Department of Energy
Washington, D.C. 20545

Docket No. 50-537
HQ:S:82:134

DEC 0 1 1982

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:

PROJECT ACTIONS FROM OCTOBER 18, 1982, CLINCH RIVER BREEDER REACTOR PLANT (CRBRP)/NUCLEAR REGULATORY COMMISSION (NRC) CONTAINMENT SYSTEMS MEETING; RESPONSE TO ITEM 6

Enclosed is an update to Preliminary Safety Analysis Report (PSAR) Section 6.2 concerning "open containment." This update responds to item 6 of the action items from the October 18, 1982, CRBRP/NRC Containment Systems Meeting. The remaining PSAR amendments will be submitted in early December as committed at the meeting.

Sincerely,

John R. Longenecker

John R. Longenecker
Acting Director, Office of the
Clinch River Breeder Reactor
Plant Project
Office of Nuclear Energy

Enclosure

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APPENDIX TO PSAR SECTION 6.2
OPEN CONTAINMENT SYSTEM

Open Containment Concept

The CRBRP containment design as described in detail in Section 6.2 incorporates the features which support the "open containment" concept (i.e., operate with a continuous ventilation purge).

1.0 Slow Accident Development

Features incorporated in the design and evaluation which support these characteristics are consistent with current LMFBR technology. Unlike the LWR where the accident can be postulated which result in a very rapid increase in containment pressure and temperature, the postulated events for CRBRP as detailed in Section 6.2.1.3 and Chapter 15 are very slow developing events.

In the LMFBR there are no identified accidents within the design base capable of producing any rapid changes in containment temperature or pressure. For example, for the CRBRP design base accident, the containment atmosphere pressure changes by less than 1 psig over a period of almost 100 hours from accident initiation.

An additional contributor to the slow development of the accident is the design of the inner cell system. The areas within the CRBRP containment which contain radioactive material are heavily compartmented. The reactor coolant boundary is contained within separate, inerted concrete cells, with no interconnections with the containment atmosphere. Similarly, other radioactive items, such as cold traps, are within their own inerted cells. Thus, any release of radioactive material from the reactor coolant boundary and other radioactive components would be to a localized area only. While rapid changes may occur in the temperature, pressure, sodium aerosol concentration, etc., in these cells, such changes would be translated to the containment over a relatively long period of time, and would be substantially reduced by the relative volume of a cell as compared with containment volume.

The containment response (pressures, temperatures and aerosol concentrations) to the containment design basis accident is presented in PSAR Chapter 6.2, Figures 6.2-2 through 6.2-7. As indicated in these figures, the containment and cell pressures and temperatures increase very slowly. This is due to the slow development of the Na pool fire in the primary cell. These figures are developed from the event analysis described in Section 6.2.1.3 where the cell is deinerted and open to the containment atmosphere and the reactor is shut down.

However, under all plant operating conditions, the cells will be inerted and isolated from containment atmosphere. Under these conditions, a sodium spill and resulting fire will be contained in the cell and will not affect the balance of containment. In addition to the compartmented construction of the containment, the reactor coolant system boundary is at a very low pressure with substantial fractions maintained at atmospheric or even sub-atmospheric internal pressures.

These characteristics of LMFBR acidents are sufficiently different in nature from those of LWRs to justify consideration of a very different approach to the containment concept. Because of these characteristics, rapid isolation of containment following an accident, though provided in the design, is not essential from the viewpoint of offsite doses. To illustrate this point, Table 6.2A-1 shows the effect of a 1 hour and a 2 hour delay in containment isolation time for the containment design basis event. For these reasons, it is not considered necessary to restrict access to containment during normal operation, except from considerations of plant security and good management of the plant.

2.0 Containment Access Controls

Access to the containment will be controlled by the CRBRP Security Plan which is in compliance with current regulations pertaining to industrial security.

3.0 Human Factors and Human Error Considerations and ALARA

With the "open containment" concept and controlled access as stated in Section 2.0, the number of personnel in containment during periods of plant shutdown will be substantially reduced, since most of the system inspections and instrument calibrations will be conducted at power. In this way, the in-containment work load can be programmed on an orderly schedule such that only a few people would be inside containment at any given time.

These inspections and calibrations will be conducted by qualified personnel under close supervision using detailed procedures, thereby reducing the potential for error.

The "open containment" concept supports operations in the containment building by plant personnel without the encumbrance contributed by the use of a fresh air mask. Evaluations of the effect on the efficiency of personnel when using fresh air masks and the benefit derived in providing personal protection indicate that personnel efficiency will decrease in the range of 30% to 70% dependent upon the activity being performed, conditions under which the activity is being performed and individual respiratory rates, with an average decrease in efficiency of 50%. A decrease in personnel efficiency would result in an average increase in personnel exposure, which is contrary to the intent of the ALARA program. If a "closed containment" concept were used, the buildup of dose rates inside containment would be that from minor cover gas (argon) leaks, and bleed off from nitrogen operated components. Since this gaseous dose rate is a whole body dose rate, the use of respirators would not provide a decrease in exposure.

A tabulation of personnel activities required in containment is summarized in Table 6.2A-2.

Those activities performed in containment during operation are in the following general categories.

1. Surveillance activities
2. Inspections
3. Maintenance activities
4. Plant Alarm Responses

An estimate of the radiation exposure resulting from performing these activities in a closed containment during operation indicate a substantial increase in exposure as summarized in Table 6.2A-3, with zero days after isolation established as the base for "open containment". This gives a quantitative measure of the ALARA benefits of the concept selected.

4.0 NUREG-718, Licensing Requirements for Pending Applications for Construction Permits and Manufacturing License

NUREG-718, Sections II.E.4.1 through II.E.4.4 are addressed in PSAR Appendix H.

TABLE 6.2A-1

SENSITIVITY OF OFF-SITE DOSES TO DELAY IN ISOLATING CONTAINMENT

Event	Dose Type	Dose Value (rem)		
- —		Nominal (PSAR)	1-hr delay	2-hr delay
Containment	2-hr Whole Body EB	0.02	0.3	1.1
DBA	Thyroid	0.08	1.1	4.1
	bone	0.3	4.1	15.0
	lung	0.02	0.2	0.8
	30-day Whole Body LPZ	3×10^{-3}	0.05	0.2
	Thyroid	0.01	0.2	0.7
	bone	0.05	0.7	2.4
	lung	3×10^{-3}	0.04	0.1

TABLE 6.2A-2

SUMMARY OF RCB ACTIVITIES NECESSARY DURING NORMAL PLANT OPERATION

Activity Classification	No. of Cells Entered	Time/Cell Est. M/H	Frequency of Activity
Periodic surveillance of electrical equipment located in RCB to ensure no abnormal conditions exist	15	0.75	1/shift
Operational checks on air handling units, unit coolers, fans, heating and cooling coils	6	0.5	1/shift
Surveillance of coolers, fans and panels	11	0.5	1/shift
Monitor Head Heating System control panel, record temperatures	1	0.2	1/shift
Monitor Plug Annulus Sealing System	1	0.2	1/shift
Operational check of PHTS I&C panel	1	0.25	1/shift
Cover gas sampling	3	0.20	1/day
Operation at plugging temperature indicator control panel	1	2.0	1/day
PA-IC System operability checks	all accessible cells	0.5	1/week
Inspection of Dry Standpipe System	14	0.1	1/week
Transfer operating HVAC equipment	6	0.12	1/week
Rotation of operating equipment for Control Rod System	1	.25	1/week
Detailed inspection of Inert Gas Recirculation and Cooling System	11	.12	1/week
Monitor Head Heating System control panel and record temperatures	1	0.6	1/week

TABLE 6.2A-2

SUMMARY OF RCB ACTIVITIES NECESSARY DURING NORMAL PLANT OPERATION

Activity Classification	No. of Cells Entered	Time/Cell Est. M/H	Frequency of Activity
Monitor Plug Annulus Sealing System	1	0.3	1/week
Leak Detection System components inspection and operational checks	8	1.0	1/week
Sodium sampling	1	23.0	2/week
Perform visual inspection of containment isolation valves	various	.75 (all)	1/month
Scheduled maintenance on Chilled Water System components	1	1.0	1/month
Visual inspection of RCB sump pumps	1	0.5	1/month
Tests on secondary control rod drive mechanisms	1	0.5	1/month
Reactor Vessel Head Seal Service System operability check	1	2.0	1/month
Monitor Head Heating System and record temperatures	1	0.5	1/month
Auxiliary handling machine valve operator cycling	1	1.0	1/month
Leak Detection System component operational checks and maintenance	8	18	1/month
Equipment maintenance	7	1.0	1/month
Verify operability of cell atmosphere sampling and analysis	1	2.0	1/month
Instrument channel calibration and checks	3	18	1/month
There are many other activities required on a longer term basis which are not addressed			

TABLE 6.2A-3

RADIATION EXPOSURE ESTIMATES DUE TO RCB VENTILATION SYSTEM ISOLATION DURING PLANT OPERATION

Days After Isolating Ventilation	0	1	7	30	274
Best-Estimate RCB Dose Rate mrem/hr	0.002	0.013	0.038	0.12	1.01
Estimated Routine RCB Activities man hours/day*	30	30	30	30	30
Estimated Dose mrem/year	0.022	0.14	0.42	1.3	11

*Yearly average based upon routine plant operations excluding plant alarm resposes, surveillance activities not yet defined, and scheduled maintenance with a frequency greater than once every three years.