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JUL 20 1977

Docket No. 50-346

MEMORANDUM FOR: R. C. Knop, Reactor Projects Section 1, RIII

FROM: K. V. Seyfrit, Assistant Director for Technical Programs, ROI, IE

SUBJECT: STUCK ROD MEASUREMENT FOR DAVIS BESSE UNIT NO. 1 (AITS F8000102)

The licensee's proposed procedure for measuring the stuck rod worth and the resulting high reactivity for an ejected rod accident was reviewed as requested. At one point in the procedure (Step E) the reactor is critical with all of the regulating rods, having a total worth of about 6% Δ k/k (FSAR Table 4-13), inserted in the core. An estimate of the ejected rod worth for this condition can be derived from Figure 4.7-2 (Enclosure 1) of the Startup Report for Rancho Seco Unit 1. This figure gives an ejected rod worth of 1.9% Δ k/k for an inserted rod worth of 6% Δ k/k. As Tambling's memorandum indicates the FSAR rod ejection analysis concludes (Paragraph 15.4.8.2.6) that, a reactivity greater than 1.0% Δ k/k could cause a rupture of the pressure vessel.

A conference was held with members of the NRR Core Performance Branch to discuss the acceptability of the proposed test. There was unanimous agreement that, if the proposed test resulted in operation with an ejected rod worth greater than the value considered in the accident analysis, it was not acceptable. Two possible solutions to the problem were discussed. The first was a reanalysis of the accident by the licensee to include the consequences of the higher ejected rod worth. The new analysis would require submittal to, and approval by NRR prior to the conduct of the test. The second possibility would be the modification of the procedure to reduce the maximum ejected rod worth to a safe value. Such a procedure was used for the Rancho Seco stuck rod measurement, Rancho Seco Startup Test Procedure 4.8 and Table 4.8.1 (Enclosures 2 & 3). It involved measuring the reactivity difference between two rod drops from critical with bank 5 partially withdrawn. One drop was done with the assumed stuck rod remaining at 100% withdrawn, and the other was done with the stuck rod inserted. This measurement has a larger uncertainty, since correction factors must be applied to account for the rod worth

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reduction at the lower initial inserted worth. However, this uncertainty is not considered to be significant enough to justify the less conservative test.

The following items address the four questions raised in Tambling's memorandum.

1. The analysis of the consequences of the rod ejection test presented in the FSAR may be conservative, however, it is the only analysis available and operation outside of its limits should not be permitted.

2. The accuracy to be gained by the proposed test is not considered to justify operation outside of the bounds of the analysis.

3. A stuck rod measurement similar to the one conducted at Rancho Seco is considered to be an acceptable alternate method.

4. The question of who is responsible for informing the licensee that the test is unacceptable was discussed with the NRR Project Manager. It is his position, and we concur, that this is an IE responsibility, since the determination of the adequacy of the test details is an IE function.

As was discussed, by phone between T. N. Tambling and D. C. Kirkpatrick, we recommend that the licensee be informed that the presently proposed test is considered to exceed the bounds of the safety analysis and is unacceptable.

Original signed by
K.V. Seyfrit

K. V. Seyfrit, Assistant Director
for Technical Programs, ROI, IE

Enclosures:
1. Rancho Seco Startup Report (Figure 4.7-2)
2. Rancho Seco Startup Report (Section 4.8)
3. Rancho Seco Startup Report (Table 4.8.1)

ccs w/Encls.:

	R. D. Thornburg,	IE	D. B. Fiano,	DSS		
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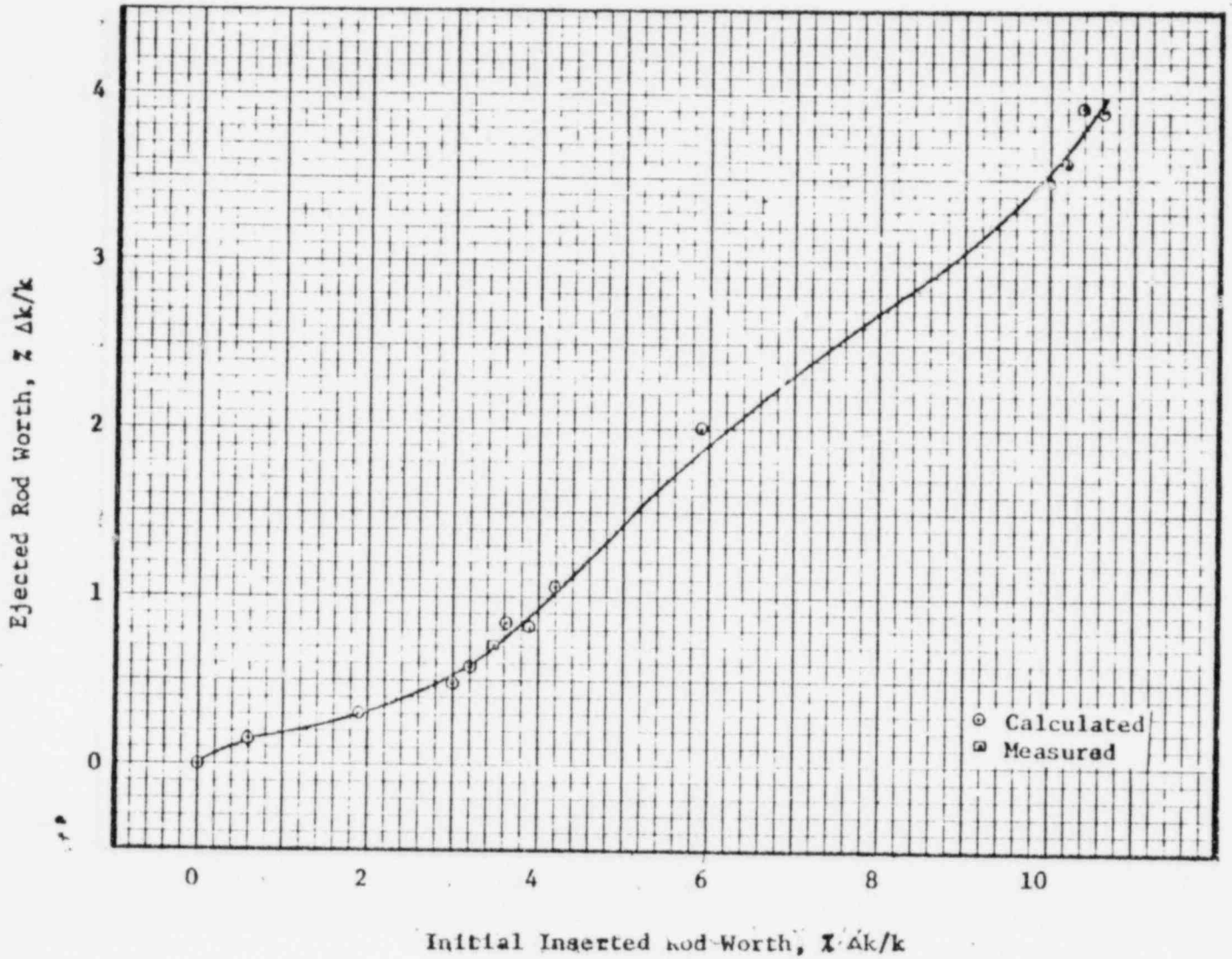
DATE ▶					7/ /77	7/ /77

RANCHO SECO UNIT 1
START UP REPORT

FIGURE 4.7-2

Ejected Rod Worth vs Initial Inserted Rod Worth



ENCLOSURE (1)

4.8 STUCK CONTROL ROD WORTH

Technical Specifications require that the shutdown margin be at least 1% Δk/k with the highest worth rod fully withdrawn. The rod calculated to have the highest worth, with all other rods fully inserted, or those symmetric to it. (See Figure 4.8-1). The reactivity worth of CRA H-2 and the shutdown margin with CRA H-2 fully withdrawn were measured and compared with calculated values.

The stuck rod worth was measured at 532°F with APSR's 36% WD by performing two rod drops. In the first drop, all rods (except APSR's) were dropped from a critical state with CRG-5 at 48% WD. For the existing boron concentration, this drop measures the subcritical reactivity with all rods in. The second drop was made at the same boron concentration but from a critical state with CRA H-2 at 100% WD and CRG-5 at 17% WD. All rods were dropped except the APSR's and CRA H-2 thus measuring the subcritical reactivity with CRA H-2 at 100% WD and all other rods in. The difference between the two drops is, therefore, the worth of CRA H-2 with all other rods in. An uncorrected value for the reactivity introduced by each drop was obtained. These values were multiplied by correction factors which had been determined from measurements on a similar reactor by comparing results from rod drop and boron swap measurements. The measured results are compared with predicted values in Table 4.8-1.

The value thus obtained for the stuck rod is well within test acceptance criteria of 3.91% Δk/k ± 30%. Since this value is greater than the measured, it is the value used for shutdown margin calculations to insure conservatism is always applied.

TABLE 4.8-1

COMPARISON OF MEASURED AND PREDICTED STUCK ROD WORTH

CRG's Dropped	Uncorrected Measured Worth % Δk/k	Correction Factor	Corrected Measured Worth % Δk/k	Predicted Worth % Δk/k	Deviation from Predicted
1,2 3,4 5(48 → 0% WD)	4.59	1.35	6.19	6.25	-1%
1,2 3,4 5(17 → 0% WD) CRA H-2 100% WD and remains out	2.90	0.93	2.70	2.34	+15%
	Stuck Rod Worth		3.49	3.91	-11%