NUREG-0968
Supplement No. 2

Safety Evaluation Report
related to the construction of the Clinch River Breeder Reactor Plant

Docket No. 50-537

U.S. Department of Energy
Tennessee Valley Authority
Project Management Corporation

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

May 1983

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1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

In March 1983, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-0968) regarding the application for a license related to the construction of the Clinch River Breeder Reactor Plant.

Since the preparation of the Safety Evaluation Report the Advisory Committee on Reactor Safeguards considered the Clinch River construction permit license application at its 276th meeting and subsequently issued a favorable report, dated April 19, 1983 to the Commission. In addition, we had received and reviewed additional documents associated with the application, and held a number of meetings with the applicants. These events and documents were identified in SSER-1 issued on May 2, 1983.

This supplement, SSER-2, to the Safety Evaluation Report, provides our evaluation of additional information received from the applicants since preparation of the SSER-1 regarding previously identified outstanding review items. This Supplement also provides additional information on radiological doses in Appendix A.5.

Each section of this supplement is numbered and titled to correspond to the sections of the Safety Evaluation Report (SER) that have been affected by our additional evaluation and does not replace the corresponding section of the SER. Appendix E is a continuation of the chronology and lists additional documents used in the supplemental review. Appendix J is an errata sheet for the SER.

The NRC Licensing Project Manager for the Clinch River Breeder Reactor Plant is Richard M. Stark. Mr. Stark may be contacted by calling (301) 492-9732 or by writing to: CRBR Program Office, U. S. Nuclear Regulatory Commission, Washington, D.C. 20555.

1.6 Summary of Outstanding Construction Permit Issues

The staff had identified certain outstanding issues in its review which had not been resolved with the applicants at the time the SSER-1 was issued. The current status of all open items is discussed below:

Item and Section	Status
(1) Review of RDT Standards F9-4T and F9-5T (3.9.9.2.3)	Closed in SSER-1
(2) Compliance with Regulatory Guide 1.75 (7.2.2.6)	Closed in SSER-2
(3) Plant Protection System Monitor (7.2.2.7)	Closed in SSER-1
(4) Solid-State Programmable Logic System (7.3.2.4)	Closed in SSER-1
(5) Emergency Planning, 10 CFR 50, Appendix E, Part II, Requirements A and B (13.3.2.1)	Closed in SSER-1
(6) Quality Assurance (17.3)	Closed in SSER-2

7.2.2.6 Regulatory Guide 1.75

On the basis of its review of the information furnished by the applicants regarding physical separation between the same division (channel) of the primary and secondary Reactor Shutdown Systems (RSSs) and between the same division (channel) of the Direct Heat Removal Service (DHRS) and the Steam Generator Auxiliary Heat Removal System (SGAHRS) (reported in Sections 7.2.2.6 and 7.6.2.1 of the SER), the staff questioned the rationale for not providing separation in accordance with Regulatory Guide (RG) 1.75.

In a letter dated February 15, 1983 from John R. Longenecker to J. Nelson Grace the applicants provided a discussion of the physical separation criteria used.

A synopsis of the criteria for physical separation of the primary and secondary RSS is as follows:

- All RSS cables shall be run in conduits or enclosed raceways with primary and secondary RSS cables run in separate conduits or enclosed raceways.
- Separate penetrations shall be used for primary and secondary RSS cables.
- A minimum separation of 5 feet shall be maintained between conduits or enclosed raceways of primary and secondary RSS of the same division channel, except in some areas of the Head Access Area (HAA) where geometry prohibits 5 feet of separation or in areas where panel locations prohibit 5 feet of separation. For these areas, conduits and raceways of primary and secondary RSS will be physically separated to the maximum extent possible.

For the hazard areas of the plant, fire barriers between the two shutdown systems will not be provided. For these areas, the applicants stated that a fire hazard analysis (ES-26NS-10-004) has determined the following:

a) The sources of fire mainly consist of the following:

  - cable insulation
  - electrical panelboards and equipment
  - cable termination and installation material including cable ties
  - lubricating oils

b) The bulk of the heat sources are those associated with the cable insulation. The cables used are fire retardant and are qualified in accordance with IEEE 383. The lubricating oils are contained within the bearings or lubrication systems of equipment and constitute a very small portion of the total combustibles. An extensive fire detection system is provided in these areas. Additionally, line type heat detectors are provided in cable trays containing safety related cables. As such, the fire hazard from cable insulation and other materials located in these cells is considered minimal.

A synopsis of the criteria for physical separation between SGAHRS and DHRS provided in the February 15, 1983 letter is as follows:

- o SGAHRS and DHRS equipment shall be located in different hazard areas except for the equipment in the control room.
- o SGAHRS and DHRS cable of the same channel may be routed together, but this will be limited to a common raceway from the Main Control Room for a short distance (approximately 75 feet) into the Steam Generator Building (SGB).

After reviewing the separation criteria used between DHRS and SGAHRS, the staff questioned the rationale for having the approximate 75 feet of cable from the control room into the SGB where the recommendations of R.G. 1.75 are not followed. In a letter dated April 1, 1983 from John R. Longenecker to J. Nelson Grace, the applicants stated that the separation criteria utilized would be modified for the approximate 75 feet of cable routing in question and would be routed in accordance with the physical separation provisions of R.G. 1.75 by maintaining a minimum physical separation of five feet between the same division of DHRS and SGAHRS. However, fire barriers between the same divisions (channels) of DHRS and SGAHRS will not be provided.

The applicants stated that a fire hazards analysis (ES-26NS-10-004) has shown that the bulk of the heat sources for this area are those associated with the cable insulation. The cables used are fire retardant and are qualified in accordance with IEEE 383. An extensive fire detection system is provided in this area. Additionally, line type heat detectors are provided in cable trays containing safety related cables. As such, the fire hazard from cable insulation and other materials located in these cells is considered minimal.

The staff has reviewed the PSAR and the information provided by the applicants in response to our questions and concluded that the criteria for separation between divisions (channels) and between divisions (channels) of DHRS and SGAHRS are acceptable. The applicants have confirmed that the approximate 75 feet of DHRS and SGAHRS cable routing from the control room into the SGB will be run in separate conduits or enclosed raceways (ref. May 16, 1983, Longenecker to Grace letter).

17 QUALITY ASSURANCE

17.3 Q. A. Program

The staff's evaluation of the applicants' Q.A. program is provided in Section 17.3 of the Clinch River Breeder Reactor Plant (CRBRP) SER (NUREG-0968, dated March 1983). The program was reviewed against the applicable Q.A. criteria of 10 CFR 50 Appendix B (As reflected in NUREG-0800, "Standard Review Plan") and TMI Action Plan (NUREG-0660) Item I.F. In the SER the staff indicated that it was still reviewing the list of structures, systems, and components controlled by the CRBR QA program. The staff has completed its review and asked several questions in this regard. The applicants have provided a response (Longenecker to Grace letter dated May 5, 1983) which acceptably addressed the staff questions. Thus, the staff has found the description of the applicants' QA program and the list of items to which it applies acceptable and now has no open items in this regard.

Addition to Appendix A.5

The staff evaluated the radiological consequences of CDAs and reported the results in Appendix A.5 of the March 1983 SER. In our March and April 1983 meetings with the ACRS additional details were provided to the Committee. The staff has recently provided these details as additional information relative to a discovery request in the CRBR hearing process. Therefore, in order to provide a more complete staff evaluation the additional information regarding the staff evaluation is added here. The staff conclusion in the March SER is not altered by this additional information.

Using the TACT code, the staff has evaluated the radiological consequences of a CDA scenario. Further, the assumptions used in evaluating the CDA were judged to be conservative. Because this type of accident requires multiple failures, is less likely and is more severe than accidents normally evaluated in the staff's safety review, the staff utilized more realistic assumptions than used for DBAs. While the assumptions were more realistic they were nevertheless conservative. For example, the staff assumed that the exposed individual remains in one place the whole time, i.e., at the LPZ boundary for 30 days without protective measures.

The assumptions and related parameters are summarized in Table 1A. The results of the dose computation are presented in Table 2A. The realistic (albeit conservative) scenario used in developing this case gives the staff confidence in the applicants' claim that the critical organ dose for a CDA would be within the 10 CFR Part 100 dose guidelines. The 10 CFR 100 guidelines were developed for siting analysis and are often applied in design-basis accident analysis. Nonetheless, the comparison to 10 CFR 100 dose guidelines is made here to provide perspective regarding the relative severity of the CDA consequences and to provide assurance that if such an event were to occur that adequate accommodation has been provided to limit the consequences of such an event, so that doses would not exceed dose guidelines in 10 CFR Part 100. Throughout this appendix, dose comparisons to 10 CFR 100 guidelines are made on the basis of realistic calculations for CDAs.

The staff has also evaluated variations in the timing of certain radionuclide releases in order to judge the sensitivity of the radiological consequences to alternative scenarios. The staff found that timing variations did not alter the conclusions with respect to radiological consequences of a CDA. Therefore, the staff concludes that the calculated doses for a CDA for all critical organs would not exceed the 10 CFR Part 100 dose guidelines based on a realistic scenario.

TABLE 1A

HCDA MODEL PARAMETERS

Power (Mwt)	1121
Leakrate (%/day)	
0-24 hours	0.1
1-30 days	0.05
Vent/purge rate (CFM)	
0-24 hours	0
24-27 hours	20,000
27-720 hours	17,000
Fission Product Release (%)	
Noble gases (instantaneous release at 0 hours)	100
Halogens (10-130 hours)	100
Cs-Rb (instantaneous release at 10 hours)	100
Te-Sb (10-130 hours)	100
La (10-130 hours)	0.16
Ru (10-130 hours)	0.16
Ba-Sr (10-130 hours)	0.16
Annulus filtration system (CFM)	
Recirculation 0-24 hours	11,000
1-30 days	0
Exhaust 0-24 hours	3,000
1-30 days	0
Bypass fraction (%)	
0-24 hours	0
1-30 days	100
Pool Boiling rate (%/day)	
0-10 hours	0
10-27 hours	20
27-96 hours	40
96-130 hours	10,000
Rate of removal by fallout (hr^{-1})	0.72
Particulate Filter Efficiency (%)	99

Exclusion Area Boundary, X/Q (50% meteorology), (sec/m^3)	
0-2 hours	1.3×10^{-4}
Low Population Zone X/Q (50% meteorology), (sec/m^3)	
0-8 hour	1.1×10^{-5}
8-24 hour	1.0×10^{-5}
24-96 hour	8.0×10^{-6}
96-720 hour	5.7×10^{-6}

TABLE 2A

Calculated Doses for Postulated HCDA

Dose at LPZ (Rem)					Percent of Core Released to Environment						
Whole Body	Thyroid	Bone	Lung	Liver	I-Br	Xe-Kr	Cs-Rb	Te-Sb	La	Ru	Ba-Sr
8	192	8	8	2	0.031	23	0.0001	0.01	0.0002	0.0002	0.0002

1. Lanthanides include Y, La, Zr, Nb, Ce, Pr, Nd, Np, Pu, Am, Cm.
2. Rutheniums include Ru, Rh, Mo, Tc.
3. Calculated two-hour doses at the Exclusion Area Boundary were negligible.
4. Iodine compounds were assumed to be filtered as a particle.

APPENDIX E

CHRONOLOGY

April 28, 1983	Applicants submitted revised response to Open Item No. 6, "Quality Assurance."
May 2, 1983	Letter to applicants providing final photo copy of SER Supplement No. 1.
May 4, 1983	Notice of meeting with the applicants for May 24, 1983, to review the status of the PRA Program.
May 5, 1983	Applicants submitted revised response to Open Item No. 6, "Quality Assurance."
May 16, 1983	Applicants submitted information on cable separation.

APPENDIX J

ERRATA TO MAY SSER-1

Page 3-2, 2nd paragraph, 1st line, change "RDT Standard F9-ST" to "RDT Standard F9-5T".

Page 3-3, top of page, 1st line, change "damage actions" to "damage fractions".

Page 3-3, 2nd paragraph, 2nd line, change "(membrane, pending, peak)" to "(membrane, bending, peak)".

ERRATA TO MARCH SER

Page 4-85, 2nd paragraph, 3rd line, change "unlikely" to "likely".

Page A.5-16, 1st paragraph, 6th line, change "20" to "10".

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16. ABSTRACT (200 words or less)

Supplement No. 2 to the Safety Evaluation Report for the application by the United States Department of Energy, Tennessee Valley Authority, and the Project Management Corporation, as applicants and owners, for a license to construct the Clinch River Breeder Reactor Plant (Docket No. 50-537) has been prepared by the Office of Nuclear Reactor Regulation of the United States Nuclear Regulatory Commission. This supplement provides an evaluation of additional information received from the applicants on previously identified outstanding review items since the preparation of Supplement No. 1. Also provided is additional information on radiological doses in Appendix A.5.

17. KEY WORDS AND DOCUMENT ANALYSIS

17a DESCRIPTORS

Clinch River Breeder Reactor Plant
(CRBRP)
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17b IDENTIFIERS/OPEN ENDED TERMS

18 AVAILABILITY STATEMENT

19 SECURITY CLASS (This report)
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