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From: S.B. Brumbach SBB ZPPR-13 Assembly Coordinator

Subject: ZPPR Assembly 13 - Detailed Work Plan No. 28: Sodium-Void Worth Measurements in ZPPR-13B/4.

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ZPPR Assembly 13
Detailed Work Plan No. 28
Sodium Void Worth Measurements in ZPPR-13B/4

All experiments and geometry changes described herein are subject to safety review and approval by the reactor manager. Additional measurements may be added at his request to satisfy safety and operational requirements.

1. Introduction

The engineering benchmark configuration of ZPPR-13, designated 13B/4, will be used to measure the worth of sodium removal from a series of zones which include parts of all three fuel rings and one blanket ring. In a departure from recent practices, the voiding zones will have only half-core symmetry. By maintaining only half-core symmetry, a larger variety of zones can be voided without requiring the handling of an excessive number of drawers. The zones to be voided are shown in Fig. 1. Zone numbers indicate the voiding sequence. The sequence is determined by the power density in this assembly (zone 1 highest power). Reflooding will be done in a single step.

2. Reactor Configuration

The beginning reactor configuration will be the ZPPR-13B/4 subcritical reference. In order to compensate for the positive reactivity effect of sodium removal, it will be necessary to decrease the reactivity further below that of the subcritical reference. This pre-voiding subcriticality should be approximately 0.55$.

3. Measurement Sequence

The zones shown in Fig. 1 should be voided sequentially and cumulatively. Detector drawers and those drawers opposite detector drawers will not be voided. The thermocouple drawer and the drawer opposite the thermocouple drawer will not be voided. Narrow drawers next to PSR blades will be voided. All fuel drawers will be voided $\pm$ 12 in. Blanket drawers will be voided $\pm$ 8 in.

Step 1: Measure the subcriticality of the subcritical reference using both the SIXTY4 program and a rod drop.

Step 2: Reduce the reactivity further by converting double-fuel-column drawers to single-fuel-column drawers to achieve a subcriticality of approximately 0.55$. Measure the subcriticality using the SIXTY4 program.

Step 3: Void the sodium from the fuel drawers in zone 1 to ± 12 in. There is one detector in this zone and 38 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 4: Void the sodium from the fuel drawers in zone 2 to ± 12 in. There is one detector in this zone and 42 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 5: Void the sodium from the fuel drawers in zone 3 to ± 12 in. There is one thermocouple drawer and one detector drawer in this zone and 44 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 6: Void the sodium from the fuel drawers in zone 4 to ± 12 in. There is one detector drawer and 4 narrow drawers in this zone and 94 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 7: Void the sodium from the fuel drawers in zone 5 to ± 12 in. There are 2 detectors in this zone and 92 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 8: Void the sodium from the fuel drawers in zone 6 to ± 12 in. There is one detector in this zone and 54 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 9: Void the sodium from the fuel drawers in zone 7 to ± 12 in. There is one detector in this zone and 30 drawers to be voided. Measure the subcriticality with the SIXTY4 program.

Step 10: Void the sodium from the blanket drawers in zone 8 to ± 8 in. For drawers with 7-in.-long sodium cans in the first 14 in., remove both sodium cans and add back one 8-in. void can and one 6-in. sodium can. Measure the subcriticality with both the SIXTY4 program and a rod drop.

Step 11: Restore all voided drawers to their original, flooded condition. In zone 8, restore the 2 7-in.-long sodium cans. Measure the subcriticality with the SIXTY4 program.

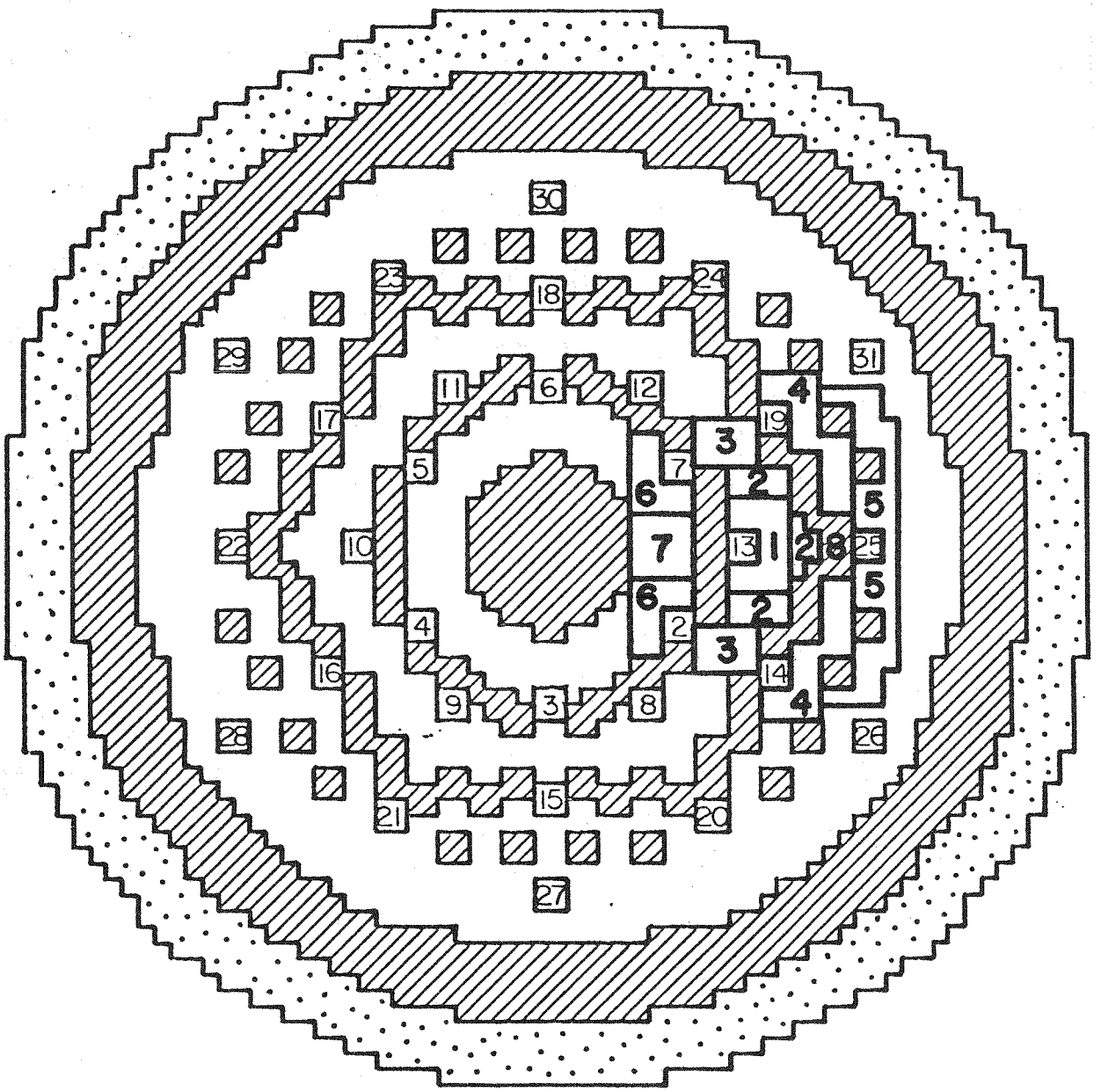
Step 12: Restore the subcritical reference. Measure the subcriticality with both a rod drop and the SIXTY4 program.

4. Measurement Technique

All measurements should be made with all the PSRs and shim rods fully withdrawn from the core. Before any data collection begins, wait for ten minutes

after achieving a stable power. For data collected by the SIXTY4 program, count statistics should be within ± 1% or for a time interval not longer than 30 min. The subcriticality of the reference steps will be measured by dropping the set of eight neutral rods (gang 3).

All sodium cans removed in each step should be weighed.



BLANKET

REFLECTOR

CONTROL ROD POSITION

NA VOID ZONE

ZPPR-13B/4

Fig. 1. Sodium Void Zones in ZPPR-13B/4.