Commonwealth E[illegible]on
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

May 27, 1982

Mr. Paul O'Connor
Project Manager
Operating Reactors Branch #5
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Dresden 2
SEP Topic: V-5, Reactor Coolant Pressure Boundary (RCPB) Leakage Detection

NRC Docket 50-237

Reference: P. O'Connor (NRC) letter to L. DelGeorge (CECo) dated February 24, 1982

Dear Mr. O'Connor:

This letter is in response to the above referenced NRC review which states that Dresden Unit 2 has not met the acceptance criteria for the detection of leakage from the reactor coolant pressure boundary per Regulatory Guide 1.45. This Guide recommends that, "at least three separate detection systems be installed in a nuclear power plant to detect unidentified leakage from the reactor coolant pressure boundary to the primary containment of one gallon per minute within one hour."

The detection systems should be capable of performing their functions following certain seismic events and capable of being checked in the control room. "Of the three separate leak detection methods recommended, two of the methods should be (A) sump level and flow monitoring, method (C) may be either monitoring of condensate flow rate from air coolers or monitoring of airborne gaseous radioactivity. Other detection methods (D) such as humidity, temperature, and pressure should be considered to be alarms of indirect indication of leakage to the containment."

A review of our present Dresden Unit 2 has found the following systems which would meet the acceptance criteria of Regulatory Guide 1.45.

A035

A) Sump Level and Flow Monitoring

Leak detection for the reactor coolant system is accomplished using several methods of continuous or periodic monitoring of the entire drywell space. They are:

1) Equipment Drain Sump: Approximately 40% of a free liquid leak (the amount flashing to steam) and essentially all of condensate from the drywell air cooler. The background leakage in this sump is 0-3 gpm and is essentially constant during any given period of operation. A significant increase can be detected by monitoring the discharge rate controlled leakage into this sump from various seals within the drywell. Leakage from such seals can be detected by instrumentation on leak-off lines.

2) Floor Drain Sump: In the case of a free liquid leak, about 60% of the leakage will not flash to steam but will drain directly into the floor drain. The background leakage to this sump is 0-3 gpm and essentially constant. Again, a significant increase can be detected.

3) Air Cooler Coolant Temperature Rise: The design coolant temperature rise of $10^{o}F$ is based on a normal operating heat load of 3×10^{6} BTU/hr. A 1 gpm steam leak or a 2.5 gpm liquid leak represents about a 16% increase in total heat load and will cause a $1.6^{o}F$ increase in air cooler coolant temperature. Thus, a 5 gpm steam leak will give an increase of 5 to $8^{o}F$ in air cooler coolant temperature; this is on the threshold of detection in the daily variations.

If the floor drain leakage exceeds 5 gpm, a drywell equipment or floor drain sump high level annunciation will alarm at which point a primary system leak is suspected. An air sample is taken to verify radiological consequences before the drywell is deinerted for visual inspection of the primary system (Technical Specification 3.6.D). This requirement is designed to insure that leaks will be identified before cracks can grow to a critical length.

Identified leakage into the equipment drain tank is composed of the normal seal and valve packing leakage and does not represent a safety consideration as long as the leakage is small compared to the reactor coolant makeup capacity available. If a total leakage to the floor drain sump exceed 25 gpm a high-high level annunciator will alarm at which time an orderly shutdown is initiated and the reactor is placed in cold shutdown condition within 24 hours (Technical Specification 3.6.D). This limit is only 0.5% of the capacity of the HPCI system, which is the make-up system available with reactor pressure greater than 350 psig. In addition, thermocouples located on or near key equipment such as the recirculation pump seals may help in establishing the source of the leakage. Both sumps have flow recorders, alarms, and integrators in the control room.

B) Airborne Particulate Radioactivity Monitoring

The Sentry High Radiation Sampling System (HRSS) has been implemented as of the Unit 2 1981 refueling outage. The design criteria for the HRSS can be summarized as follows:

1) Control of background radiation and operator exposure to radiation.

2) Rapid sampling and analysis.

3) Sampling and transfer of undiluted sample.

In addition to meeting the minimum NRC requirments, the HRSS has many additional capabilities which provide a high degree of flexibility in anticipation of the escalation of requirements:

1) Can be used for both routine and post-accident sampling and has the capability to obtain an undiluted reactor coolant sample under accident conditions for transport off-site for independent analysis.

2) Additional sample connections are available for more flexibility in selecting sample points; redundant sample connections allow for further expansion if needed to assure sample acquisition under post-accident conditions.

3) Methods for cooling and depressurizing all high temperature, high pressure fluids for gas sampling and in-line analysis.

C) Condensate Flow Rate from Air Coolers (Conditioners) or Monitoring of Airborne Gaseous Radioactivity

Section A) above has mentioned how condensate flow rate is measured. Section B) has introduced the HRSS and CASP systems. Dresden has developed a set of Dresden Sample Building Procedures (DSBP) for measuring post-accident analysis of particulate and gaseous radioactivity in containment.

D) Other Detection Methods

The description of the systems contained in this section would be used by the operator to determine that leakage does exist within the drywell (containment). These various systems operating together or singly provide the intelligence to the operator that a possible problem has developed within the drywell.

1) Air Sample System: Each drywell is equipped with 24 air sampling points, and each suppression chamber (torus) with one sampling point. For leak detection mode of operation, one or two of the air sample points would be in service. Each half-inch tube will take an air sample from a selected point within the drywell. The air sample will be drawn through the tubing, out through a drywell penetration, auto-isolation valves, and then to a continuous air monitor. This air monitor will count gross beta activity which will be recorded and alarm on an increase. This provides an indication that a leak has occurred.

2) Thermocouple Leak Detection: Large valves in the primary system are equipped with stuffing box leak-off lines. Leakage through the stuffing box packing at approximately its midpoint is vented off through a closed piping system. This hot leakage from each valve is routed past its own thermocouple and then to a water-filled reservoir and finally to the drywell equipment drain sump. An increase in temperature on any of the thermocouples will sound an alarm in the control room. A similar system is also provided for the safety and relief valves. This system permits leak location information.

3) Flow or Pressure Switches: Large valves in the primary system are equipped with stuffing box leak-off lines. Leakage through the stuffing box packing at approximately its midpoint is vented off through a closed piping system. This hot leakage from each valve is routed past its own thermocouple and then to a water-filled reservoir and finally to the drywell equipment drain sump. An increase in temperature on any of the thermocouples will sound an alarm in the control room. A similar system is also provided for the safety and relief valves. This system permits leak location information.

4) Process Radiation Monitoring Systems: The process radiation monitoring system consists of several individual process subsystems:

   a) Air Ejector Offgas Monitoring: Continuously monitors, indicates, and records the radioactivity level of the effluent gases removed from the main condenser by the air ejector offgas system.

   b) Radioactive Stack Gas Monitoring: Continuously monitors, indicates, and records the radioactivity level of the effluent gases discharged from the stack to the atmosphere.

   c) Main Steam Line Monitoring: Designed to continuously monitor the radiation from the main steam lines to permit the prompt indication of gross release of fission products from the fuel to the reactor primary system coolant and subsequently to the turbine-generator system.

d) <u>Process Liquid Monitoring</u>: Continously measures, indicates, and records the radioactivity concentration levels of major process system streams which are:

Reactor Building Closed Cooling Water System
Service Water Discharge System
Radioactive Waste Disposal System

e) <u>Reactor Building Air Monitoring</u>: Designed to provide automatic initiation of the standby gas treatment system and closure of the normal reactor building ventilation when the concentration of radioactive materials in the ventilation exhaust exceeds prescribed levels.

f) <u>Isolation Condenser Vent Monitor</u>: Designed to detect and warn the operator of a tube leak.

The monitoring subsystems which provide automatic signals, such as isolation valves closure or reactor shutdown, are designed so that a single component failure does not prevent the required action. All monitors are capable of self-supervision. As an example, an alarm annunciates when the instrument is downscale or de-energized. Alarms are also provided to give warning if the monitor's sampling system malfunctions. All monitors are capable of operational verification by means of test signals or radioactive check sources.

All monitoring systems provide continuous indication in the control room. As a general requirement, the various process monitors are capable of initiating appropriate alarms and actuating control equipment to assure containment of radioactive materials, if preestablished limits are approached.

5) <u>High Primary Containment System Pressure</u>: Part of the reactor protection system. Abnormal pressure could indicate a rupture of, or excessive leakage from, the reactor coolant system into the drywell structure.

In conclusion, it is the opinion of the station that Dresden Unit 2 does meet the recommendations given in Regulatory Guide 1.45 to measure reactor coolant pressure boundary leakage. The types of leakage detection systems have been significantly upgraded to reflect the present plant conditions and status.

Please address any questions you may have concerning this matter to this office.

One (1) signed original and thirty-nine (39) copies of this transmittal have been provided for your use.

Very truly yours,

T.J. Rausch
Nuclear Licensing Administrator
Boiling Water Reactors

SPP/ji
1949D
Attachments
cc: RIII Resident Inspector, Dresden
Gregg Cwalina, SEP Integrated Assessment Mgr.

NOTES

1) The equipment and floor drain sumps in the drywell are pumped at the beginning of each shift. The amount is recorded and compared with previous shifts to determine changes or trends. The sumps are no longer automatically pumped. Since TMI, the operator, upon receiving a sump high level alarm, manually initiates the pumping process. Again, the amount is recorded and compared to determine changes or trends.

2) Condensate flows from the air coolers (conditioners) are directed to the equipment drain sump. Changes in frequency of sump pumping plus rises in service water cooling outlet temperature may indicate leakage.

3) URS/John A. Blume and Associates was employed as a seismic consultant for the original design to prepare an acceleration (earthquake) response for Dresden Station based on time history and the smooth response spectrum. They based their calculation upon a ground acceleration of 0.1g OBE. The seismic design of Class I structures and equipment was based upon a dynamic analysis. The natural periods of vibration were calculated for buildings which are vital to the proper shutdown of the plant.

For the design of Class I structures and equipment, the maximum horizontal acceleration and the maximum vertical acceleration were considered to act simultaneously. Where applicable, the resulting seismic stresses for the two motions were combined linearly. The vertical acceleration assumed was equal to 0.067 g, two-thirds the horizontal ground acceleration.

To assure that the plant can be shutdown with containment and heat removal facilities intact, Class I structures have been designed to accommodate a ground motion of 0.2g SSE (FSAR 12.1.1-11). However, based on a letter to SEP Group II Plant (Big Rock Point, Dresden 1/2, Haddem Neck, La Crosse, Yankee Rowe) Licensees from D.G. Eisenhut, NRC dated August 4, 1980, the recommended probalistic spectra at 5% damping and 0.13g SSE site specific ground response spectra was used which is more conservative than the 0.20g SSE as stated in the FSAR. The results of the seismic analysis were used in the design of the associated Class I structures, systems, and components. For the seismic analysis of equipment, absolute acceleration is used at the points of support. Where a dynamic analysis was not performed, the horizontal seismic coefficients for rigid Class I equipment in the reactor/turbine building are equal to or greater than the building acceleration at the installed elevation.

NOTES

4) An actual example of the sensitivity of the air sampling system occurred during the week of March 22, 1982. Gross beta concentrations in the containment (drywell) changed from 9.1E-12 uCi/cc to 1.47 E-7 uCi/cc. This change was attributed to the Unit 9A recirc. header bypass valve packing leak which produced a leak rate of about 0.2 gal./hr. (4 gal./day) of reactor water (545°F). Backseating the valve found the air sample results returning to 2.0E-10 uCi/cc. A pipe/weld crack of a similar leak rate would be detected.

REACTOR COOLANT PRESSURE BOUNDARY LEAKAGE DETECTION SYSTEMS
Regulatory Guide 1.45 Requirements

Table 1: **Plant:** DRESDEN 2

RCPB to Containment System	Incorporated	Leak Rate Sensitivity	Time Req'd to Achieve Sensitivity	Earthquake For Which Function Is Assured	Control Room Indication For Alarms & Indicators	Documentation Reference	Testable During Normal Operation
1) Sump Level Monitoring (Inventory)	Yes	T.S. 3.6.D	24 hrs.	Note 3	Yes	FSAR § 4. T.S. 3.6.D	No
2) Sump Pump Actuations Monitoring (Time Meters)	No	Note 1		Note 3	Yes		No
3) Airborne Particulate Radioactivity Monitoring (Stack gas)	Yes	T.S. Table 4.8-2	24 hrs.	Note 3	Yes	FSAR §7.6 T.S. 3.8.A	Yes
4) Airborne Gaseous Radioactivity Monitoring (Air Sampling System)	Yes	T.S. Table 4.8-2 (Note 4)		Note 3	Yes	Quest B.14 FSAR §7.6	Yes
5) Condensated Flow Rate from Air Coolers	No	Note 2		Note 3	N/A		N/A
6) Containment Atmosphere Pressure Monitoring	Yes	T.S. Table 4.1.1 0-75	psi	Note 3	Yes		T.S. Table 4.2.1 Yes
7) Containment Atmosphere Humidity Monitoring	No	N/A	N/A	N/A	N/A	N/A	N/A
8) Containment Atmosphere Temperature Monitoring	Yes			Note 3	Yes		T.S. Table 4.2.1 Yes
9) Accoustic Emissions	Safety/Relief Valves Only			Note 3	Yes		T.S. Table 4.2.1 Yes
10) Moisture Sensitive Tape	No			Note 3	N/A		N/A
11) Thermocouple Leak Detection (valves)	Yes			Note 3	Yes	Question B.14	T.S. Table 4.2.1 Yes
12) Air Conditioner Coolant Temp.	Yes			Note 3	Yes	FSAR §4	Yes

NOTES: See attached sheet.

§ = Section of FSAR where information is found.

REACTOR COOLANT PRESSURE BOUNDARY LEAKAGE DETECTION SYSTEMS
Regulatory Guide 1.45 Requirements

Table 2:

Plant: DRESDEN 2

Intersystem Leakage Systems Which Interface w/ RCPB	Methods to Measure RCPB In-Leakage	Leak Rate Sensitivity	Time Req'd to Achieve Sensitivity	Earthquake For Which Function Is Assured	Control Room Indication For Alarms & Indicators	Documentation Reference	Testable During Normal Operation
1) Reactor Building Closed Cooling Water System	Radiation Monitor			Note 3	Yes	FSAR §7.6 & 10.10	Yes
2) Service Water System Discharge	Radiation Monitor			Note 3	Yes	FSAR §7.6	Yes
3)							
4)							

Table 3:

RCS Inventory Balance

Leak Rate Sensitivity				Note 3			
Corresponding Time Required to Achieve Sensitivity				Note 3			