Department of Energy
Washington, D.C. 20545
Docket No. 50-537
HQ:S:83:199

JAN 27 1983

Mr. Paul S. Check, Director
CRBR Program Office
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Check:

ADDITIONAL INFORMATION ON SODIUM SPILL VOLUMES - CLINCH RIVER BREEDER REACTOR PLANT

Enclosed is additional information on sodium spill volumes for inerted cells as requested by the staff. It will be incorporated into the Preliminary Safety Analysis Report in a future amendment.

Any questions regarding the information provided can be addressed to Mr. W. Pasko (FTS 626-6096) or Mr. D. Florek (FTS 626-6188) of the Project Office Oak Ridge staff.

Sincerely,

John R. Longenecker

John R. Longenecker
Acting Director, Office of
Breeder Demonstration Projects
Office of Nuclear Energy

Enclosure

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c) pipe embedded in concrete and welded directly to cell liner with full penetration welds.

Penetrations between inerted cells having a common atmosphere may also consist of an open pipe sleeve which is welded to the cell liner 59 at each face with full penetration welds.

3A.8.3 Design Evaluation

The piping integrity investigation analysis of crack growth due to all design duty cycle events indicated negligible crack growth. Based upon this evaluation, it is concluded that no leaks will occur under operation in accordance with the piping design specifications.

The sodium and NaK components and piping in the CRBRP nuclear steam supply system and auxiliary systems are all designed to prevent leakage. The liners in cell which contain sodium or NaK should therefore not be exposed to any conditions more severe than those corresponding to normal plant operation. However, accidental sodium leaks or spills cannot be precluded and therefore 45 must be considered in the design of the liners.

To accommodate the effects of accidental sodium leaks or spills, the cell liners will be designed for a design basis sodium spill. Based on the operating experience of existing sodium facilities and previous assessments of sodium spills, the amount and/or leakage rate of an accidental sodium spill into a cell are minor. Leaks which could develop from flaws, fatigue, creep, etc. are expected to be much less than the Design Basis Leak as discussed in Reference 2 of Section 1.6.

3A.8.3.1 Sodium Spill Evaluation

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The evaluation of the consequence of sodium spills is provided in PSAR Section 15.6. The method and criteria for evaluation of the cell liners are discussed in Section 3.8-B.

3A.8.3.2 Brittle Failure Potential of the Liner in Irradiated Areas

The increase in ductile-brittle transition temperature due to neutron damage is estimated to be less than 10oF for the reactor cavity liner. This is based on damage function analysis, which indicates that the damage level for the neutron spectrum in the reactor cavity will be 37 approximately 100 times lower than that for LWR reactor vessels.

For the neutron embrittlement evaluation of the cell liner plate, the methods and limits established by USNRC Regulatory Guide 1.99, "Effects of Residual Elements on Predicted Radiation Damage to Reactor Vessel Materials" will be used. The only area of the plant exposed to neutron fluence is the reactor cavity. By considering the worst case exposure condition for the reactor cavity cell liner where the maximu fluence is 7.8×10^{18} n/cm^2, (E >0.1 MeV) and 6.1×10^{13} n/cm^2 (E <1.0MeV), the maximum adjustment of Nil-ductility temperature (NDT) is 10^{o}F and does not require trace element control. This indicates that the liner steel is not effected by neutron 59 embrittlement nor does gamma radiation result in steel degradation.

Amend. 59
Dec. 1980

INSERT TO 3A.8.3.1

Cells other than those analyzed in PSAR Section 15.6 are analyzed in a similiar fashion. The cells will be designed to accommodate the peak pressure from these spills. For the cells that are specified as a 15 psig cell, the worst case maximum peak pressure is calculated to be 13 psig. For the cells with a 12 psig design pressure the peak cell pressures are in the range of 2-6 psig.

ATTACHMENT C

DESIGN BASIS LEAKS

To accommodate the effects of accidental sodium leaks or spills, the cell liners shall be designed for a design basis sodium spill. Based on the operating experience of existing sodium facilities and previous assessments of sodium spills, the amount and/or leakage rate of an accidental sodium spill into a cell are minor. To insure that cell structures are conservatively designed, leak rates, spill volumes and spray impingements used to establish structural loadings are based on leakage from a sharp edged circular orifice whose area is equal to one quarter of the pipe wall thickness multiplied by the pipe inside diameter. This leakage criterion is consistent with the intent of the moderate energy fluid system leak defined for fluid systems with low stored energy in NRC Branch Technical Position MEB3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment."

Leak rate time histories for the Primary Heat Transport and Reactor Cavity Cells are defined in Table 15.6.1.4-1. Leakage flow-rates for postulated leaks in the Auxiliary System piping in Reactor Containment and Reactor Service Building inerted cells range from approximately 100 GPM to 6 GPM.

The total spill volumes and spill temperature for the inerted cells are found in Table 3.8-B.C-1

TABLE 3.8-B.C-1

SPILL VOLUMES IN INERTED CELLS

Cell	Spill Volume (Gallons)	Spill Temperature °F
101A	See 15.6.1.4	See 15.6.1.4
101C	"	"
101D	"	"
101E	"	"
102A	25,400	830
102B	25,400	830
103	25,400	830
104	25,400	830
107A	25,400	830
107B	25,400	830
107C	25,400	830
121	See 15.6.1.4	See 15.6.1.4
122	"	"
123	"	"
131	700	200 (NaK)
132	400	830
141	360	830
157A	17,500	830
157B	17,500	830
157D	17,500	830
157E	17,500	830
331	4,650	600
331A	4,650	600
337	15,250	600
351A	700	400
351B	15,250	600
351C	15,250	600
351D	15,250	600
357	4,800	600
357A	4,800	600
357B	4,800	600
360	15,250	600
360A	15,250	600
361	15,250	600
386	840	600
387	630	600