CENTERIOR ENERGY

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Docket Number 50-346

License Number NPF-3

Serial Number 2110

February 22, 1993

United States Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Subject: Request for Exemption from 10 CFR 50, Appendix J, Type B Local Leak Rate Testing Requirements for Containment Penetration Expansion Bellows

Gentlemen:

This letter transmits Toledo Edison's request for exemption from the leakage quantification requirements specified in 10 CFR 50 Appendix J for certain Type B Local Leak Rate Tests (LLRTs). This request is based on information provided in Nuclear Regulatory Commission (NRC) Information Notice (IN) 92-20, Inadequate Local Leak Rate Testing, that potential leakage from certain types of 2-ply bellow penetration assemblies may not be adequately quantifiable. Toledo Edison met with the NRC on November 19, 1992 and January 15, 1993 to discuss in detail this exemption request and special circumstances at the Davis-Besse Nuclear Power Station (DBNPS).

Toledo Edison has reviewed IN 92-20 and has determined that it is applicable to four containment penetrations at the DBNPS. Review of the DBNPS test methodology and other available information related to IN 92-20 confirm that although potential leakage can be detected in these assemblies, leakage at rates greater than a threshold value may not be adequately quantifiable.

Information supporting this request is contained in the attached exemption request. Toledo Edison has concluded that for the reasons specified in the attachment, special circumstances as defined in 10 CFR 50.12 exist and that the granting of the requested exemption will not present an undue risk to the health and safety of the public and is consistent with the common defense and security.

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Approval of this exemption request would be needed to support restart from the upcoming eighth refueling outage (8RFO) only in the event that leakage greater than the threshold leakage rate is detected in these penetration assemblies. To date no leakage has been detected during testing of these assemblies and Toledo Edison has no reason to expect leakage at this time. Testing to determine the threshold leakage rate will be conducted during the 8RFO. Restart from the 8RFO is currently expected to occur on May 1, 1993.

If you have any questions regarding this matter, please contact Mr. Robert W. Schrauder at (419) 249-2366.

Very truly yours,

PWS/dlc

attachment

cc: A. B. Davis, Regional Administrator, NRC Region III
J. B. Hopkins, NRC Senior Project Manager
S. Stasek, DB-1 NRC Senior Resident Inspector
Utility Radiological Safety Board

EXEMPTION REQUEST

In accordance with 10 CFR 50.12, Toledo Edison requests exemption from the Appendix J leakage measurement requirement for Type B local leak rate testing of the eight expansion bellows associated with the Davis-Besse Nuclear Power Station, Unit 1 (DBNPS) main steam (MS) and main feedwater (MFW) containment penetrations (Penetration Numbers 37, 38, 39 and 40). The exemption will be applicable for measured leakage rates greater than a threshold value below which the current Type B test method provides valid leakage rate measurements.

Background

10 CFR 50.54(o) requires primary reactor containments for water cooled power reactors to be subject to the requirements set forth in 10 CFR 50, Appendix J. 10 CFR 50, Appendix J, Section III.D.2(a) states:

> Type B tests, except tests for airlocks, shall be performed during reactor shutdown for refueling, or other convenient intervals, but in no case at intervals greater than 2 years.

10 CFR 50, Appendix J, Section II.G states:

> "Type B Tests" means tests intended to detect local leaks and to measure leakage across each pressure containing or leakage limiting boundary for the following primary containment penetrations:
>
> 1. Containment penetrations whose design incorporates resilient seals, gaskets, or sealant compounds, piping penetrations fitted with expansion bellows, . . .

The underlying purpose of 10 CFR 50 Appendix J, as provided in the Introduction to Appendix J, is to assure that: a) leakage through the primary reactor containment, and systems and components penetrating primary containment shall not exceed allowable leakage rate values as specified in the Technical Specifications or associated Bases, and b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of the containment, and systems and components penetrating primary containment.

At the DBNPS expansion bellows are used in the design of the main feedwater system (MFW) and main steam system (MS) containment penetrations (Penetrations 37, 38, 39 and 40). There are a total of eight expansion bellows, two for each of the MS and MFW penetrations. The configurations of the MS and MFW penetrations are shown in Updated Safety Analysis Report (USAR) figures 3.8-7 and 3.8-8 (attached). These expansion bellows allow for relative movement between the containment vessel and the auxiliary building resulting from thermal expansion associated with normal plant heatup and cooldown, or from postulated seismic events. These bellows are subject to Appendix J, Type B local leak rate testing.

On March 3, 1992, the Nuclear Regulatory Commission issued Information Notice 92-20, Inadequate Local Leak Rate Testing, (IN 92-20, Toledo Edison Log Number 1-2622). In particular, IN 92-20 identified questions regarding the leakage quantification capability of the current Type B local leak rate test (LLRT) method used for containment penetration expansion bellows at the Commonwealth Edison Company Quad Cities and Dresden Stations. The expansion bellows have two plies. The Type B test is conducted by pressurizing the interspace between the two plies and measuring the flow into the interspace. Because the plies may contact one another, the flow may be restricted resulting in a lower leakage rate being indicated by the Type B test for a leak through both bellows plies than would be indicated during an Integrated Leak Rate Test (ILRT). The test, however, is capable of detecting leakage and measuring leakage rates less than a threshold value.

Toledo Edison reviewed the applicability of IN 92-20 to the DBNPS. The questions raised in IN 92-20 are relevant for the DBNPS since eight containment penetration expansion bellows from the same manufacturer as at Quad Cities, and a similar Type B test method are employed.

The bellows are described in Updated Safety Analysis Report (USAR) sections 3.8.2.1.10, Penetrations. The MS penetration bellows are 60 inches in diameter. The MFW penetration bellows are 40 inches in diameter. The process lines are anchored at the flued heads. Consequently, the only motion seen by the bellows is the relative movement between the containment and the auxiliary building during plant heatup and cooldown, and during seismic events. The bellows assemblies are equipped with test taps at one end to allow pressurization of the interspace between the two bellows plies to accommodate Type B testing. Six of the bellows assemblies have a second test tap at the opposite end of the assembly. Unlike the bellows at Quad Cities, the bellows installed at the DBNPS incorporate a layer of stainless steel wire mesh covering the entire area between the two plies of the bellows. This mesh layer is intended to improve flow distribution between the plies. It would be expected that this design feature would enhance the leakage detection and measurement capability of the Type B test method.

The DBNPS containment design consists of a free standing metal containment pressure vessel and a concrete shield building separated by an annulus. The annulus is serviced by two redundant trains of the safety grade Emergency Ventilation System (EVS). The Technical Specifications (TS) include operability and performance requirements for the EVS. The Safety Features Actuation System (SFAS) automatically initiates EVS operation following postulated accidents. Following an accident, the EVS will maintain the annulus at a negative pressure thereby collecting leakage from the containment vessel, including any leakage through the penetration expansion bellows. Containment leakage collected by the EVS is passed through high efficiency particulate filters and charcoal adsorbers for removal of radioactive iodines and particulates prior to release through the plant vent stack. Thus, there is no direct unfiltered containment leakage path to the outside environment through the penetration expansion bellows.

The DBNPS has maintained a high degree of containment integrity as evidenced by the results of the five integrated leakage rate tests which have been conducted to date. As can be seen from Table 1, attached, considerable margin exists between the as-found ILRT results and the TS limit on L_a of 0.5 %/day. The ILRTs demonstrate that a high degree of containment integrity has been maintained since construction.

The Type B test results for the MS and MFW bellows penetrations have consistently shown zero leakage with the exception of tests conducted in 1985 and 1988. The results are tabulated in Table 2. The 1985 and 1988 test results are anomalous and not considered to be indicative of bellows leakage, since subsequent tests have continued to demonstrate zero leakage. Zero leakage constitutes a valid Type B test since any flow restriction between the bellows plies has no effect under zero flow conditions. The test also provides valid leakage measurements for through ply leaks below a threshold size, where the pressure loss due to restrictions between the plies becomes important.

Basis for Exemption Request

10 CFR 50.12, Specific Exemptions, permits the Nuclear Regulatory Commission to grant exemptions which are authorized by law, will not present an undue risk to the health and safety of the public, and are consistent with the common defense and security, provided that special circumstances are present. Special circumstances are present when application of the regulation in the particular circumstances is not required to serve the underlying purpose of the rule. Toledo Edison believes that leakage quantification for Appendix J Type B testing of the DBNPS containment penetration expansion bellows is not required to serve the underlying purpose of Appendix J.

The underlying purpose of 10 CFR 50 Appendix J, as provided in the Introduction to Appendix J, is to assure that: a) leakage through the primary reactor containment, and systems and components penetrating primary containment shall not exceed allowable leakage rate values as specified in the Technical Specifications or associated Bases, and b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of the containment, and systems and components penetrating primary containment.

Both of these purposes can be accomplished by the current Type B test method. The current Type B test method is capable of detecting leakage, and can provide valid measurements of leakage rates below a threshold value. Above the threshold value, if leakage through both bellows plies is detected, the leakage rate can be estimated.

This conclusion is based on Toledo Edison's evaluation of information provided to the NRC in letters from Commonwealth Edison dated April 19, 1991 and November 12, 1991. NRC review of this information is documented in the exemption granted to Commonwealth Edison by letter dated February 6, 1992. The work performed by Commonwealth Edison in support of the exemption request demonstrates that the existing Type B test method can detect leakage, and that relative contributions and overall leakage through observed flaws can be estimated.

Commonwealth Edison performed a one time helium flow rate validation test on the two ply bellows assemblies at the Dresden Station in October 1991 to demonstrate that the current test method using air would, with sufficient sensitivity (using a threshold of detection of 0.5 scfh), detect leakage from a bellows assembly. This validation consisted of two separate pressurizations and leak rate measurements, one with air, and one with helium. Because of the high diffusivity of helium relative to air, the results of the two tests would indicate whether air flow between the bellows plies to an external leak through the plies was obstructed. The measured helium flow rate compared favorably with the expected flow rates of helium calculated for turbulent and laminar flow conditions, knowing the measured airflow rates. Based on these tests, the NRC concluded that an air leakage test (i.e., the current Type B test method using air) with a threshold of detection of 0.5 scfh, is a valid means to detect leakage in the two ply bellows assemblies.

During the Eighth Refueling Outage (8RFO), Toledo Edison will conduct a one time special test on the six bellows assemblies which have taps on both ends to determine the threshold leakage rate for valid leakage measurement. The test will involve installation of a pressure gauge and vent valve on the end of the bellows opposite the test rig (pressure source and flow meter). The bellows will be pressurized and time to reach test pressure at the downstream pressure gauge will be observed. This test will provide confidence in the existence of flow paths between the bellows plies and the leakage detection capability of the test method. Secondly, the vent valve will be opened until the indicated pressure begins to drop. The flow measured on the test rig at this point represents the threshold leakage rate below which the test method can quantify leakage, and satisfies Appendix J.

Routine Type B testing of the containment penetration bellows will continue to be performed using the current Type B test method in conjunction with the above determined threshold. Leakage rates less than the above determined threshold constitute valid Type B tests. Toledo Edison's normal non-conformance process will be used to evaluate detected leakage and specify any corrective actions determined necessary. In addition, for indicated leakage rates greater than the above determined threshold the following actions will be carried out.

1) If the measured leakage exceeds the threshold, the test will be repeated using a suitable trace gas, such as helium, at Pa. While pressurized, the exterior ply of the bellows will be tested using a trace gas analyzer. If no trace gas is detected, the exterior ply of the bellows assembly will be considered to be intact and no further actions will be necessary.

2) If trace gas is detected through the exterior ply of the bellows, the interior ply of the bellows will be tested using a trace gas analyzer. If no trace gas is detected, the interior ply of the bellows assembly will be considered to be intact and no further actions will be necessary.

3) If trace gas is detected through both inner and outer plies, indicating a through wall leak path, the outer protective shroud will be removed and the exterior of the bellows will be subjected to soap bubble testing and/or dye penetrant testing. Indicated cracks will be measured and mapped. The current and projected leakage rate will be estimated using methods described in Commonwealth Edison Company's letter to the NRC dated April 19, 1991 (Evaluation COE-118-021, Revision 0 dated March 1991 and Calculation COE-118.0200.01, Revision 0, dated March 1991). The NRC's review of these methods are documented in the Appendix J exemption granted to Commonwealth Edison by NRC letter dated February 6, 1992.

The leak rate estimation method has been benchmarked against leakage measurements made on the failed bellows on penetration X-25 at the Quad Cities station. Commonwealth Edison conducted a special local leak rate test and the measured leakage rate through the failed bellows on penetration X-25 was 137 scfh. Commonwealth calculated an expected leakage rate based on the size of the observed flaws. The estimate was about 1/3 of the measured leakage rate. The large difference was due to uncertainties in the roughness and actual profile of the cracks. The calculated and measured leakage rates were used to establish a scaling factor for projecting leakage from measured cracks. Toledo Edison reviewed the above noted supporting calculations for the leakage estimation method and concluded that this method would be valid for estimating bellows leakage at the DBNPS, should use of this Appendix J exemption be necessary. Toledo Edison has confirmed with the vendor which performed the leakage evaluation for Commonwealth Edison that the method is applicable to the DBNPS and can be modified readily to account for plant specific bellows data to obtain an accurate estimate of leakage, should it become necessary in the future. A margin of 20% will be added to the leakage estimate for added conservatism for use in comparisons with acceptance criteria.

Based on the foregoing, Toledo Edison concludes that in the event that leakage exceeds the threshold leakage rate, calculations can provide a conservative estimate of actual leakage providing assurance that the overall primary containment leakage rate will not exceed L_a. Therefore, this alternative to measurement of containment penetration expansion bellows leakage during Type B tests satisfies the underlying purpose of Appendix J. Because the underlying purpose of Appendix J is preserved, Toledo Edison concludes that the proposed exemption does not present an undue risk to the health and safety of the public and is consistent with the common defense and security.

Table 1

Summary of Davis-Besse Nuclear Power Station

Containment Integrated Leakage Rate Test Results

(Total Time Method)

Year	As-Left (%/day)	As-Found (%/day)
1976	0.11224	0.11224
1980	0.14845	0.14931
1984	0.08783	0.26283
1988	0.052511	0.060917
1991	0.06218	0.06363

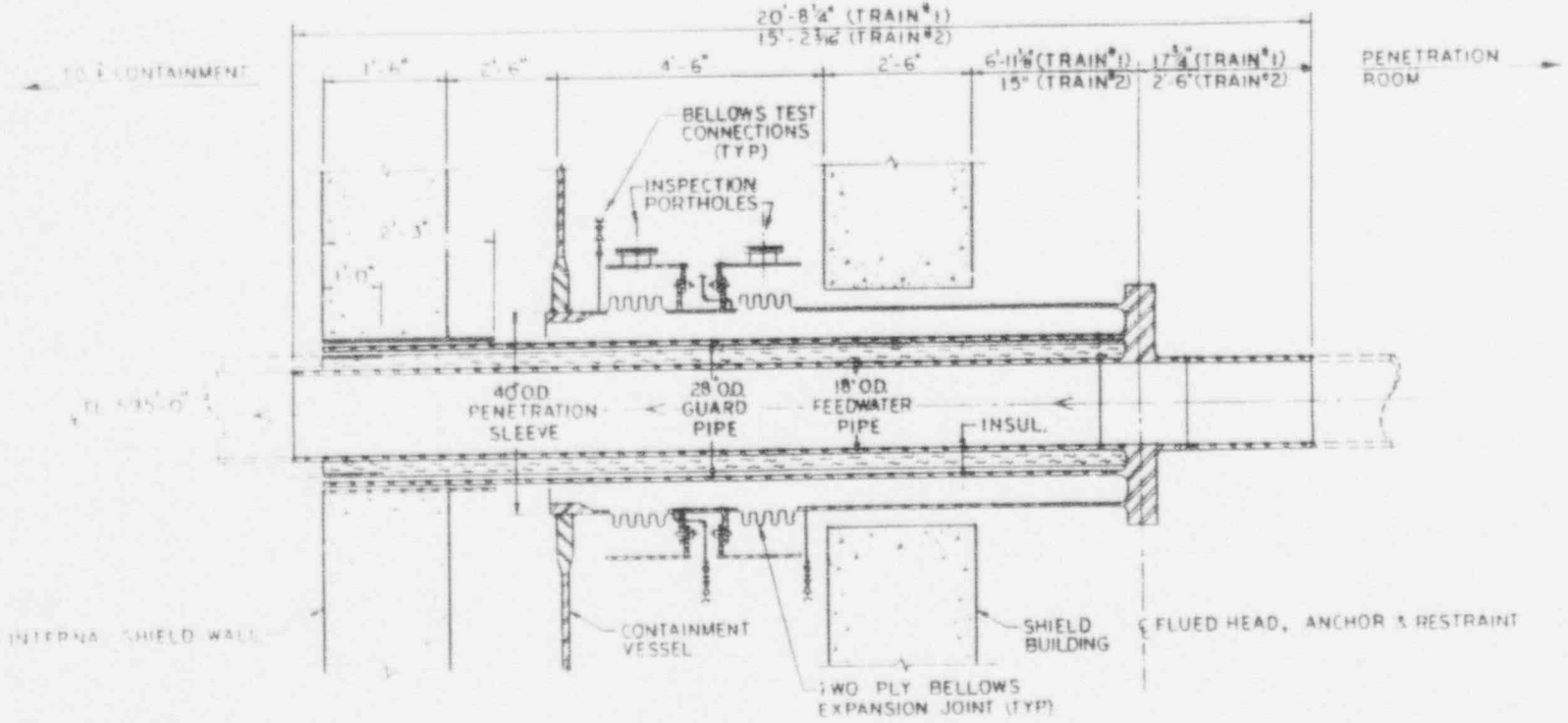
Table 2

Summary of Davis-Besse Nuclear Power Station

Type B Local Leakage Rate Test for

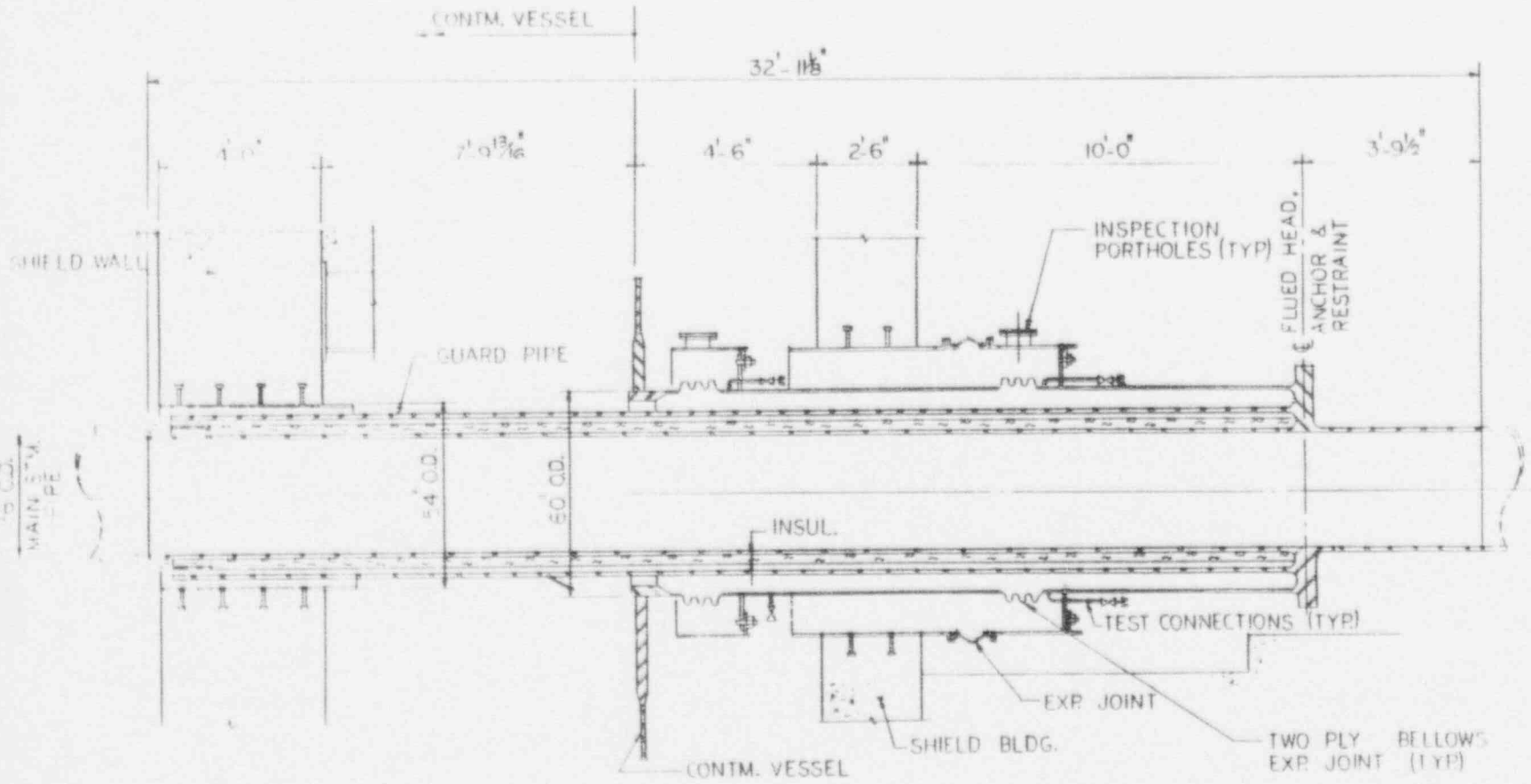
Containment Penetrations 37, 38, 39 and 40

Year	Leakage Rate (scfh)			
	Pen. 37	Pen.38	Pen. 39	Pen. 40
1976	0	0	0	0
1978	0	0	0	0
1980	0	0	0	0
1982	0	0	0	0
1983	0	0	0	0
1985	40	9	9	40
1988	74	42	68	0
1990	0	0	0	0
1992	0	0	0	0



PEN. 38, TRAIN #1
PEN. 37, TRAIN #2

DAVIS-BESSE NUCLEAR POWER STATION
MAIN FEEDWATER LINE CONTAINMENT VESSEL
PENETRATION DETAILS
FIGURE 3.8-8



MAIN STEAM LINE CONTAINMENT PENETRATION
PENETRATION # 39 & 40

DAVIS-BESSE NUCLEAR POWER STATION
MAIN STEAM LINE CONTAINMENT VESSEL
PENETRATION DETAILS
FIGURE 3.8-7