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USAEC - AECL COOPERATIVE PROGRAM
AND HEAVY WATER REACTOR PROGRAM
MONTHLY PROGRESS REPORT

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RECORDS ADMINISTRATION



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SECTION I

REACTOR PHYSICS EXPERIMENTS

B. C. Rusche

USAEC/AECL COOPERATIVE PROGRAM

Temperature Coefficient Measurements (TAC 5.2)

INTRODUCTION AND SUMMARY

Measurements of the uniform temperature coefficient of D₂O-moderated and cooled assemblies containing simulated burned-up UO₂ fuel have been completed. Measurements were made for triangular pitches of 12.12 inches and 9.33 inches. Foil irradiations were performed at 23 and 80°C for both pitches. Buckling measurements have been completed for "Dowtherm"* A and air-cooled lattices of natural UO₂ and a simulated burned-up UO₂ fuel at 25 and 260°C. Foil irradiations have been performed at the same temperature in both the "Dowtherm" A and air-filled cases.

Measurements of the temperature coefficient of reactivity for organic-cooled lattices with simulated burned-up UO₂ fuels in the SE will be completed in July 1968.

DISCUSSION

Measurements of the uniform temperature coefficient of reactivity have been performed for a D₂O-cooled lattice of simulated burned-up UO₂ fuel in the SE. The fuel assembly consisted of 31 fuel rods with Pu/U weight fraction of 0.00259. Results of measurements for a pitch of 12.12 inches have previously been reported.

The 9.33-inch pitch measurements were completed in a lattice of 19 of the above assemblies in the SE. Results of these measurements are presented in Table I.

Changes in material buckling with temperature were calculated using the HAMMER code for a D₂O purity of 99.75 mol % and are shown in Table I. Changes in effective radial buckling, calculated using the PDQ-05 code, are also given and have been used with the measured values of k^2 to determine the measured changes in material bucklings. HAMMER calculated D₂O purity coefficients have been used to correct the measured values of k^2 to a purity of 99.75 mol % D₂O. The region between the inner and outer housing cans, which is normally filled with air, was filled with D₂O for the uniform temperature coefficient measurements.

Analysis of data obtained from all other buckling measurements and detailed foil activation measurements is currently underway.

* Trademark of Dow Chemical Co.

Table I
Buckling as a Function of Temperature

Material Between Tubes	Temperature, °C	Measured k^2 , μb	Moderator Purity, Mol % D ₂ O	k^2 (a) Corrected to 99.75	PDQ-05 ΔB_R^2 , μb	Measured (b) ΔB_M^2 , μb	HAMMER ΔB_M^2 , μb
D ₂ O	23	729	99.33	704	0	0	0
D ₂ O	40	719	99.32	695	-2	+7	-
D ₂ O	48	729	99.27	701	-2	+1	-
D ₂ O	60	724	99.31	700	-4	0	+1
D ₂ O	80	721	99.28	698	-7	-1	-1

(a) Corrections made using HAMMER calculated moderator purity coefficients.

(b) ΔB_M^2 determined from PDQ-05; calculated B_R^2 and measured values of k^2 corrected to 99.75 mol % D₂O.

U. S. HEAVY WATER REACTOR BASE PROGRAM

INTRODUCTION AND SUMMARY

The SE experimental HWR program consists of measurements with various coolant materials to bracket conditions of boiling H₂O cooled assemblies.

The scheduled SE measurements for 12.12-inch and 9.33-inch triangular pitches have been completed.

DISCUSSION

Buckling measurements have been performed for fuel assemblies consisting of 31-rod clusters of a burned-up fuel mockup with Pu/U weight fraction of 0.00259. Five coolant materials were used to bracket conditions of boiling H₂O coolant.

All measurements for a lattice pitch of 12.12 inches, except that with "Dowtherm" A coolant, have been previously reported. The SE loading for all 9.33-inch pitch measurements contained 19 of the above assemblies surrounded by twelve natural UO₂ assemblies. Measured values of the square of the reciprocal of the axial thermal neutron relaxation length, k^2 , are reported in Table II. The moderator purity corresponding to each measurement is also given.

Analysis of the experiments to obtain the material bucklings is underway.

Table II

Buckling Measurements for Various Coolants
in SE Lattice on 9.33-inch Triangular Pitch

<u>Coolant</u>	<u>Moderator Purity Mol % D₂O</u>	<u>Measured k^2, μb</u>
Air	99.24	580
H ₂ O	99.23	895
39.4% H ₂ O ^(a)	99.24	753
D ₂ O	99.25	654
"Dowtherm" A	99.23	798
"Dowtherm" A ^(b)	99.22	849

(a) 39.4 mol % H₂O - 60.6 mol % D₂O.

(b) 12.12-inch triangular pitch.

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