U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-456/94011(DRP)

Docket No. 50-456

Licensee: Commonwealth Edison Company
Opus West III
1400 Opus Place
Downers Grove, IL 60515

Facility Name: Braidwood Station, Unit 1

Inspection At: Braidwood Site, Braceville, Illinois

Inspection Conducted: March 28 through 31, 1994

Inspector: V. P. Lougheed

Approved By: Bruce L. Jorgensen, Chief
Reactor Projects Section 1A

4-15-94
Date

Inspection Summary

Inspection from March 28 through 31, 1994 (Report No. 50-456/94011(DRP)
Areas Inspected: Special announced safety inspection of the events surrounding the Unit 1 second periodic containment integrated leak rate test (ILRT) conducted on March 10-12 and again on March 15-17, 1994.

Summary: No violations were identified. The Unit 1 ILRT was determined to have failed in the as-found condition. Because the 1991 ILRT was also deemed an as-found failure, Technical Specification 4.6.1.2.b requires performance of an ILRT every 18 months until two as-found ILRTs successfully pass. Concerns were identified relating to a prolonged "stabilization" time for the ultimately successful test, which was not satisfactorily explained, and relating to apparent liner leakage of unidentified location in the "as left" condition.

DETAILS

1. Management Interview

The inspectors met with the licensee representatives denoted in Section 6 during the inspection period and at the conclusion of the inspection on March 31, 1994. The inspectors summarized the scope and results of the inspection and discussed the likely content of this inspection report. The licensee acknowledged the information and did not indicate that any of the information disclosed during the inspection could be considered proprietary in nature.

2. First Pressurization of Containment

On March 10, 1994, the licensee began pressurization of the Unit 1 containment for performance of the second periodic integrated leak rate test (ILRT). Following attainment of test pressure, the air compressors were shut off, and the required temperature stabilization period begun. Although temperature stabilization requirements were met within six hours, the licensee did not begin ILRT data collection because the measured leakage rate exceeded the allowable of 0.075 weight percent per day (wt%/day) or 0.75 L_a. Test personnel began a systematic inspection of the outside containment penetrations, searching for possible leakage locations. Eventually a large leak was identified between the emergency hatch and its 3-inch concrete support.

The licensee injected foam insulation material into the emergency hatch penetration boundary to confine the leakage to a small cross-sectional area. Air samples were taken at the emergency hatch and isotopic analysis confirmed that the leakage was from containment. Deck plates within the emergency airlock were removed to inspect for potential leak pathways in or around the airlock barrel. The licensee then discovered that caps were never installed on concrete pouring vents in the barrel. The containment was depressurized so that caps could be installed. Leak rate testing was then performed to confirm that the vents were the source of the leakage. The licensee subsequently quantified the leakage at approximately 42 standard cubic feet per hour (scfh), or about 0.009 wt%/day.

The inspector reviewed the licensee's actions regarding the vent caps and found them acceptable. However, the inspector determined that both the injection of foam insulation under the airlock barrel and the cap installation process would have affected the leakage rate. Therefore, the value of 0.009 wt%/day could not be considered an as-found leakage rate and any use of this value (such to compare the 1991 and 1994 as-left values) would not be technically sound.

The inspector reviewed the results from the first periodic ILRT, conducted in 1991. During the 1991 test, no leakage was identified as coming from the emergency airlock barrel. Based on this review, the inspector concluded that leakage through the airlock barrel had not

occurred during previous operating cycles. The inspector determined that the 1994 ILRT failed in the as-found condition, due to the unquantified leakage from the vents under the emergency airlock. Because both the 1991 and the 1994 ILRTs were classified as as-found failures, the licensee is required to perform an ILRT every 18 months, in accordance with Technical Specification 4.6.1.2.b, until two successful ILRTs are performed.

3. Second Pressurization of Containment

On March 14, 1994, following installation and testing of the vent caps, the licensee began a second pressurization. The containment was successfully pressurized and on March 15, at approximately 10:00 a.m., the licensee began the required temperature stabilization period.

Similar to the events of the first pressurization, the containment temperature stabilized within a few hours. The calculated leakage rate, however, remained above the allowable maximum (0.75 L_a), although the value was lower than seen during the first pressurization. While searching for possible additional leak sources, the licensee identified noticeable leakage around the perimeter of the emergency hatch outer door; they closed the outer door and opened the inner one. Approximately one hour later, the service air penetration was identified as leaking severely. Following confirmation that the leak was from containment (and not from the service air system), the vent valve was closed and the penetration pressurized to a value below containment pressure. The licensee monitored the pressure source throughout the test period to ensure that the penetration pressure remained below the containment pressure.

Six hours after the isolation of the service air penetration leak, the leakage rate was decreasing, but was still very close to 0.75 L_a. In an effort to further reduce the leakage, the licensee isolated the vent paths to four process sampling penetrations and one fuel pit cooling penetration. Over the next three hours, each of these penetrations was reopened to determine the extent of the leakage. Only two of the process sampling penetrations were actually leaking; the licensee closed the vent valves for these penetrations. The other three penetrations remained properly vented for the test duration.

After another six hours, the leakage rate fell below 0.75 L_a, and the licensee began a twenty-four-hour ILRT. The test was satisfactorily completed, with a final leakage rate of 0.046 wt%/day (at the 95 percent upper confidence level). The licensee then completed the supplemental test, with the induced leakage leveling out towards the bottom of the band, but well within it.

The inspector reviewed the test results for both the ILRT and the supplemental test, and found the results satisfactory. An inspector concern, regarding the length of time required for the containment to stabilize, is discussed in Section 4 below. The inspector also reviewed the results of the as-found local leak rate tests (LLRTs) for the

service air and process sampling penetrations and found them to be minimal contributors to the overall leakage rate (approximately 0.006 wt%/day.)

4. Protracted Stabilization Period: As discussed above, following the second containment pressurization, the test remained in the temperature stabilization phase for 20.75 hours. The temperature stabilization criteria, as given in the test procedure, were met within 6 to 8 hours; however, the leakage rate did not decrease below the acceptance criteria for another 12 hours. (Typically, temperature stabilization phases range from the 4 hour minimum to about 8 hours.) During this protracted stabilization phase, the licensee isolated a number of penetrations which later proved to have only minimal leakage rates.

   For the 1991 Unit 1 ILRT, the stabilization phase lasted 38 hours. During that time, the leakage rate remained greater than the allowable until the licensee isolated a number of penetrations, which later proved to have only minimal leakage rates. The length of the stabilization phase, along with the penetration isolations, formed the basis for the test being judged an as-found failure. The inspector was concerned about the similarities between these two tests, and the possible impact on future tests.

   The inspector and the licensee held several discussions as to why such a protracted stabilization period was required. The inspector also discussed with the licensee why isolating and pressurizing a penetration would appear to change the leakage rate from above L_a to below it - but, later, the penetration LLRT would show minimal leakage. The licensee speculated that the large containment volume and changes in the reactor coolant temperature might be contributors; however, no one factor could be conclusively shown to have affected the leakage rate. During the management interview, the inspector discussed the prolonged stabilization period with station management. Besides the regulatory impact of having to perform a test every outage, there was considerable schedular impact this outage when a 24-hour stabilization phase, plus a 24-hour ILRT, plus a 4-hour supplemental test had to be performed. Station management indicated that they were aware of both the regulatory and schedular penalties and stated that they were strongly committed to determining the root cause of the protracted test period.

5. Additional Leak Detection Efforts

   Weld Channel Leak Testing: The Braidwood containment has weld channels over a majority of the plate-to-plate welds on the containment liner. These channels are normally plugged, but the plugs can be removed to perform leak testing of the channels. Following discovery of the uncapped vents, and before the second pressurization, the licensee tested all the weld channels from elevation 374 to elevation 424. The licensee did not plan to test the weld channels below elevation 374, mainly due to radiation dose levels. Only two channels had any leakage, both of which were very small (≈17.9 scfh or 0.004 wt%/day total.)

Sodium Hexafluoride Injection: Due to finding the uncapped vents under the emergency airlock, the licensee decided to search for other potential containment leaks while the containment was pressurized. Following preparation of a special procedure, sodium hexafluoride was injected into containment through the mini-purge exhaust line. The licensee then monitored a number of areas for the presence of the sodium hexafluoride five minutes, fifteen minutes, and thirty minutes after the injection. Sodium hexafluoride was detected near the equipment hatch, near the electrical penetrations on elevation 426, and in the curved wall area on elevation 364. The licensee was unable to accurately quantify the extent of the leakage, but they suspected that there was some containment liner leakage. As the equipment hatch did not have weld channels, and because it was one of the major locations where sodium hexafluoride was detected, the licensee was developing a method to check for leaks, especially in the area where the liner and equipment hatch barrel met.

The inspector was concerned about potential liner leakage, given the sodium hexafluoride detected outside the equipment hatch. However, the inspector noted that the as-left leakage rate was acceptable and had not significantly changed over the last two operating cycles, so that liner degradation did not appear to be occurring. Nevertheless, future performance is unpredictable, so the licensee was encouraged to continue efforts to identify and correct any significant sources of liner leakage, especially in light of the need to improve the overall ILRT test performance.

Containment Inspection at Fifteen psia: During the final depressurization of containment, personnel entered containment while it was pressurized to 15 psia to further hunt for possible leakage paths. The team members, equipped with a sonic gun to aid in leak detection, identified four penetrations where they believed noises were heard. After the containment was completely depressurized, the licensee performed leak testing on the circular weld channels around the four penetrations. No leaks were identified during this subsequent testing.

6. Persons Contacted

*K. L. Kofron, Station Manager
R. Kerr, Engineering and Construction Manager
*D. Miller, Technical Services Superintendent
*A. Checca, System Engineering Supervisor
*D. Skoza, Site Engineering Supervisor
*M. Smith, Primary Group Leader, System Engineering
*J. Lewand, Regulatory Assurance, NRC Coordinator
*T. Eliakis, ILRT Coordinator, System Engineering
*J. Glover, ILRT Coordinator, Nuclear Engineering Department

*Denotes those attending the management interview conducted on March 31, 1994.

The inspector also met with other individuals throughout the course of the inspection, including members of the quality control department.