February 6, 1992

Docket Nos. 50-237, 50-249,
and 50-254, 50-265

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Mr. Thomas J. Kovach
Nuclear Licensing Manager
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Dear Mr. Kovach:

SUBJECT: EXEMPTION FROM THE TESTING REQUIREMENTS OF APPENDIX J TO 10 CFR PART 50 FOR DRESDEN AND QUAD CITIES NUCLEAR POWER STATIONS (TAC NOS. M81299, M81300, M81301, AND M81302)

By letter dated November 12, 1991, you requested an Exemption from certain Type B (local leak rate) testing requirements of Appendix J to 10 CFR Part 50, for the two-ply containment penetration expansion bellows at Dresden and Quad Cities Nuclear Power Stations. Enclosed is the granted Exemption from Appendix J. A copy of this Exemption is being forwarded to the Office of the Federal Register for publication.

Sincerely,

Original signed by:
Bruce A. Boger

Bruce A. Boger, Director
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosure:
Exemption

cc w/enclosure:
See next page

*See previous concurrence

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01/10/92	01/10/92	01/10/92	01/28/92	01/21/92

*ADR3/DRPW	D/DRPW	
JZwolinski	BBoger	
01/29/92	2/6/92	

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	
	)	
(Dresden Nuclear Power Station, Units 1 and 2; Quad Cities Nuclear Power Station, Units 1 and 2)	)	Docket Nos. 50-237, 50-249, 50-254, and 50-265

EXEMPTION

I.

Commonwealth Edison Company (CECo, the licensee) is the holder of Operating License Nos. DPR-19 and DPR-25, which authorize operation of Dresden Nuclear Power Station, Units 1 and 2; and Operating License Nos. DPR-29 and DPR-30, which authorize operation of Quad Cities Nuclear Power Station, Units 1 and 2. These licenses provide, among other things, that Dresden and Quad Cities are subject to all rules, regulations, and Orders of the Commission now or hereafter in effect.

Dresden Station is comprised of two boiling water reactors at the licensee's site located in Grundy County, Illinois. Quad Cities Station is comprised of two boiling water reactors at the licensee's site located in Rock Island County, Illinois.

II.

By letter dated November 12, 1991, the licensee requested an exemption from certain Type B (local leak rate) testing requirements of Appendix J to 10 CFR Part 50, for a total of 83 two-ply containment penetration expansion

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bellows at four reactor units. This is because the bellows design is such that they cannot be properly tested to satisfy Type B testing requirements, barring replacement with bellows of a different design.

On November 19, 1990, during the Quad Cities, Unit 1, Cycle 11 Refueling Outage, the licensee performed a local leak rate test (LLRT) on the Drywell Ventilation Penetration X-25 bellows. This was done in the normal way, by pressurizing the small space between the two plies of the bellows assembly by using a test tap made for that purpose. The measured leakage rate was 4.3 standard cubic feet per hour (scfh). After the LLRT was performed, a significant amount of maintenance and new construction work was performed in the area surrounding the bellows assembly. This included extensive maintenance on a valve located in-line with the bellows (valve 1-1601-23) and installation of a new penetration (X-109, Reactor Vessel Level Instrumentation Lines) directly above X-25. After the completion of this maintenance and construction, a new LLRT was performed on the X-25 bellows, with a measured leakage rate of 6 scfh. Approximately two days later, the primary containment integrated leak rate test (ILRT) was performed. While the containment was at pressure, application of a soap solution to the surface of the X-25 bellows indicated three cracks ranging in length from 0.187 inch to 1.7 inch, and a large number of small pin-hole cracks. The ILRT was successfully completed with the leaking bellows in its as-found condition. Following the ILRT, an additional LLRT was performed on the bellows, and the results matched the previous LLRT leakage rate. A soap solution was applied to the bellows assembly during this LLRT and showed only a few small leaks.

Next a "special" LLRT was performed in an effort to quantify actual leakage from the bellows. A steel plate was welded to the vent line inlet which is located inside the drywell. The bellows were pressurized through a threaded hole in the plate and a leak rate test was performed on the entire penetration. The soap solution indicated a large leak with many small leaks similar to that encountered during the ILRT. A leakage rate of 137 scfh was measured.

With the validity of the LLRT in question, the licensee tried to determine the sensitivity of the LLRT procedure to detect and quantify leaks. A 0.25-inch hole was drilled through the two bellows from the outer diameter to the inner diameter in the convolute adjacent to the LLRT taps on the bellows. A LLRT was performed and resulted in a small increase in leakage (from 6 scfh to 7 scfh). A second hole was drilled and the LLRT was repeated. The measured leakage was 8 scfh.

These circumstances indicated that the current method used to perform a LLRT on two-ply containment penetration bellows could identify leakage, but could not quantify the extent of the leakage. The licensee formally notified the Commission of these findings by letter dated March 27, 1991.

The bellows assembly for penetration X-25 at Quad Cities Station is typical of two-ply bellows for other containment penetrations at both Quad Cities and Dresden Stations. These assemblies are original plant equipment, which were manufactured and installed in the late 1960s and early 1970s. These flexible metallic bellows are constructed with two plies of austenitic type 304 stainless steel which are formed together into cylindrical corrugated bellows elements. This design configuration is

typical of bellows penetrations which are used at all units at Dresden and Quad Cities Stations. The investigation conducted by the licensee, which included discussions with the supplier and an independent analysis at Argonne National Laboratory, revealed that the forming process can bring the plies into contact, thereby limiting the flow of the local leak rate test medium (inert gas or air) between the inner and outer plies. The X-25 LLRT and ILRT test results indicated that leakage can be detected under these conditions; however, the leakage cannot be accurately quantified.

In order to achieve full compliance with Type B testing requirements, both Dresden and Quad Cities would be required to replace all two-ply containment penetration bellows with a testable bellows design. The cost of replacement of two-ply bellows assemblies is projected to be approximately $400,000 per assembly, which would mean between approximately $7.1 million and $9.5 million per unit for both Dresden and Quad Cities Stations. The total cost of bellows replacement is projected to be approximately $33.35 million.

III.

In lieu of an Appendix J Type B test on the applicable two-ply containment penetration bellows assemblies at Dresden and Quad Cities Stations, the licensee proposes to implement the following testing program:

1. All two-ply bellows will be locally pressurized with air (between the plies) at a pressure of Pa. The leakage rate will be measured in accordance with station procedures. If leakage is less than 0.5 scfh, the bellows assembly will be considered to be intact and no further testing on that bellows assembly is necessary.

2. If the leakage rate is greater than or equal to 0.5 scfh, then the bellows assembly will be locally pressurized at the test

taps with helium (between the plies) at a pressure of Pa. The outer ply will then be tested for the presence of helium with a helium sniff detector. If no helium is detected, the integrity of the outer ply will be considered to be intact, and no further testing on that bellows assembly is necessary.

3. If helium leakage is detected through the outer ply, then the inner ply will be tested for the presence of helium. If no helium is detected, the integrity of the inner ply will be considered to be intact, and no further testing on that bellows assembly is necessary.

4. If helium is detected through both the inner and outer plies, then the protective covers will be removed, and the outer ply will be examined by penetrant and/or snoop testing. All observed flaw indications will be measured and mapped. Bellows assemblies which indicate leakage through both plies will not be considered to be intact.

5. All crack indications will be evaluated by the [licensee's] Nuclear Engineering Department (NED) and the current and projected leakage rate will be calculated. The NED review will include a structural assessment of the bellows with regards to critical flaw size.

6. Upon completion of the two-ply bellows testing program, a Type A ILRT test will be performed to verify primary containment integrity.

7. All two-ply bellows assemblies which demonstrate leakage through both plies will be replaced during the subsequent refuel outage, unless Commonwealth Edison Company provides justification for continued operation greater than one operating cycle.

This Exemption and associated testing program is requested for each non-testable two-ply bellows assembly (original design). Upon replacement with a testable bellows assembly, that bellows will no longer be included in the Exemption and will be required to be tested in accordance with the normal Type B test program. Similarly, if a method is developed which insures a valid Type B test on one or more bellows assemblies, those bellows will also be excluded from the Exemption and will be required to be tested in accordance with the normal Type B test program.

This testing program is intended to assure that at least one ply of a two-ply bellows is intact and that overall containment leakage is within its allowable limit as shown by Type A testing. The Type A test is essential to this program, because it is the only test available that can properly quantify the bellows' leakages, albeit not individually. This is especially important for those bellows which are known to leak but will not be replaced until after another cycle.

It is also important to be assured that a leaking bellows will not degrade excessively during the period that ends with its replacement. The licensee examined the X-25 bellows assembly from Quad Cities and determined that the crack mechanism was transgranular stress corrosion cracking (TGSCC). The licensee stated that this mechanism, which has caused previous bellows assembly deterioration at Dresden and Quad Cities, is normally characterized by the slow development and propagation of cracks. The X-25 penetration deterioration is unique in the licensee's experience since the bellows appeared to exhibit a large increase in leakage during one operating cycle based upon the potential impact of 137 scfh on the ILRT results. This large amount of leakage would have had a noticeable impact upon ILRT results during previous outages (although it would not have led to the failure of the ILRT). This significant leakage increase may have occurred as a result of maintenance work associated with the replacement of a valve which is directly in-line with the bellows. During the replacement of the in-line valve (1-1601-23), which is located approximately 12 inches from the bellows assembly, excessive force was used to remove the valve. Resultant torsional and/or translational forces may have caused an

accelerated growth of existing TGSCC in the bellows. The metallurgical investigation also identified the presence of several corrosive species which contribute to TGSCC. These included chlorides, flourides, and sulfides. The original form of this material could not be determined and the method substance deposit is therefore unknown.

The licensee has performed a fracture mechanics evaluation, detailed in their submittal, which concludes that substantial structural margin exists to ensure that, during one operating cycle, catastrophic failure should not occur for bellows assemblies with cracks and holes of the type and size that would be detected by the proposed surveillance procedure.

Recent tests at Dresden, using the proposed procedures, have detected flaws of the anticipated size in several bellows assemblies. The staff questions, however, whether the LLRT with air could detect all significant flaws, since the flow of air between the plies is so restricted. In order to insure that the air test and associated threshold of 0.5 scfh would, with sufficient sensitivity, detect leakage from a bellows assembly, the licensee performed a one-time helium flow rate validation test on the two-ply bellows assemblies at Dresden Station during October 1991. This validation consisted of two separate pressurizations and leak rate measurements, one with air at Pa, and one with helium at Pa. By pressurizing with helium, the licensee would then be able to detect if an obstruction between the plies was preventing air from reaching a leak. The helium flow rate compared favorably with the expected flow rates of helium calculated for turbulent and laminar flow conditions, knowing the measured airflow rates.

Therefore, the initial air leakage test described in the proposed test program is a valid means to test for the presence of leaks in two-ply bellows assemblies. This in turn validates the ability of the proposed testing program (which includes a Type A test) to verify the integrity of a bellows assembly, and insure that primary containment leakage is less than 0.75 La.

The staff finds that the proposed testing program will detect bellows assemblies with significant flaws and result in replacement of flawed assemblies within one operating cycle, during which period there is reasonable assurance that the bellows assemblies will not suffer excessive degradation. If the licensee should propose to wait longer than one cycle to replace any belows assembly, the staff must evaluate and approve the request at that time.

IV.

Accordingly, the Commission has determined pursuant to 10 CFR 50.12(a)(1) and (a)(2)(ii), that (1) the Exemption from Appendix J is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security, and (2) application of the regulation in this particular circumstance is not necessary to achieve the underlying purpose of the rule. The Commission concludes the testing and replacement program for the containment penetration bellows assemblies is an acceptable alternative to the Appendix J Type B testing requirement. Accordingly, the Commission hereby grants the Exemption from Appendix J.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this Exemption will have no significant impact on the quality of the human environment (57 FR 4651).

This Exemption is effective upon issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Bruce A. Boger, Director
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland
this 6th day of February 1992