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DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 3180101
T-643704

REFUELING - CORE 1; SEED 1
RADIATION SURVEY OF SCRAM SHAFT ASSEMBLIES

CORE 1 SEED 1

Section 1 of 1 Section

First Issue, July 27, 1960
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TEST RESULTS
DLCS 3180101
T-643704

RADIATION SURVEY OF SCRAM SHAFT ASSEMBLIES

Purpose

To determine the radiation level of several scram shaft assemblies after their removal from the reactor vessel during Core I, Seed 1 refueling operations.

Conclusion

The radiation levels obtained approximately 75 days after reactor shutdown at Location I (one foot from the surface and three feet down from the top) for the eight scram shaft assemblies surveyed varied from 1.2 mr/hr to 15 mr/hr.

The radiation levels obtained approximately 75 days after reactor shutdown at Location II (one foot from the surface and five inches up from the bottom) for the eight scram shaft assemblies surveyed varied from 2 mr/hr to 650 mr/hr. The actual level was well below the predicted level of 35 R/hr for an unshielded tie rod. The approximate diameter of the scram shaft assembly is 1.5 inches.

Description of Test Procedure and Test Equipment

The eight scram shaft assemblies that were to be monitored for DLCS 3180101 in conjunction with Refueling Procedure, SPS-R1-108, "Disassembly, Inspection, and Reassembly of Shroud and Scram Shaft Assemblies", were transported from the reactor vessel to the Underwater Radiation Probe Assembly. The scram shaft was placed next to the probe assembly so the top of the scram shaft was level with the canal water, and against the positioning rings.

The radiation probe was lowered into the guide tube, and the radiation levels at Location I and Location II were monitored and recorded at these locations.

The radiation detectors used were the Riggs Monitors, Model GA-3BA. Prior to this test, the Riggs Monitors were taken to the General Electric Laboratory in Schenectady, New York, for calibration of the high range (1 to 10^5 R/hr) monitors. However, all of the readings obtained for this test were taken with the low range (10^{-1} to 10^4 mr/hr) monitors (A and B). These low range monitors were calibrated at the Shippingport Site, in accordance with the instruction manual, before any readings were taken. When calibrating the low range monitors a known source (1.6 Curie - Co^{60} Source) was placed at various distances from the meter. The radiation level at these distances were then calculated and compared with the corresponding monitor readings.
After monitoring four scram shafts, the "A" low range monitors were not operating properly, and no further readings were taken with the instrument.

Results

DLCS 3180101, Refueling - Core I, Seed 1, Radiation Survey of Scram Shafts Assemblies, was performed December 21 to 28, 1959. The reactor had been shut down since 0731 on October 7, 1959, after completing 5806.1 EFPH.

The eight selected scram shaft assemblies were removed from the reactor vessel 71 days after reactor shutdown. These scram shaft assemblies were then monitored in conjunction with Refueling Procedure, SPS-R1-108. The data obtained for Locations I and II are tabulated in Table I. The values vary from 1.2 mr/hr to 15 mr/hr for Location I, and from 2 mr/hr to 650 mr/hr for Location II. The data for Table I was obtained from 75 to 82 days following reactor shutdown. The predicted level for Location II for an unshielded tie rod at this time was 35 R/hr.

The predicted radiation levels of the tie rod (center portion of the scram shaft assemblies) were computed, considering the tie rod as a line source for a period covering up to six months after the end of Seed 1 life. This method of calculation and Figure 1 were obtained from Westinghouse's letter WAPD-PWR-RD-771.

The tie rods were not surveyed independently, but as part of the scram shaft assemblies and consequently were somewhat shielded. A scram shaft assembly consists of a tie rod enclosed in a hollow lead screw and hollow scram shaft. The upper end of the scram shaft is fastened to the lead screw. The upper end of the lead screw and the tie rod are fastened together with the damper nut. The tie rod extends through the lead screw and the scram shaft and out the lower end of the scram shaft approximately one inch.

The calibration data for the radiation monitors are tabulated in Table II.

Figure 2 shows co-ordinate system for locating components in the PWR Core 1 reactor.
Activity of the tie rod in water for a point 5 inches up from bottom, one foot from centerline.

- Full power for 6000 hours
- Half power for 12000 hours

FIGURE 1
Core Coordinates For Fuel Assemblies

FIGURE 2
TABLE I

RADIATION SURVEY OF THE SCRAM SHAFT ASSEMBLIES

<table>
<thead>
<tr>
<th>Date</th>
<th>Scram Shaft Assembly</th>
<th>Control Rod Number</th>
<th>Co-ordinate</th>
<th>Meter</th>
<th>Time</th>
<th>Location I Radiation Level</th>
<th>Meter</th>
<th>Time</th>
<th>Location II Radiation Level</th>
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<td>74</td>
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<td>62</td>
<td>J-12</td>
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<td>3.3</td>
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<td>8</td>
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<td>650</td>
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### TABLE II

**CALIBRATION DATA FOR THE RADIATION DETECTOR**

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TEST RESULTS DPLS 3180101
T-643704
REFUELING - CORE I, SEED 1 RADIATION SURVEY OF SCRAM SHAFT ASSEMBLIES

Results Prepared By: [Signature]
Results Reviewed By: [Signature]
Approved (Duquesne Light Company): [Signature] Date 7-27-63