U. S. ATOMIC ENERGY COMMISSION
REGION III
DIVISION OF COMPLIANCE

March 24, 1964

CO REPORT NO. 10/64-2

Title: COMMONWEALTH EDISON COMPANY
LICENSE NO. DPR-2
Date of Visit: March 11, 1964

By: H. D. Thornburg, Reactor Inspector

SUMMARY

A visit was made to the Dresden Nuclear Power Station on March 11, 1964. The following items of interest were noted:

1. One control drive has been locked out in the fully inserted position because of a malfunction. Personnel at the site suspect that the problem is due to galling of the index tube.

2. After preliminary consideration of the 1963 bio-assay results it would appear that ingestion of radionuclides has occurred in several instances. The majority of the results were negative.

3. One of the post incident cooling system inlet valves was found inoperative during a recent routine test. Heat transfer calculations indicate that the system meets license specifications with the valve closed and locked out.

No items of noncompliance were noted.

DETAILS

I. Scope of Visit

A visit was made to the Dresden Nuclear Power Station on March 11, 1964 to obtain information about:

A. Radioactive effluents and waste disposal at the site. The information will be forwarded to RI in compliance with their recent request.

B. Containment vessel leak rate testing.

(continued)

Scope of Visit (continued)

C. An inoperable control drive.

D. A problem with the post incident cooling system.

The following Commonwealth Edison personnel were contacted:

Mr. H. K. Hoyt	Station Superintendent
Mr. C. B. Zitek	Assistant Station Superintendent
Mr. N. A. Kershaw	Manager of Efficiency Group
Mr. G. Redman	Operating Engineer, Mechanical
Mr. F. Palmer	Technical Supervisor
Mr. W. Kiedaisch	Radiation Protection Engineer

II. Results of Visit

A. Discussion of Containment Vessel Leak Rate Testing

The inspector discussed the various aspects of containment vessel leak rate testing with personnel at the site. They stated that they are currently performing an engineering evaluation of the problem and will make a proposal to RL as soon as the study has been concluded.

The following general topics were covered:

1. Vessel penetration design.

2. Recent experience related to extrapolating leak rate data obtained at intermediate pressures to the peak accident pressure.

3. Work which has been performed on leak mechanisms.

4. The possible methods of performing leak rate tests.

Mr. Palmer and the inspector calculated the extrapolated leak rate from the 5 psig test performed in 1961 assuming laminar flow and arrived at a value of approximately 0.6% of the contained volume per day.

Mr. Palmer stated that the four ventilation isolation valves were leak tested recently. The inspector reviewed a rough copy of the test report and noted that the test was performed at 20 psig. Both valves inside the containment vessel indicated no leakage. One exterior valve indicated no leakage and one was found to leak at the rate equivalent to 0.0015% of the contained volume/day. Mr. Palmer indicated that the steam and ventilation isolation valves and the air locks are leak tested at least once per year. The inspector has reported the results in previous reports.

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Results of Visit (continued)

e. Binding Control Rod Drive

During the course of the routine daily exercising of all completely withdrawn control drives (at 4:25 a.m. on March 2, 1964), it was noted the control drive K-4 did not respond to a normal insert signal.1/

At 7:35 a.m. on March 2, 1964 when drive K-2 was given another insertion signal with normal hydraulic system pressures, it was inserted a single notch. Successive attempts to withdraw the drive resulted in progressive notch by notch insertion. Normal and greater than normal hydraulic driving pressures were used during the above sequence. Each notch of insertion required at least two withdraw signals, indicating the drive was ratcheting in under the influence of the preliminary insert impulse.2/

While the drive was in the fully inserted position, the operation of the hydraulic system valves associated with the drive was investigated and appeared to function properly. The drive was then disarmed in the fully inserted position until subsequent tests were conducted during a previously scheduled outage on March 6, 1964.

During the outage on March 6, 1964, additional attempts to withdraw drive K-4 were again unsuccessful. Special gages were installed at critical points in the hydraulic system to ascertain if the problem was associated with that part of the drive hydraulic system. The results of this test indicated normal hydraulic system pressures, valve action, etc. The drive was again disarmed in the fully inserted position. At the time of the inspection the solenoid valves were deactivated and the position indicator was tagged in the control room.

Commonwealth Edison Company's evaluation of the problem, with the concurrence of G-E consultants, indicates that the inoperability of the drive was due to increased friction. The probable cause of the increased friction is considered to be galling of the index tube similar to the problem encountered on June 17, 1962 with control drive C-7.

Commonwealth Edison Company's justification for continuing operation with control drive K-5 fully inserted into the core and deactivated was as follows:

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1/ The drive performed normally during a similar test on March 1, 1964.

2/ The preliminary insert impulse is necessary in the Dresden design to force the shuttle piston down to unlock the latch fingers.

Results of Visit (continued)

1. All other control drives are operating properly.
2. Apparently the onset of maloperation can be detected by routine daily and weekly tests.
3. Although increased friction in a drive may impair normal motion, it has never been observed to prevent scram operation. Scram pressures are on the order of five times that necessary to insert K-4.
4. The fact that drive K-4 was locked out in the fully inserted position has no effect on the stuck rod criteria and will not impair reactor control.
5. No indication of an impending massive failure of the control system was indicated.
6. Axial flux data showed that the insertion of K-4 does not impair the control of axial flux.

It is planned that the drive will be removed, inspected, and replaced during the refueling outage in April. One other drive will be selected for inspection also, according to personnel at the site.

C. Post Incident System

Mr. Hoyt notified the inspector on January 31, 1964 by telephone that a problem had been encountered with the operation of one of the inlet valves of the post-incident system during the course of a routine test of the system performed on the weekend prior to the call. The valve, one of three valves in two identical systems which contain a total of six similar valves, was disabled and locked in the fully closed position.

An analysis of the situation by personnel at the site concluded that the system in the above-described condition could meet the requirements of DPR-2, Appendix A[3/] based on:

1. Heat transfer data obtained during precparational testing, assuming a conservative fouling factor.
2. Calculations that were corrected based on the density and viscosity of water at the accident condition.
3. A conservative value for the heat transfer coefficient (approximately 200 Btu/hr ft.^{2} $^\circ$F).

It was calculated that the heat removal capacity of the system in the condition outlined above is approximately 31 x 10^6 Btu/hr at an enclosure temperature of 256°F.

The valve will be repaired during the forthcoming refueling outage, according to personnal at the site.

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3/ Item B.11 of DPR-2, Appendix A states that the heat removal capacity of this system is at least 30 x 10^6 Btu/hr at an enclosure internal temperature of 256°F.

Results of Visit (continued)

D. Personnel Exposure

The inspector reviewed the annual summary reports on the exposure of employees to direct radiation and bio-assay program results for 1963. The following items were noted:

1. Radiation Exposure Summary

   a. The exposure for 90 permanently assigned Dresden personnel averaged 890 mrem for the year 1963.

   b. The average for the year 1962 was 874 mrem.

   c. The highest individual exposure for 1963 was 2313 mrem.

   d. The highest individual exposure for the year 1962 was 1985 mrem.

   e. The highest exposures for a work group in 1963 were accumulated by maintenance personnel and appear to be attributable to maintenance jobs performed during overhaul periods. Approximately 60% of the maintenance groups' exposure was accumulated in the first quarter, during which the refueling outage occurred.

   f. The exposures accumulated by the equipment operators, equipment attendants, and radiation protection men were above the average also. These men are required to enter radiation areas frequently to operate equipment, take radiation measurements, etc. Roughly 50% of the exposure for these groups was accumulated during the first quarter (refueling outage).

2. Bio-assay Summary - 1963

   a. The average concentrations of 331 urine sample analyses was 0.03 d/m/ml.

   b. The results ranged from 0.94 d/m/ml to 0.02 d/m/ml.

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Results of Visit (continued)

c. A limit of 4 d/m/ml has been established by Commonwealth Edison Company as the point where the contractor performing the analysis is instructed to notify the Commonwealth Edison Company Medical Director immediately.

   (1) Subsequent samples would be collected to check the original result.

   (2) If a high concentration is confirmed and sustained in subsequent samples, the Medical Director will prescribe the necessary action.

d. The limit of 4 d/m/ml has been calculated as a value which approaches 10 CFR 20 specifications for internal dose. Allowances were made on the basis of the critical organ which is influenced by the distribution of isotopes and their possible physiological effects.

No limits are used other than the 4 d/m/ml upper limit for consideration of bio-assay data. Other facilities have two intermediate values: one which is considered a positive threshold result and a second which is considered a warning limit. The absolute numbers depend on some of the following considerations:

a. Isotopes considered.

b. The critical organ associated with a given isotope.

c. Excretion rates.

d. Assay techniques.

Bio-assay limits employed by various installations are not comparable unless the assumptions, assay methods, etc., have been fully evaluated. The inspector has not fully analyzed these considerations as yet at Dresden.

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Results of Visit (continued)

E. Operational and Test Information

1. The refueling outage is still scheduled for about the middle of April despite the fact that the full insertion of control rod K-5 is worth approximately 8 MWe or one week of operation.

2. System activity levels for March to the date of the visit are:

Stack effluent activity (after two hours)	$\cong$ 4,000 microcuries/sec.
Gross system activity	$\cong$ 0.51 microcuries/ml.
Gross Iodine activity	$\cong 1.4 \times 10^5$ cpm/ml.

As one would expect, system activity is influenced by power level. The maximum capacity of the plant has been on the decline since January of 1964.

3. The results of the recent tests performed during the March 6, 1964, outage have not been fully evaluated as yet. It was determined that the temperature coefficient became negative at 300°F.

A test was performed at 155 MWe which involved tripping one of the main heat transfer pumps. A second pump, which feeds the core through a nozzle opposite that for the previously tripped pump was tripped several minutes later. The purpose of the test was to obtain data for the evaluation of whether or not one or more main heat transfer pumps should be tripped by the safety system whenever a turbine trip occurs.4/

It was suggested that the safety system be so modified following a turbine trip in the summer of 1963. The Dresden Review Committee suggested that tests be performed before the modifications were performed. Dresden personnel performed an analysis of the hazards presented

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4/ See CO report dated 8-2-63.

Results of Visit (continued)

by such a test and found that it did not involve hazards exceeding the magnitude of those encountered during full power operation or previous test operations. General Electric consultants concurred in this view.

Three-pump flow was observed to be 29.0×10^6 lbs/hr, while two-pump flow was $> 21.0 \times 10^6$ lbs/hr. The burn-out ratio was calculated to be > 4.0 with both two and three-pump flow.

4. Extensive testing performed in January and February has identified nine control cells as possibly containing failed fuel elements. The testing has been performed at 110 MWe, 160 MWe and 190 MWe. Rod pattern changes were made to assure that all rods were tested. The flux-tilting method was used as was the case with Core I. The data were not reproducible at all power levels. For example, the data obtained at 110 MWe did not exhibit the large leakers at 160 MWe, but did exhibit two leaker locations found during previous testing.

   The series of tests provided more insight with respect to core power distribution in both the axial and radial directions.

F. Plant Effluents and Waste Disposal

These data have been transmitted to CO Headquarters as a separate memorandum addressed to B. H. Grier, dated March 13, 1964.