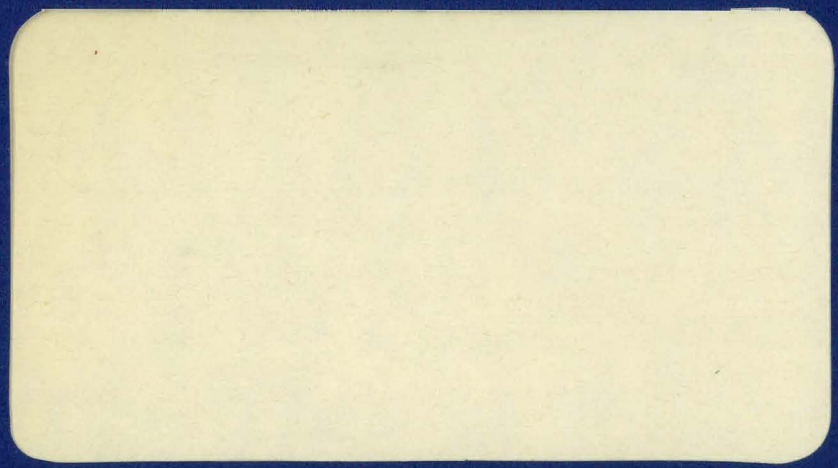

Westinghouse Nuclear Energy Systems

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WCAP-3385-29

SAXTON PLUTONIUM PROJECT
QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING SEPTEMBER 30, 1971

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SECTION 1

INTRODUCTION AND SUMMARY

1.1 SCOPE

This quarterly report covers work completed on the Saxton Plutonium Project during the period -- July through September 1971.

1.2 OBJECTIVES

The overall objective of the Saxton Plutonium Project is to develop information concerning the utilization of plutonium enriched fuels in pressurized water reactor systems. The program includes design, fabrication, operation and post-irradiation examination of a partial plutonium core.

The inpile performance of the fuel will be evaluated and compared with analytical predictions.

1.3 PROJECT ADMINISTRATION

The quarterly report for the April - June 1971 (WCAP-3385-28) period was written, reviewed and released.

The Work Program for fiscal year 1972 (Revision number 10) was written, reviewed and submitted to the AEC.

1.4 SUMMARY OF PROGRESS DURING THE PERIOD

The Saxton reactor was shutdown for the entire third quarter of 1971. The cumulative energy generated as of September 30, 1971, remains at 3,637 MWD with a total of 464 load follow cycles. The peak burnups in the loose latice region were revised and are summarized in Section 2.0 of this report.

Post irradiation examination of loose lattice fuel rods was begun. Non-destructive examinations were completed on three of the seven rods removed during the midlife shutdown.

SECTION 2

CORE III OPERATIONS

(C. E. Palmer, R. L. Stover and T. E. Caye)

The Saxton reactor was shut down throughout the third quarter of 1971. The Core III cumulative energy generated and the total load follow cycles achieved remain at 3,637 MWD and 464 cycles, respectively, as reported in the last quarterly report.

Post mid-life startup has been delayed by system modification and maintenance activities. Post mid-life physics tests are expected to begin in late November.

New curves of predicted peak pellet power vs. core life for the lead plutonium rods were prepared for use with the WANG on-site computer. The curves take into account the mid-life fuel changes and provide the capability for reducing flux map data on-site. Estimated core power at mid-life startup is calculated to be 25.2 MW_t with the limiting rod located in the UO_2 assemblies. (This work was performed under another program.)

Lead rod powers and burnups through mid-life shutdown (3714 EFPH) were re-analyzed. The analysis took into account final Core II burnup adjustments and Core III axial burnup shape corrections. Values are listed in Table 2-1.

Beginning of life rod powers, and accumulated burnups through the mid-life shutdown are summarized in Table 2-2 for the seven loose lattice rods which are currently undergoing post irradiation examination. These power and burnup values reflect final Core II burnup adjustments and Core III axial burnup shape corrections.

TABLE 2-1

SUMMARY OF SAXTON CORE III OPERATING HISTORY

THROUGH SEPTEMBER 30, 1971

	Through June 30, 1971	During July Aug., Sept.	Cumulative to Sept. 30, 1971
Energy Generated, MWD	3,637	0	3,637
Number of Load Cycles	464	0	464
Peak Linear Power, kw/ft[a]			
1. Peak power rod	18.6	-	-
2. Peak burnup rod (in center 3x3)	14.9	-	-
3. Peak burnup rod (outside center 3x3)	11.9	-	-
Peak Pellet Burnup, MWD/MTM[b] [c]			
1. Peak power rod	35,100	0	35,100
2. Peak burnup rod (in center 3x3)	43,300	0	43,300
3. Peak burnup rod (outside center 3x3)	40,000	0	40,000

(a) Best estimate, thermal basis (thermal = 0.974 of fission) at core power of 24.0 MW_t on 2/4/71.

(b) Best estimate, fission basis.

(c) Burnup estimates reflect re-analysis done in July 1971.

TABLE 2-2

SAXTON LOOSE LATTICE ROD

CALCULATED PERFORMANCE SUMMARY

Rod Identification Number	Peak Linear Power (kw/ft)[1] BOL/MOL	Burnup (MWD/MTM)[2] Rod Average	Burnup (MWD/MTM)[2] Peak Pellet
LZ	17.3/14.6	33,100	43,300
MQ	10.7/9.6	28,100	36,600
BO	21.0/17.8	25,500	34,500
NI	18.3/15.8	25,300	33,700
FS	15.4/13.0	25,000	32,400
GL	15.3/13.4	24,300	33,300
RD	17.1/15.2	24,100	32,200

(1) Powers are Core III beginning of life/mid-life best estimate, thermal values at 23.5 MW reactor power.

(2) Burnups are accumulated best estimate fission values at discharge.

SECTION 3

EVALUATION OF CORE III FUEL*

(M. G. Balfour, N. R. Metcalf, A. C. Hott, J. B. Melehan, and T. E. Caye)

3.1 VISUAL EXAMINATIONS OF MID-LIFE RODS

The on-site examinations during the Saxton Core III mid-life shutdown were visually confirmed in the hot cells. Five 9x9 Core III fuel rods, MQ, FS, GL, RD, and BOX and one center 3x3 subassembly rod, LZ, were transferred from the reactor to the hot cells in holders to minimize damage to crud deposits. Fuel rod NI was also transferred to the hot cells.

The rods were visually examined and photographed to document crud distribution. No defects were observed in the clad or in the end plug weld regions. Crud thickness appeared to be dependent on rod power, being thinnest on rod MQ and thickest on rod BO (cf. section 2). The axial variation of crud thickness seemed to parallel the power profile, being thickest at the peak power region.

3.2 PROFILOMETRY AND LENGTH MEASUREMENTS

All seven loose-lattice rods being examined in the hot cells are scheduled for profilometry. The profiles consist of a continuous helical scan from approximately one inch from the bottom of each rod up to the plenum region at the top. Preliminary evaluation of profiles on rods LZ, NI and BO indicates no clad anomalies such as blisters, ridges, or local collapse.

Length measurements on LZ and NI showed increases of 0.28 and 0.25%, respectively.

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*Hot cell operation conducted by BMI, Columbus, under contract to Westinghouse Nuclear Fuel Division.

3.3 FISSION GAS COLLECTION

Two fuel rods have been punctured in a calibrated vacuum system to collect and sample internal gases. Samples of released gases have been sent for mass spectrometry analysis,but results are not yet available. Released gas volumes for the punctured rods are listed in Table 3-1. The balance of the seven rods which were included in the MOL sampling plan will be punctured and analyzed during the next quarter. Power and burnup histories for each of the seven rods are summarized in Section 2.0 of this report.

TABLE 3-1

FISSION GAS COLLECTION RESULTS

Rod Identification Number	Volume of Gas Collected (STP cc)
LZ	161.0
NI	130.0

3.4 GAMMA SCANS

Rods LZ, NI and FS were gamma scanned using a sodium-iodide detector measuring gross gamma activity with energies greater than 0.5 MEV. A calibrated specimen translation system permits correlation of rod axial positions and relative gamma intensities. Preliminary evaluation of these scans shows no significant fuel stack gaps or other anomalies in activity distribution. The balance of the loose lattice rods will be gamma scanned during the next quarter.