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USAEC - AECL COOPERATIVE PROGRAM

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Compiled by:

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This document is furnished pursuant to the memorandum of understanding of June 7, 1960, between the U. S. and Canadian Governments establishing a Cooperative Program on the development of heavy water moderated power reactors.

E. I. du Pont de Nemours and Co.
Savannah River Laboratory
Aiken, South Carolina

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CONTENTS

SECTION I

PHYSICS EXPERIMENTS FOR CANDU LATTICES

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INTRODUCTION

Experiments have been performed at the Savannah River Laboratory (SRL) to investigate the physics behavior of simulated burned-up fuel. The analysis is still in progress.

New Savannah River experiments are being prepared for the measurement of the change of η with temperature in a natural uranium lattice in the PDP.

SUMMARY

Analyses are being continued for the PDP substitution measurements of the lattice bucklings.

Candidate lattices for the $d\eta/dT$ experiments have been selected on the basis of HAMMER calculations. Copper cladding tubes used to reduce the lattice bucklings have been ordered.

DISCUSSION

PDP Buckling Measurements

The analysis of the substitution measurements performed in the PDP is continuing as outlined in the Monthly Progress Report for November 1966 (DPST-66-83-11). The two-region analysis is being performed with the FLOG code, which is a four-group diffusion code, rather than with a two-group code. No additional results are available at this time.

Change η with Temperature

An experiment to measure the variation of eta (η) with temperature is scheduled to be run in the PDP in June 1967. The purpose of the experiment is to measure η , the average number of fission neutrons produced per thermal adsorption in the fuel, as a function of temperature. Preliminary discussion of the experiment is given in DPST-66-83-11.

To minimize errors in material buckling and other lattice parameters, a full reactor loading at two different pitches is planned. Criterion used in determining which two lattice pitches will be chosen is that they have nearly the same buckling values and a large difference in resonance capture.

A plot of buckling as a function of moderator-to-fuel volume ratio is shown in Figure 1. The parameters f, ρ, L^2, and τ are shown in Figure 2 as a function of moderator-to-fuel volume ratio.

Difficulty was experienced in obtaining the specified 0.034-inch copper F-tubes, mentioned in DPST-66-83-11, in time to meet the schedule. Calculations show that commercially available copper water tubing, with an outside diameter of 1.125-inch and 0.035-inch wall thickness can be used. 1500 tubes have been ordered with a delivery date of about April 1, 1967.

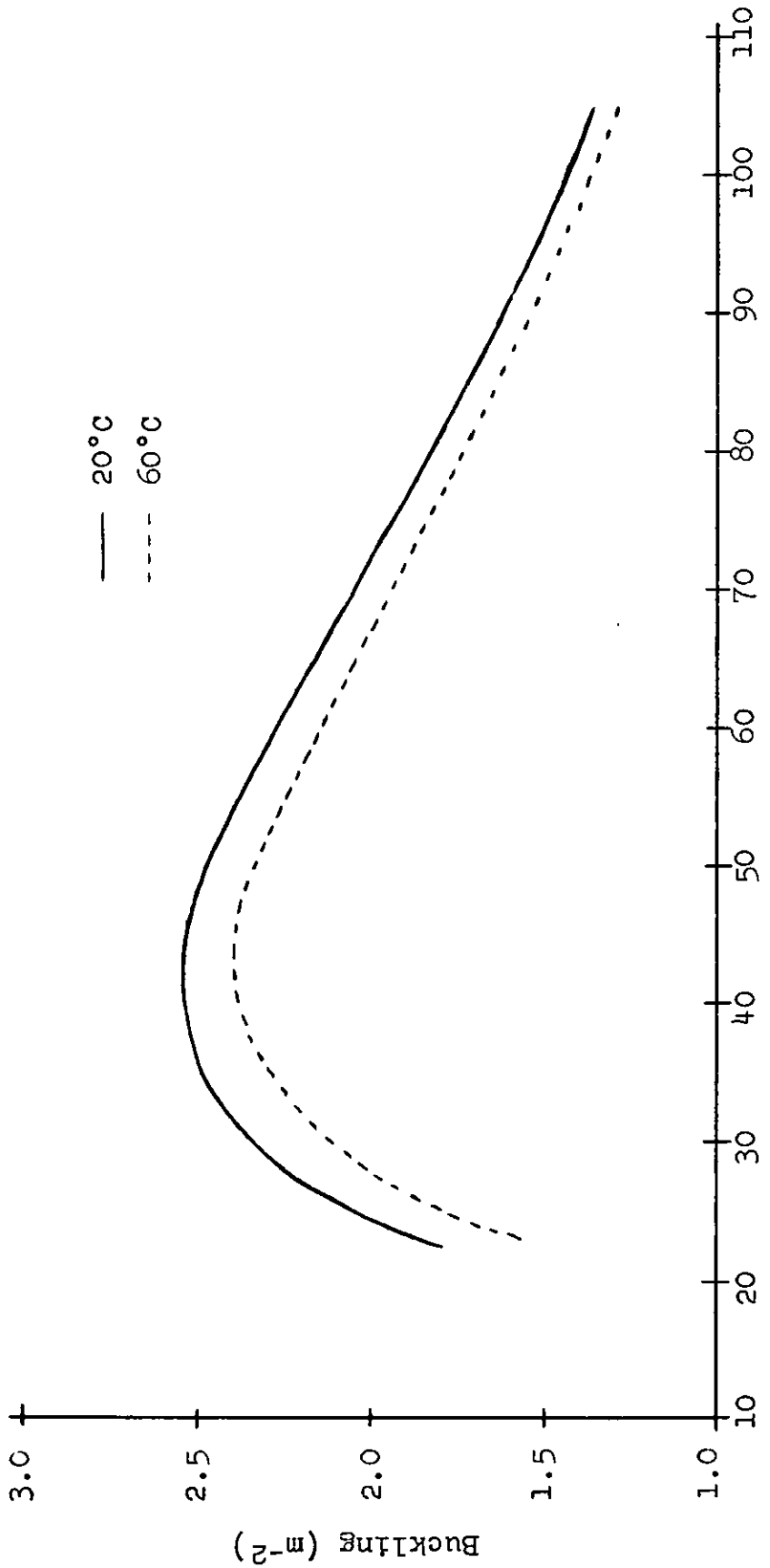
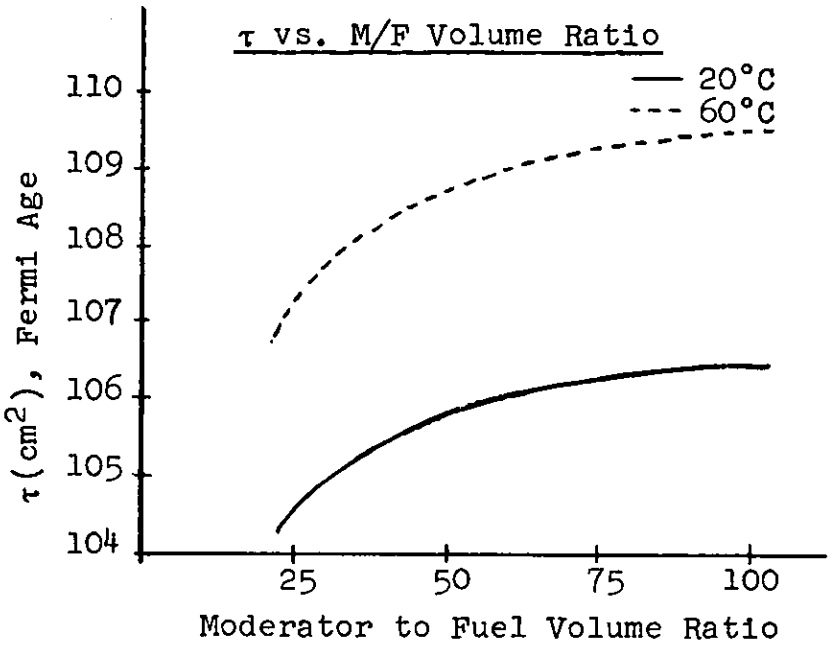
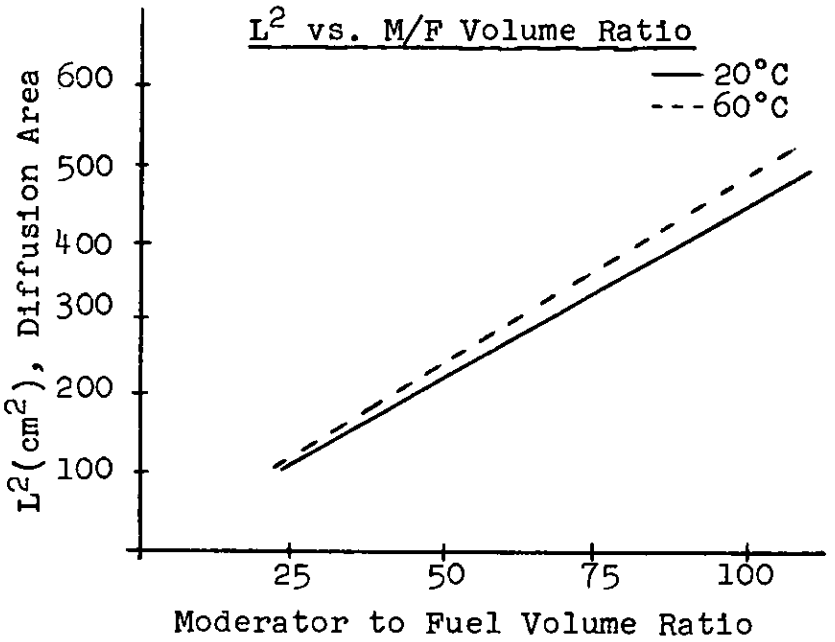
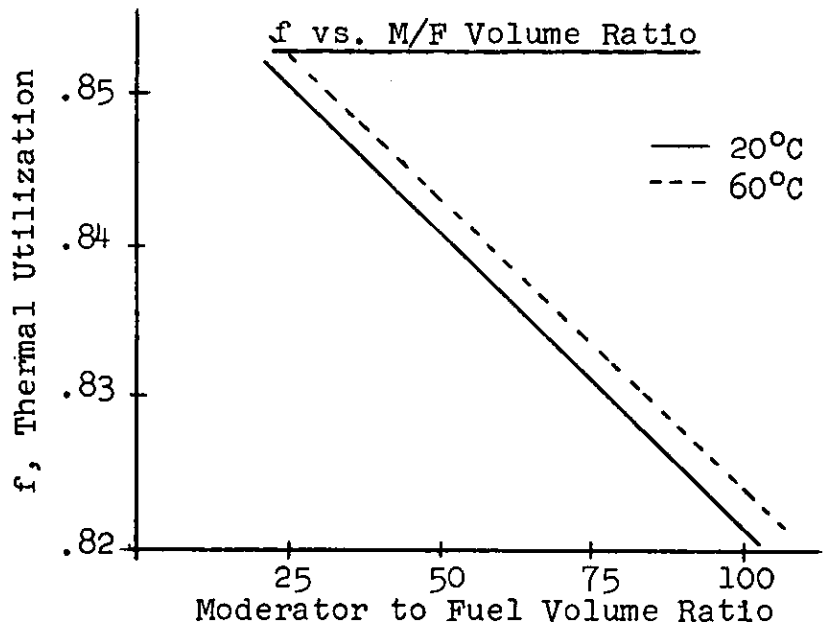


Fig. 1. Buckling vs. Moderator to Fuel Volume Ratio
Cu-clad 1" natural uranium rods in D_2O







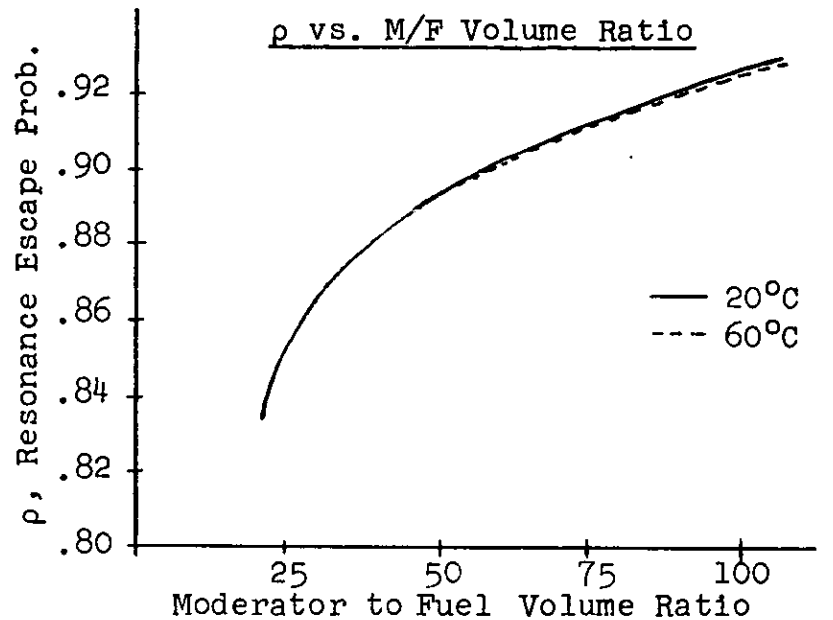


Fig. 2. Calculated Parameters of Lattices for dη/dT Experiments

SECTION II

AECL IN-CORE FLUX MONITORS

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An irradiation test of in-core flux monitors is being made in one of the Savannah River Plant reactors to determine the life characteristics of a selection of flux detectors and of the mineral insulation used in their construction. Self-powered flux detectors are relatively new; therefore, confidence in their use hinges to a great extent on proven performance at large integrated exposures. The chief points of interest are 1) integrity of the conductors and sheath during life, 2) life of insulation, and 3) sensitivity. The higher flux density available at SRP (vis-à-vis Chalk River) will shorten the irradiation time for a given exposure and should also show whether or not any new high intensity effects appear.

Fabrication and installation of the detector rod in the reactor has been completed and testing is in progress. There were no special tests in December. No significant changes in the detector or cable outputs from those reported in DPST-66-83-8 have occurred. The data being collected will be reported in a separate topical report at the conclusion of the tests.

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