ZPR-I Memo No. 431 April 13, 1983

~~APPLIED TECHNOLOGY~~

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

Subject: ZPPR Assembly 13 - Detailed Work Plan No. 19: Transformation From 13B/2 to 13B/3

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ZPPR Assembly 13
Detailed Work Plan No. 19
Transformation From 13B/2 to 13B/3

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 completion of the ZPPR-13B/2 construction, the broken-hexagonal-blanket configuration of ZPPR-13B/2 will be immediately converted to the dispersed-blanket configuration of ZPPR-13B/3. This conversion will consist of interchanging blanket drawers and fuel drawers with a net subtraction of fuel drawers and a slight radial contraction of the reactor core. The fraction of double-fuel-column drawers will increase slightly. Fuel/blanket interchanges will be made in a series of steps from the center outward. Outer-radial blanket and radial reflector boundaries will be adjusted in a single step. Flux distribution measurements will be made at each step using the 64 in-core fission counters. Final criticality will be achieved by adjusting the ratio of double to single fuel-column drawers.

II. Initial Reactor Configuration

The reactor configuration for the beginning of the conversion will be the 3.5$ subcritical reference configuration of ZPPR-13B/2 as established in loading 172.

III. Sequence of Configuration - Changing Steps

Configuration changes will be made approximately from the core center outward. The following steps are planned:

1. Remove 8 blanket drawers from the central blanket and add back eight fuel drawers. Remove 48 fuel drawers from fuel ring 1 and add back 48 blanket drawers.
2. Remove 40 blanket drawers from the outer edge of blanket ring 1 and add back 40 fuel drawers.
3. Remove 112 fuel drawers from the edge of blanket ring 2 and add back 112 blanket drawers.
4. Remove 104 blanket drawers from blanket ring 2 and add back 104 fuel drawers.
5. Remove 40 fuel drawers from around blanket ring 2 and add back 40 blanket drawers.
6. Remove 48 blanket drawers from the outer edge of blanket ring 2 and add back 48 fuel drawers.

7. Remove 80 fuel drawers from the inner edge of blanket ring 2 and add back 80 blanket drawers.
8. Remove 80 blanket drawers from the outer edge of blanket ring 1 and add back 80 fuel drawers.
9. Remove 80 fuel drawers from the inner edge of blanket ring 2 and add back 80 blanket drawers.
10. Remove 64 blanket drawers from blanket rings 1 and 2 and add back 64 fuel drawers.
11. Remove 80 fuel drawers from the vicinity of blanket ring 2 and add back 80 blanket drawers.
12. Remove 64 blanket drawers from blanket ring 2 and add back 64 fuel drawers.
13. Remove 80 fuel drawers from the outer edge of the reactor and add back 80 blanket drawers.
14 Remove 64 blanket drawers from blanket ring 2 and add back 64 fuel drawers.
15 Remove 56 fuel drawers from the outer edge of the reactor and add back 56 blanket drawers.
16. Remove 40 blanket drawers from blanket ring 1 and add back 40 fuel drawers.
17 Remove 24 blanket drawers from the edge of the core and add back 24 fuel drawers.
18 Adjust the outer boundary of the outer-radial blanket and the boundaries of the radial reflector.
19. Adjust the distribution of single-fuel-column drawers by converting 64 double-fuel-column drawers to single-fuel-column drawers.
20. Further adjust the distribution of single-fuel-column drawers and achieve criticality by converting single-fuel-column drawers to double-fuel-column drawers.

After each step, data will be taken using the 64 in-core fission counters to measure the flux distribution and the subcriticality of the reactor.

Some of the positivity-reactivity (fuel addition) steps listed above may need to be divided into two steps depending on the subcriticality of the reactor prior to the listed step and on the estimated worth of the listed step.

Step 19 is made necessary by the concentration of single-fuel-column drawers generated by moving only fuel drawers from the relatively-low-enrichment ZPPR-13B/2 configuration. Double-column-fuel drawers can be converted to single-fuel-column drawers at any step in order to increase the reactor subcriticality. Single-fuel-column drawers should only be converted to double-fuel-column drawers in a final approach-to-critical step.

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.