U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-265/79-27

Docket No. 50-265 License No. DPR-30

Licensee: Commonwealth Edison Company
P. O. Box 767
Chicago, IL 60690

Facility Name: Quad-Cities Nuclear Power Station, Unit 2

Inspection At: Quad-Cities Site, Cordova, IL

Inspection Conducted: December 11-14, 1979

Inspectors: L. J. Hueter — 1/17/80

N. J. Chrissotimos for R. L. Spessard — 1/17/80

Approved By: R. L. Spessard, Chief — 1/17/80
Reactor Projects Section 1

Inspection Summary

Inspection on December 11-14, 1979 (Report No. 50-265/79-27)
Areas Inspected: Special, inspection of unplanned radiological effluent release. The inspection involved 39 inspector-hours onsite by two NRC inspectors.
Results: Three items of noncompliance (infraction-failure to follow a temporary procedure-Details I, Paragraph 3, infraction-failure to follow a radiation control procedure-Details II, Paragraph 6, and infraction-failure to continuously monitor an unplanned radioactive liquid release from the facility-Details II, Paragaph 6) were identified.

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DETAILS I

1. Persons Contacted

*N. Kalivianakis, Superintendent
T. Tamlyn, Assistant Superintendet Operations
*K. Graesser, Assistant Superintendent Administrative
*L. Gerner, Technical Staff Supervisor
*J. Heilman, Quality Assurance Operations

2. General

This inspection was conducted to examine the operational aspects of the unplanned radioactive liquid effluent release on December 9, 1979.

3. Unit 2 is currently in a refueling outage and the service water side of the RHR Heat Exchanger was to be drained so as to initiate a minor modification. Draining of the heat exchanger was estimated to take approximately 13 hours and normally would have been to the radwaste system via the floor drain system. However, the licensee did not elect to use this system due to the currently large inventory of water in the radioactive waste system and due to recent uncertainty in disposal of waste generated in processing liquid in the system, thus Temporary Procedure 1261 was issued to drain to an outside storm drain. The Procedure was issued in accordance with Station Procedures QAP 1100-5 and QAP 1100-7.

The first shift foreman, who is senior licensed, began implementing this procedure at approximately 4:30 a.m. on Sunday, December 9, 1979. At this time the drain hose was connected to an instrument manifold. This manifold has other instrument tap offs to primary system water which passes thru the manifold on occassion, and is a possible source of contamination. This connection was contrary to Step F26 of Temporary Procedure 1261 which states in part "connect a hose to the differential pressure switch instrument line DPS 2-1001-78A (2-1001-78B)". This operation continued until approximately 6:30 a.m. at which time it was ceased pending shift turnover.

At 9:00 a.m., the oncoming equipment attendant was requested to resume draining operations. Upon arrival at the instrument panel, the attendant was not sure as to what was to be done. The equipment attendant then asked the second shift foreman, who is also senior licensed, for further instructions. The foreman indicated to the equipment attendant to open the remaining instrument valves on the manifold. Opening of these valves allowed primary water to be discharged to the storm sewer for approximately 14 hours, before the unit operating engineer discovered it and stopped the discharge. These actions (opening additional instrument valves) were contrary to any of the steps contained in Temporary Procedure 1261.

Temporary Procedure 1261 in the prerequisites states in part "to extend a hose from the integrated leak rate connector outside of Unit 1 reactor building to the storm sewer". Contrary to this requirement, the hose connection was not made and effluent was discharged onto the blacktop pavement and allowed to drain by gravity to the storm drain approximately 30 feet away. This resulted in contamination of an area of the blacktop pavement.

The preceeding actions, as directed by the two shift foreman, were contrary to approved Temporary Procedure 1261 and is an item of noncompliance with Technical Specification 6.2.A. (265/79-27-01)

DETAILS

Section II

Prepared by L. J. Hueter

Reviewed by W. L. Fisher, Chief
Fuel Facility Projects and
Radiation Support Section

1. Persons Contacted

R. Flessner, Rad-Chem Supervisor
M. Whitemore, Chemistry Laboratory Foreman
R. Robie, U-2 Operating Engineer

2. General

This inspection, which began at about 10:00 a.m. on December 11, 1979, was conducted to examine licensee's compliance with regulatory requirements in the areas of liquid radwaste and radiation protection management programs related to an unplanned radioactive liquid effluent release while intending to drain only the service water side of the 2B RHR Heat Exchanger on December 9, 1979.

3. Cause of Unplanned Radioactive Liquid Release

The draining of the service water side of the 2B RHR Heat Exchanger to the storm sewer was intended to involve release only of nonradioactive liquid. Further, the procedure prepared for this operation, Temporary Procedure 1261 - "Draining Unit 2 RHR Service Water Piping," first required draining some of the liquid into a container and then sampling and analyzing this liquid to verify the presence of only background levels of activity before release to the storm sewer. This sampling and analysis was conducted before beginning the release and the analysis identified no activity above background levels. If Temporary Procedure 1261 had been followed, the unplanned release of radioactive liquid would not have occurred.

4. The Release Pathway

The effluent was pumped through the integrated leak rate connector to the outside (east side) of the Unit 1 Reactor Building, discharged onto the blacktop pavement and allowed to flow by gravity to the storm sewer drain about 30 feet east of the Reactor Building. The storm sewer carried this effluent south past two additional surface drains. A fourth surface drain is located where the storm sewer makes a right angle turn to the west at a location southeast of the Service Building. A fifth drain is located on this line where the effluent (nonradio-

active) from the Waste Water Treatment Plant (WWTP) enters the storm sewer by an underground connection. A sixth drain is located shortly before the effluent enters the Unit 1 Oil Separator Tank, a 30,000 gallon tank that normally remains full and overflows to the discharge bay, across from and slightly to the downstream side of the north and south River Diffusers. The south River Diffuser was partially open throughout this release to permit balancing the water level in the cooling system with only one of the two reactor Units in operation. Of the total 550,000 gpm estimated flow rate in the discharge bay, the licensee determined that the discharge to the river via the south River Diffuser was about 180,000 gpm. Radioactivity not promptly released from the discharge bay to the south River Diffuser would be lifted by the two operating lift pumps to the spray canal. Here the liquid would make a circuit in this approximate 160 million gallon body of water every seven or eight hours before it, and river make-up water, perform their cooling function and enter the discharge bay, where about one third of this cooling water is released to the river via the south River Diffuser.

5. Magnitude of Unplanned Release

The release rate from the instrument manifold system (open to both primary system water and service system water) was determined by the licensee to be about 5 gpm. This release continued for a maximum of 14 hours (10:00 a.m. to midnight on December 9, 1979), resulting in about a 4200-gallon release. Of the various samples collected in the release path following the discovery and termination of the unplanned radioactive release, the highest activity concentration measured was 2.4E-03 μCi/ml based on gamma isotopic analysis. This was in a small pool of water in one of the surface drains (manholes) before the influent (15 gpm) from the WWTP. This gamma isotopic analysis indicated a slightly higher total activity concentration than the gross beta-gamma analysis.

This concentration in 4200 gallons would indicate a total activity of 38 millicuries released from the instrument manifold. However, only about 25 millicuries of this total was released to the discharge bay and ultimately to the Mississippi River as an unplanned release. The remainder was isolated in the storm sewer and Oil Separator Tank system when input to the storm sewer from the WWTP was stopped by plugging the drain line at 11:00 a.m. on December 10, 1979, about 25 hours after the initial radioactive release began from the instrument manifold. The contents of the Oil Separator Tank were later released on a planned batch basis meeting release requirements by performing prerequisite sampling and analysis, and pumping through a flow meter to the South River Diffuser where a compositer sampler was placed in operation for the planned release. The contaminated blacktop surface subsequently was flushed to the storm sewer and the storm sewer in turn was flushed to the Oil Separator Tank with water from fire hose

after which a similar planned release was made. Continued flushing and planned batch release(s) were to continue if concentrations were not down to background levels. The isotopic analysis showed the activity to be comprised of about 67% cobalt 60, 15% iodine 131, 4% manganese 54, and lesser amounts of cobalt 58, cesium 134, cesium 137, technetium 99m, and zinc 65.

Technical Specification 3.8 D.2.a limits the maximum permissible concentration (MPC) of gross radioactivity (above background), excluding tritium, in the discharge bay to 1E-07 μCi/ml unless the discharge is controlled on a radionuclide basis in accordance with Appendix B, Table II, Column 2 of 10 CFR 20 and note 1 thereto. If one were to make the conservative assumption that the 5 gpm from the instrument manifold at the maximum measured concentration (before dilution) of 2.4 E-03 μCi/ml entered the discharge bay directly (without dilution of 15 gpm from the WWTP and dilution in the 30,000 gallon Oil Separator Tank) and was diluted with it's 550,000 gpm, the maximum concentration in the discharge bay and out the South Diffuser would have been 2.2E-08 μCi/ml or 22% of the Technical Specification limit. If, based on after-the-fact isotopic analysis, this discharge had been controlled on a radionuclide basis in accordance with 10 CFR Appendix B, Table II, Column 2 and note 1 thereto, calculation shows that the concentration was only about 1% of the MPC, using the same conservative dilution analysis described above. Therefore, it is concluded that this unplanned release did not exceed any release rate limits.

6. Other Findings Associated With Unplanned Release

Technical Specification 6.2.B requires that radiation control procedures be maintained and adhered to. Radiation Protection Surveillance Procedure QRS 300-1 titled "Station Liquid Discharge Records" states in Paragraph E, "Limitations and Actions," "Measurements shall be made on a representative sample of each batch released and station records retained of the activity (mCi) and concentration μCi/ml of gross radioactivity and volume (gallons) of each batch of liquid effluent released and estimates made of the water flow (gpm) used to dilute the liquid effluent prior to release from the restricted area."

A liquid sample from the 2B RHR Heat Exchanger was collected and analyzed before initial draining of the heat exchanger began. This sample showed no activity above background levels. No further samples were taken during the release.

Technical Specification 3.8.D.1 states "Radioactive liquid released from the facility shall be continuously monitored. To accomplish this, either the radiation monitor on the discharge line or the discharge bay sampler shall be operable or grab samples shall be taken in the discharge bay during the course of the discharge."

Contrary to this requirement, the unplanned radioactive liquid release from the instrument manifold which began about 10:00 a.m. on December 9, 1979, was not continuously monitored, in that: (1) the release path was not via the discharge line on which the radiation monitor is located; (2) the compositer sampler on the south River Diffuser line (the path from the discharge bay to the river during this release) was not placed in operation; and (3) grab samples were not collected from the discharge bay during the discharge. (265/79-27-02)

Technical Specification 6.2.B requires that radiation control procedures be maintained and adhered to. Radiation Control Procedure QRP 100-1 titled "Radiation Control Standards" states in Paragraph F. 16. A.2., "Except as noted, a Special Work Permit (SWP) will be required when personnel may or are expected to exceed a daily whole body dose of 50 millirem. If however, a Radiation Protection man is in continuous attendance at the job site while a job is in progress, he may authorize a daily whole body dose of up to 100 millirem per day without requiring an SWP."

A review of daily exposure records for December 9, 1979, for personnel involved in the operation in which the unplanned release occurred showed an Equipment Attendant (EA) received a dose of 75 mrem for the day and the Shift Foreman (SF) received a dose of 130 mrem for the day. The EA received about 15 mrem of his dose at the Radwaste Facility and the remaining 60 mrem dose he attributed to work in the radiation field around the instrument manifold. The SF indicated he spent very little time near the instrument manifold, but received nearly all of his 130 mrem in overseeing the draining of a Reactor Recirculation Pump. The licensee provided no evidence that either worker was working under an SWP or under continuous H.P. surveillance. Workers exceeding 50 mrem of exposure in a day without approved authorization is an apparent item of noncompliance. (265/79-27-03)

As an immediate corrective action for the unplanned release, the licensee discontinued the release of any RHR draining as nonradioactive waste and is directing all such drainage be sent to the Radwaste System.

Smearable activity of the blacktop surface, which remains restricted by rope barricades and signs, initially ranged from about 2,000 to 11,000 dpm/100cm^2 except for one smear showing about 90,000 dpm/100cm^2 near the point of release on the blacktop surface. As noted earlier, the initial flush had been completed during the inspection. Information on reduction of contamination levels by the flushing was not obtained by the inspector. The licensee had not finalized the decontamination plan for the blacktop surface.

7. Apparent Leak in the Unit 1B RHR Heat Exchanger

The Residual Heat Removal (RHR) System is normally used for a few days in the early stages of an outage to cool primary system water. At other times, surveillance tests of the RHR system are conducted at specified intervals to demonstrate operability. Normally the surveillance tests are conducted monthly, except that daily tests are required of all remaining components if a component is known to be out of service. For a period of about two months in September and October, 1979, the Unit 1B RHR system was surveillance tested daily while repairing a Service Water Pump. During this testing, spikes which coincided with initiation of the RHR system began appearing on the Service Water Monitor Chart. A review of the chart covering the period September 3 through October 5, 1979, showed the spikes in early September were on the order of 70 net counts/sec (cps), but increased with a few spikes in the range of 3000 to 6800 net cps in late September through early October. The three final spikes on the chart ranged from 350 to 1000 net cps. The service water side of the heat exchanger is at a higher pressure than the primary side when the heat exchanger is operating, but is at a lower pressure when the Service Water Pump is not operating. The licensee had not quantified the releases indicated by these spikes or determined the significance or lack of significance of these spikes. The heat exchanger leak was being repaired at the time of the inspection, and during the exit interview the licensee agreed to evaluate the significance of the leak for review during a future inspection. The licensee has identified previous leaks and made repairs of RHR heat exchangers, including this same Unit 1B heat exchanger in 1973, the Unit 2B heat exchanger in 1975, and the Unit 2A heat exchanger in 1977. However, daily testing during this leak period tends to increase the significance of the release. Also, the Service Water Monitor has been moved to a location with lower background radiation. The change in location may have affected the monitor's sensitivity. This matter is considered an unresolved item and will be reviewed during a future inspection. (265/79-27-04)

8. Unresolved Item

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. An unresolved item disclosed during this inspection is discussed in Paragraph 7.

Exit Interview

The inspectors met with licensee representatives (Denoted in Paragraph 1 of Details 1 and 2) at the conclusion of the inspection on December 14, 1979, and summarized the scope and findings of the inspection activities, including the items of noncompliance and the unresolved items. The licensee acknowledged the inspectors comments and stated that the event occurred solely as a result of the failure to follow the apporved Temporary Procedure.