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Clifford K. Beck, Deputy Director of Regulation
THRU: Robert Lowenstein, Director, Div. of Licensing and Regulation
Martin B. Biles, Chief
Test & Power Reactor Safety Branch

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POSSIBLE ISSUES IN FRDC AND PEACH BOTTOM REACTOR REVIEWS

As requested in your telephone call of November 15, I am forwarding a list of the various issues which appear to be most significant to the reviews of the Fermi and Peach Bottom reactors.

FERMI REACTOR

Technical issues derived from prior testimony and reviews:

1. Similarities between Fermi and the EBR-1, EBR-II and Dounreay reactors and applicability of experience gained in the latter reactors to Fermi.

2. General adequacy of information available on which to base the hazards evaluation, including matters that can be resolved only by operation of Fermi reactor.

3. State of knowledge on the real origin of the prompt positive power coefficient that led to instability in EBR-I.

4. Application of knowledge gained from EBR-I to Fermi design.

5. Magnitude and sign of all computed temperature coefficients, including time constants and the effects occasioned by plutonium buildup.

6. Adequacy of experiments performed to determine the doppler coefficient and correlation with theory.

7. Adequacy of the test program with the Fermi reactor to establish accurately the expected reactivity effects including: a) geometric effects, b) hydraulic effects and c) resonance effects at various power levels and flow conditions.

8. Safety of low power oscillator and transient tests proposed in connection with test program.

9. Reactivity effect of sodium voids and loss of sodium.

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10. Adequacy of protection against boiling of sodium in core. Probable course of events if sodium boiling is initiated.

11. Degree of protection afforded against loss of sodium from the core.

12. Effects of interuption of primary loop flow or blockage of individual subassemblies by foreign matter or through mechanical distortion.

13. Prediction of the course of events during any fuel meltdown. The effects of the presence or absence of sodium on the course:
    a. Initiating events.
    b. Maximum amounts of reactivity and maximum rates of addition possible under various conditions.
    c. Pressure generated by rapidly vaporizing sodium and the possibility that compacting of the core would result.
    d. Examination of methods, other than meltdown or sodium pressures, which could compact the core.
    e. Possibility that fuel melting may interfere with scram action of control rods.
    f. Possibility of accumulation of a secondary critical mass following an initial meltdown event.
    g. Applicability of TREAT fuel meltdown tests to Fermi analysis.

14. Possibility that any accident, but particularly as a result of meltdown, could breach the containment vessel:
    a. Protection against missiles.
    b. Integrity of containment penetrations.
    c. Breaching by non-nuclear accidents.

15. The possibility that hydrogeneous or other moderating substances can enter the core and evaluation of maximum possible reactivity addition that could credibly pertain.

16. Adequacy of protection against fuel loading accidents: loading excess fuel, loading fuel too rapidly, interchange of core and blanket assemblies, interchange of fuel and control rods.

17. Adequacy of methods used for assaying fuel content in subassemblies and boron isotopic content of control rods.

18. Effects of radiation damage and thermal cycling on fuel.

19. Swelling and bursting of pins due to fission gas formation.

20. Radiation damage effect on mechanical structure of core, reactor vessel and primary system components.

21. Study of effects of malloperation of control system.

22. Results of simulator and other tests on control and safety systems.

23. Possibility of sodium-water reactions and possible effects on the reactor and containment.

Technical issues that have resulted from difficulties encountered during preoperational testing:

1. Outgassing of $CO_2$ from borated graphite in the Rotating Shield Plug was noted during the high temperature sodium tests (1000°F). The $CO_2$ reacted with sodium producing $Na_2CO_3$ and C as sodium contaminants. Several questions are raised:

   a. Will the graphite continue to outgas significantly during nuclear operation?

   b. Will contaminants plug coolant passages or foul heat transfer surfaces?

   c. Will contaminants carburize steel or other materials in the primary system?

2. During the 1000°F tests, borated graphite around the reactor vessel deteriorated grossly. The following questions arise:

   a. Will replacement graphite be subject to the same difficulty?

   b. If the graphite does deteriorate, will its volume increase affect tank alignment, or possibly overstress local portions of the tank structure.

3. A dummy fuel element became stuck in the core and required several thousand pounds of force for removal. During removal the element parted from the end fitting.

   Reasons for this binding have to be established in order to determine whether or not remedial design changes will eliminate the problem.

Broad technical and operational issues that the staff intends to study during the present review:

1. Integrity of the reactor as designed.

2. Anticipated operating characteristics of the reactor and plans for experimental verification (startup program).

3. Accident possibilities due to equipment malfunction.

4. Control and instrumentation adequacy under normal and abnormal conditions.

5. Protection against releases not directly involving the reactor, e.g. spent fuel handling and storage, waste storage, effluent release.

6. Environmental monitoring.

7. Competence of startup team.

8. Adequacy of operating procedures.

PEACH BOTTOM REACTOR

Technical issues which have evolved from the staff and ACRS review of the application for construction permit:

1. Adequacy of the fuel element design.

2. Resolution of problems concerning the design of fission product trapping system, including the following:

   a. The proportional distribution of fission products between the fuel, internal traps, and external traps.

   b. The methods and materials to be used for collection of fission products in the various traps.

   c. The engineering arrangements to accommodate safe handling and storage of fission products in the various traps.

   d. Development of facilities and procedures for handling, storage, shipment, and disposal of trapped fission products.

3. Reactor control system including the reliability of the proposed design, structural capability of the graphite control system materials and ability of the control system to function under all emergency conditions.

4. Emergency shutdown system including the need for such system and the adequacy of the proposed system.

5. Structural integrity of the proposed core design.

6. Long term integrity of the graphite materials proposed for various core components including fuel elements, control rods, guide tubes and reflectors.

7. The requirement for an emergency cooling system and the adequacy of the proposed system.

8. The magnitude of the reactivity coefficient particularly the prompt fuel coefficient.

9. The effects of possible water leakage into the core and protection against such an event.

10. The effects of possible air leakage into the core and the protection against such an event.

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