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To: ZPR-I Distribution (Limited)

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

Subject: ZPPR Assembly 13 - Detailed Work Plan No. 18: Transformation From 13B/1 to 13B/2

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ZPPR Assembly 13
Detailed Work Plan No. 18
Transformation From 13B/1 to 13B/2

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 or operational requirements.

I. Introduction

At the end of the 13B/1 experimental program, the broken-circular-blanket configuration of ZPPR-13B/1 will be converted to the broken-hexagonal-blanket configuration of ZPPR-13B/2. This conversion will consist of interchanging blanket drawers and fuel drawers with a net addition of fuel drawers and a radial expansion of the reactor core. Interchanges will be made in a series of steps, and flux distribution measurements will be made at each step using the 64 in-core fission counters. It is anticipated that the final hexagonal configuration will be approximately 3$ subcritical.

II. Reactor Configuration

The reactor configuration for the beginning of the transformation will be the ZPPR-13B/1 reference subcritical configuration as established in loading 125.

III. Sequence of Configuration Changing Steps

Configuration changes will be made ring by ring starting with fuel ring 3, followed by fuel rings 1 and 2. In each ring, the negative reactivity changes (substitution of blanket for fuel) will be made before the positive changes (substitution of fuel for blanket). The following steps are planned:

1. Substitute Blanket for Fuel in Fuel Ring 3.

Replace 104 fuel drawers in fuel ring 3 with blanket drawers and measure the subcriticality of this configuration with the 64 in-core fission counters.

2. Substitute Fuel for Blanket in Fuel Ring 3.

a. Replace 104 blanket drawers with fuel drawers in fuel ring 3 and measure the subcriticality of this configuration.

b. If the subcriticality measured in step 2a is sufficiently negative, replace 56 radial blanket drawers with fuel drawers along the outer boundary of fuel ring 3. Measure the subcriticality of this configuration.

c. If the subcriticality measured in step 2b is sufficiently negative, replace 56 additional radial blanket drawers with fuel drawers along the outer boundary of fuel ring 3. Measure the subcriticality of this configuration.

The estimated subcriticality at the end of step 2c is approximatley 1$. If the estimated reactivity additions in either of the steps 2b or 2c are more than one-half of the value of the subcriticality measured in the previous step, then add fewer drawers than indicated above, and increase the number of steps.

3. Replace 24 fuel drawers with blanket drawers in fuel ring 1 and measure the subcriticality of this configuration.

4. Replace 24 blanket drawers with fuel drawers in fuel ring 1 and measure the subcriticality of this configuration.

5. Replace 80 fuel drawers with blanket drawers in fuel ring 2 and measure the subcriticality of this configuration.

6. Replace 48 blanket drawers with fuel drawers in fuel ring 2 and measure the subcriticality of this configuration.

7. Move 168 radial reflector drawers from the inner edge of the reflector to the outer edge. Add 40 additional reflector drawers to the outer edge of the reflector.

8. Add 168 blanket drawers to the positions vacated in Step 7. Measure the subcriticality of this configuration.

IV. Measurement Methods

All subcriticality measurements will be made using the subcritical source multiplication method. All measurements will be made with all shim rods, and PSRs 30 and 31 fully withdrawn. Wait 10 min after achieving stable power before acquiring data. Count statistics should be within $\pm$ 1%, but count times should not exceed 30 min.