beyond the service area boundaries. However, in very large service areas, the required diversity might be found without exploring the entire service area.

The requirements may impose a need for large regions of interest in water limited areas, particularly in the western regions of the nation. The rule is intended to ensure in all cases that all reasonable alternatives have been considered. The analysis of remote alternatives need be carried only as far as necessary to demonstrate the reasons (which include costs) for not considering them further.

The rule is intended to apply to utilities having well defined service areas as well as those that do not. In situations where the State is asking the review of the alternative sites issue or where the service areas of the applicant are not defined, the State in which the proposed site is located would be the starting point for determining the region of interest.

When considering water sources that would provide adequate water availability, the staff intends that the characteristics of the terrestrial watershed (i.e., the physiographic characteristics) also be included and considered. Under this concept, a river having adequate water for a nuclear power plant but that flows through a dedicated terrestrial area such as a national park or national forest might not qualify as an acceptable resources. It is permissible, however, to designate portions of a watershed for possible siting while excluding other portions of the same watershed.

Different portions of a watershed or coastal zone may be considered to be different physiographic units, if the environmental impacts of siting in these areas would be clearly different from one another. For example, the "head waters" region of a river watershed would be designated as a physiographic unit separate from the estuarine region of the same watershed,

since the impacts on fisheries and other aspects of the environment would be clearly different in the two areas. The rule is not intended to compel the consideration of water bodies that are in similar physiographic settings, since that would not add significantly to the range of environmental choice.

In emphasizing the terrestrial components the staff intends that the search for sites should not be confined to land areas immediately adjacent to water bodies but should be expanded to include a reasonable corridor of search around the water body. Siting up to several miles from a suitable water body may be desirable to avoid land use conflicts that are often found adjacent to water bodies. Using criteria of Section V., Region of Interest, Appendix A, 10 CFR Part 51, the reviewer will determine whether the region of interest employed by the applicant is of sufficient size.

D. Selection of Candidate Sites

The rule provides the applicant with a choice of two approaches to demonstrate that the candidate sites are among the best that could reasonably be found, the process-oriented approach and the product-oriented approach. The reviewer will evaluate the candidate sites using either one of the approaches, but not both.

The rationale for the process-oriented approach is to provide guidance to all parties regarding the elements that govern NRC reviews of that process. The general rationale for the product-oriented approach is that candidate sites that pass all of the proposed threshold standards would be unlikely to have substantial, unidentified, adverse environmental impacts. Therefore, the resulting slate of candidate sites likely would be of comparable environmental quality and should be environmentally acceptable to the NRC. While there could be a situation where the proposed site could be marginal with respect to several of the thresholds and thus might be inferior on a cumulative impact basis, it would be

unlikely that all the candidate sites would be similarly inferior. Thus the proposed site's inferiority would be clearly displayed in the subsequent detailed comparison with the other candidate sites.

The rule provides that the slate of candidates sites should contain at least four sites. The reason for this is to ensure that even in regions of little diversity, there is some choice among the sites in the slate. For more diverse regions the criteria controlling how many sites would be necessary are oriented towards the diversity of environmental qualities presented, so as to give a meaningful environmental comparison of alternatives. The candidate sites would be required to be reasonable representative of all of the major diverse environmental qualities present in the region of interest, as follows:

a. Major types of water sources.

b. Major physiographic units.

c. Consideration of sites of existing electric generating facilities as well as new sites.

As an example of acceptable diversity, if a new site on a lake in a woodland area was already identified as a candidate site, a woodland site on another lake within the region of interest would not be required, unless that site also hosts an existing electric generating facility.

For the process-oriented approach the reviewer will determine whether the site selection process reasonably satisfies each of the criteria contained in Section VI.3, Appendix A, 10 CFR Part 51. Any deficiency identified during the review will be assessed by the reviewer and discussed in the written evaluation as to its relative significance in the site-selection process and its potential effect on the choice of the proposed site.

For the product-oriented approach the reviewer will determine whether:

1. there are a minimum of four sites selected from the region of interest,

2. at least one alternative site is associated with each type of water source and physiographic unit reasonably available within the defined region of interest,

3. at least one alternative site has the same water source as the proposed site,

4. candidate sites meet each of the criteria specified in Section VI.2.b, Appendix A, 10 CFR Part 51.

If a site does not meet one or more of the threshold criteria provided in VI.2.b, the site may be acceptable as a candidate if it can be reasonably shown that further examination of that particular type of water source and physiographic unit would not likely identify a site that would meet those same threshold criteria.

If any candidate site does not meet one or more of the threshold criteria provided in VI.2.b. to such an extent that serious adverse environmental impacts would result from its use, that site should be rejected as a candidate site.

Based on the evaluation against the above criteria the reviewer will determine whether the candidate sites are among the best that could reasonably be found.

E. Comparison of Proposed Site with Alternative Sites

The objective of this phase of the evaluation procedure is (1) to determine if the applicant has reasonably identified and described

site characteristics, predicted the environmental impacts of construction and operation at these sites, and developed and used a logical, reproducible means of comparing sites that has led to the applicant's selection of the proposed site, and (2) to determine if any candidate site can be shown to be obviously superior to the applicant's proposed site.

Many of the evaluation steps must be based on use of reviewer judgment. For these evaluations, the principal criterion will be that of reasonableness of the applicant's data and procedures. Since the evaluation involves a number of scientific and technical disciplines the reviewer will consult with reviewers of ES Section 2, 4, and 5.

The objective of this evaluation of this portion of the applicant's process is not to determine whether the applicant has selected the best site (since on the basis of previous evaluations the reviewer has determined those candidate sites that can reasonably be expected to be licenseable) but is to determine if any candidate site can first be judged as environmentally preferred and then, based on the comparison of economic technological, and institutional factors, be also judged superior to the applicant's proposed site.

The rule provides that "in applying both parts of the test, the NRC will give consideration to the inherent uncertainties of cost-benefit analysis techniques and, where applicable, to the disparity in the data base between the proposed and alternative sites". To implement this provision, the basic decisional criterion for determination of environmental preference and obvious superiority should be existence of an important difference, in one or more important factors between the alternative and the proposed site. Such determination should not depend on slight differences which can be explained by inherent uncertainties in the data base or analysis.

For the first part of the two-part analytical test the comparison will focus on environmental considerations of hydrology, water quality, aquatic biological resources, terrestrial resources, water and land use, socioeconomics and population. If the results of this comparison indicate that no alternative site can on balance be judged environmentally preferred, the reviewer can stop the review and draw the conclusion that no alternative site is obviously superior to the proposed site, and, therefore, the proposed site is acceptable from the standpoint of alternative sites consideration.

If the comparison identifies one or more environmentally preferred alternative sites, the reviewer will continue the comparison using economics, technology and institutional factors to determine whether such environmentally preferred site is obviously superior. The reviewer need not establish or confirm a relative ranking of candidate sites but must make the determination on a one-by-one comparisons of sites.

Since a determination of existence of an obviously superior alternative site can lead to the rejection of the site proposed by the applicant, such a conclusion must be supported by the corresponding ES Sections 2, 4, and 5 reviewers.

When the reviewer determines that an obviously superior site can be identified, the reviewer will consult with the applicant to determine the applicant's reasons (if not already available) for not selecting that particular site. In addition, the reviewer will document the conclusion that an alternative site is obviously superior to the proposed site.

V. INPUT TO THE ENVIRONMENTAL STATEMENT

This section of the environmental statement should be planned to accomplish the following objectives: (1) a brief description and evaluation of the applicant's site selection process, (2) description of the staff analysis, and (3) presentation of staff conclusions and recommendations regarding alternatives to the proposed site. The following information will usually be provided in ES Section 9.2 in a summary format:

A. Applicant's Site-Selection Process

1. A description of the applicant's documented site-selection process methodology, including a summary of the process objectives.

2. A description of the selected region of interest.

3. A list and general description of the candidate sites.

B. Staff Analysis

1. A description of the process used by the staff to review the applicant's selected region of interest, candidate sites, methodology, the selection criteria used by the applicant, and comparisons of the alternative sites to the proposed site.

C. Staff Conclusions

1. Conclusions with respect to the reconnaissance-level information.

2. Conclusions with respect to the size of the region of interest.

3. Conclusions with respect to the applicant's objective to identify candidate sites that are among the best that could reasonably have been found by:

a. meeting the product-oriented criteria of Section VI.2, Appendix A, 10 CFR Part 51, or

b. meeting the process-orientded criteria of Section VI.3, Appendix A, 10 CFR Part 51.

4. Conclusions with respect to the identification of an environmentally preferred site.

5. Conclusions with respect to the identification of an obviously superior site.

6. Recommendations for consideration of acceptance or rejection of the site proposed by the applicant.

In addition, the reviewer will provide inputs to the following ES Sections:

Section 10.4.3. The reviewer will present results of the evaluation of these data to the reviewer for ES Section 10.4.3 as a conclusion that (1) the proposed site is acceptable, or (2) that an obviously superior site reasonably available to the applicant has been identified and that rejection of the applicant's proposed site has been recommended.

VI. REFERENCES

1. Atomic Industrial Forum, Nuclear Power Plant Siting, A Generalized Process, National Environmental Studies Project, R-1578, August 1974.

2. R.L. Keeney and H. Raiffa, Decisions with Multiple Objectives, John Wiley and Sons, New York, N.Y. 1976.

3. K. Nair and R.L. Keeney, Selecting Nuclear Power Plant Sites Using Decision Analysis, Woodward-Clyde Consultants, San Francisco, CA, 1975.

4. H. Raiffa, Decision Analysis, Addison-Wesley Publishing Company, Reading, Mass. 1970.

5. R.L. Keeney and C. W. Kirkwood, An Evaluation of Nuclear Power Plant Siting Methodologies, and Woodward-Clyde Consultants, San Francisco, CA, 1977.

ENVIRONMENTAL STANDARD REVIEW PLAN

FOR ES SECTION 9.2 ALTERNATIVE SITES

APPENDIX A DEFINITIONS

A. "Region of Interest" means the geographic areas considered in searching for candidate sites.

B. "Candidate Sites" means those sites that are within the region of interest and are considered in the comparative evaluation of sites for a nuclear power plant and are judged to be among the best that can reasonably be found for the siting of a nuclear power plant.

C. "Proposed Site" means the candidate site submitted to the NRC by the applicant, or a person requesting an early review pursuant to Appendix Q of 10 CFR Part 50, as the proposed location for a nuclear power plant.

D. "Alternative Sites" means those candidate sites which are specifically compared to the proposed site to determine whether there is an obviously superior alternative site.

E. "Slate of Candidate Sites" means the group of candidate sites comprised of the proposed site and all alternative sites.

F. "Environmental Preferred Alternative Site" means an alternative site for which the environmental impacts are sufficiently less adverse than for the proposed site that environmental preference for the alternative site can be established.

G. "Site" means the geographic area needed for the construction and operation of a nuclear power plant, including the associated transmission corridors to the first intertie.

H. "Reconnaissance Level Information" means any information or analyses that can be retrieved or generated without the performance of new, comprehensive site-specific investigations. Reconnaissance level information includes relevant scientific literature, reports of government or private research agencies, consultation with experts, short-term field investigations, and analyses performed using such information. The amount of reconnaissance level information and the extent of analyses conducted depend on (1) the importance and magnitude of the potential impact under evaluation and (2) whether the decision is one of identifying a region of interest, identifying candidate sites, or selecting a proposed site.