ARKANSAS NUCLEAR ONE - UNIT 2 (ANO-2)

SHOULDER GAP DATA TAKEN ON BATCH D ASSEMBLIES AFTER CYCLE 3

CEN-260(A)-NP

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INTRODUCTION

During the current EOC-3 refueling outage at ANO-2, measurements of remaining fuel rod shoulder gap were taken on the sixteen Batch D fuel assemblies listed in Table 1. For the C-E fuel assembly design, fuel rod shoulder gap is defined as the distance between the bottom of the upper flow plate and the top of a fuel rod. The information collected during this inspection program will be used to demonstrate that sufficient shoulder gap exists in Batch D Assemblies to accommodate the additional closure that would result from a third operating cycle in Reactor Cycle 4

All shoulder gap measurements were taken using the C-E Comprehensive Fuel Inspection Stand (CFIS). The principal features of the CFIS that were used in this campaign included the fuel assembly elevator and turntable; and the periscope which is equipped with a micrometer filar attachment and a 35mm camera for color photography. The procedures used to obtain the raw data tabulated on the attached copies of the poolside inspection sheets will be described below. The method for calculating shoulder gaps from the raw data will also be summarized.

DISCUSSION

One inspection sheet is completed for each face of each fuel assembly examined. For identification during the inspection, the fuel assembly faces are designated as North, South, East or West with the fuel assembly serial number being located in the Northeast corner of the upper end fitting. Fuel rods are numbered from left to right across an assembly face (1 to 16). Rows are identified as 1 through 4 with the peripheral fuel rods (or row closest to the periscope) being Row 1. Subsequent rows (2, 3, 4) are parallel to Row 1 and directly it.

The first operation performed on each fuel assembly after it was placed in the CFIS was to verify its serial number and serial number orientation. Then, at a suitable magnification, and with the gap of interest centered in the field of view, the micrometer filar on the periscope is aligned with the leading edge of the bottom of the upper flow plate (UFP) and the resulting micrometer

reading recorded on the data sheet. Without moving the assembly, the filar is re-aligned with the top of the upper end cap of the fuel rod of interest and the corresponding reading recorded on the data sheet. [

]

The difference in the micrometer readings between the UFP and fuel rod top (Δ lm or ΔMR) should then be multiplied by the appropriate micrometer constant (c) to arrive at the rod gap measurement. [

] These constants were determined by using the periscope to measure a special Assembly Calibration Standard periodically during the inspection campaign. This Standard contains pre-characterized shoulder gaps of varying dimensions and at distances from the periscope corresponding to the first four rows of a 16x16 fuel assembly. Micrometer readings were obtained for each measurable shoulder gap in the standard using the same procedures employed for actual fuel assembly measurements (i.e., leading edge of the bottom of the upper plate and the top of a simulated fuel rod). The pre-characterized shoulder gap dimension is then divided by the difference in the corresponding micrometer readings to arrive at the micrometer constant for the particular row desired.

Finally, 35mm color slides were taken of the shoulder gap region of each face of each assembly involved in the measurement program as additional documentation to verify shoulder gap condition.

TABLE 1

ANO-2 BATCH D FUEL ASSEMBLIES
SELECTED FOR SHOULDER GAP MEASUREMENTS

D002	D036
D006	D037
D010	D039
D014	D040
D027	D104
D028	D111
D031*	D112
D034	D115

[ ]

TABLE III-3 Rod Gap Sheet

BUNDLE SERIAL NO.: D002 FACE: EAST POOL TEMP: 100 °F ENGINEER: G Smith DATE: 11/2/83

ROW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																

[The remaining 64 pages,
of which this is one example,
present proprietary data and have, therefore,
been omitted from CEN-260(A)-NP.]

ℓ_m = MICROMETER READING ℓ_G = RODGAP (CONVERTED FROM MICROMETER READING OR DIRECT MEASUREMENT FROM UEF SHOULDER GAP GAGE)

C = MICROMETER CONSTANT (ONE CONSTANT FOR EACH ROW)
(DETERMINED IN SECTION I, TABLE I-5)

$$\ell_G = \Delta\ell_m C$$