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Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: Control Room Envelope Unfiltered Air Inleakage Test Results in Response to Generic Letter 2003-01, "Control Room Habitability"

References: (1) NRC Generic Letter 2003-01, "Control Room Habitability," dated June 12, 2003

(2) Letter from Michael P. Gallagher (Exelon/AmerGen) to NRC, dated August 11, 2003, "Exelon/AmerGen 60-Day Response To NRC Generic Letter 2003-01, "Control Room Habitability"

(3) Letter from Michael P. Gallagher (Exelon/AmerGen) to NRC, dated December 9, 2003, "Exelon/AmerGen 180-Day Response To NRC Generic Letter 2003-01, 'Control Room Habitability'"

(3) Letter from Michael P. Gallagher (Exelon/AmerGen) to NRC, dated March 19, 2004, "Generic Letter 2003-01, 'Control Room Habitability,' Integrated Control Room Envelope Unfiltered Inleakage Test Schedules"

This letter provides the results of integrated Control Room Envelope (CRE) inleakage testing performed at Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3 during the week of October 20, 2004.

Generic Letter 2003-01, "Control Room Habitability," (Reference 1) requested that licensees provide confirmation that 1) the control room meets the applicable habitability regulatory requirements (e.g., GDC 1, 3, 4, 5, and 19), and 2) the Control Room Habitability Systems (CRHSs) are designed, constructed, configured, operated, and maintained in accordance with the design and licensing bases.

References 2 and 3 provided the Exelon/AmerGen 60-day and 180-day responses to Reference 1, NRC Generic Letter 2003-01, "Control Room Habitability," dated June 12, 2003. These responses included the commitment for Peach Bottom Atomic Power Station to perform integrated CRE inleakage testing utilizing the American Society for Testing and Materials (ASTM) standard E741-00, "Standard Test Method for Determining Air Change in a Single Zone

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by Means of a Tracer Gas Dilution." Reference 4 provided the planned schedule for performance of the testing at Peach Bottom Atomic Power Station, and committed to provide a complete response to the Generic Letter requested information, based on the test results, within 90 days of completion of the test.

The measured unfiltered inleakage test values, which are based on the conservative use of the 95% upper confidence limit on the test measurement tolerance, exceeded the currently approved radiological analyses assumption for unfiltered inleakage to the control room. However, alternative source term methodology demonstrates that control room operator dose remains within GDC 19 limits. The following provides a detailed description of the testing performed and the results.

CRE Inleakage Testing

Reference 1 requested that licensees confirm that the most limiting unfiltered inleakage into the CRE is less than the values assumed for design basis radiological and hazardous chemical analyses. Reference 1 refers to ASTM E-741-00, "Standard Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution," as an example of an acceptable test methodology.

Test Engineers from NCS and Lagus Applied Technologies performed the CRE inleakage testing at Peach Bottom Atomic Power Station in accordance with ASTM E-741-00 methodology. This test was completed on October 25, 2004.

Test Configurations (System mode and System line-up)

System mode:

The tracer gas test is considered comprehensive if it quantifies all of the in-leakage associated with the control room envelope for all system emergency modes of operation. The Peach Bottom Control Room Emergency Heating, Ventilating, and Air Conditioning (HVAC) (CREV) System is common to Units 2 and 3. The system is safety related and active components are designed with redundancy to meet single active failure criteria.

The CREV system consists of two 100% capacity filter units and redundant CREV Supply Fans (Trains "A" and "B"). Each filter unit consists of a charcoal filter and two banks of HEPA filters, upstream and downstream of the charcoal filter. Both filter trains share a common supply ductwork downstream from the CREV supply fans to discharge filtered outside air to the control room. Upon initiation signal one train of the CREV system will operate and the second train remains in standby.

The CREV system initiates on a high radiation or low flow signal in the Normal control room HVAC system intake ductwork. Both isolation signals, when initiated, isolate the Normal control room supply fans (0A(B)V079), the Normal control room A/C supply fans (0A(B)V028), the normal control room return fans (0A(B)V029), the control room office area cooling unit fan (00V326) and PO-2-40D-00163-01 to allow one train of CREV to supply filtered outside air to the control room. The toilet exhaust fan (00V033) continues to run during an emergency. This fan was operating during the test to yield conservative results. A toxic gas or chemical isolation mode does not exist for the Peach Bottom Atomic Power Station's control room HVAC system.

During the performance of the tracer gas test, the CREV system was placed in-service on a simulated high radiation signal to place it in the isolation/pressurizing mode. Both trains of CREV were tested individually. Testing each train separately provided independent testing of the train-specific ductwork to assure all flow paths are tested. As stated above, during high radiation or low flow signal, since the same system alignment is achieved, testing the system in radiation isolation mode will result in the same unfiltered in-leakage value as it would if the test was performed via low flow initiation signal.

System line-up:

The control room is located in the center portion of the Units 2 and Unit 3 Turbine Building at elevation 165 feet. The control room envelope includes the control room, adjacent offices, the kitchen and lavatory facilities, and the area above the false ceiling, as well as the ductwork and associated air-handling units that comprise the CREV system. The CREV system, when operating, is designed to pressurize the control room to greater than or equal to 0.1 inch of water gauge positive pressure with respect to the Turbine Building to prevent unfiltered inleakage. During emergency operation and during the tracer gas test, the pressure in the control room was maintained well above 0.1 inches of water gage pressure required by Technical Specifications.

The Turbine Building, the Cable Spreading Room and the Fan Room are adjacent to the control room. Openings exist above the doors leading to the Cable Spreading Room that allow the air space in the Turbine Building and Cable Spreading Room to communicate. The Turbine Building and Cable Spreading Room HVAC system are designed to maintain the Turbine Building at a slight negative pressure in potentially contaminated areas.

During loss of offsite power events, the Turbine Building and Cable Spreading Room HVAC systems trip off. The Fan Room HVAC system is provided with emergency power and continues to operate during a loss of offsite power. The control room continues to be pressurized with approximately 3000 CFM of outside air via the CREV system. Therefore, the control room will remain positive with respect to the Turbine Building, Cable Spreading Room, and Fan Room with or without offsite power available. Since loss of offsite power has insignificant impact on the control room positive pressure, the system alignments for the tracer gas testing placed the CREV system in service on a simulated high radiation signal with the Turbine Building, Cable Spreading Room and Fan Room HVAC systems remaining in service.

Test Methods

Exelon Corporation contracted NCS and Lagus Applied Technology (LAT) to perform the Control Room Envelope inleakage testing at Peach Bottom Atomic Power Station. Testing was performed with the system aligned in the emergency modes as described above using NCS/LAT procedures that were written in accordance with ASTM E741-00, "Standard Test Method for Determining Air Change Rate in a Single Zone by Means of a Tracer Gas Dilution" using sulfur hexafluoride (SF6) as the tracer gas, as reviewed and approved by the site.

The test was performed using the Makeup Flowrate/Concentration Decay Test method. The tracer gas was continuously injected into the makeup air stream of the CREV system at a known constant rate while the makeup flowrate was measured three (3) times. The tracer gas

was then injected into the makeup air stream of the CREV system at a higher concentration for an additional period of time. After waiting for the tracer gas to disperse and adequately mix throughout the CRE, a series of five (5) concentration versus time points were obtained at several locations within the CRE. Upon the completion of the decay testing, the tracer gas was continuously injected into the makeup air stream of the CREV system at a known constant rate while the makeup air flowrate was measured an additional three (3) times.

Regression analysis was then performed on the logarithm of concentration versus time points to find the best straight-line fit to the data. The slope of the straight line is the volume normalized air inflow rate in Air Changes per Hour (ACH). The six (6) makeup flowrate measurements were averaged to obtain the mean makeup flowrate that existed during the testing. By subtracting the measured CREV makeup air flowrate from the measured Total Air Inflow value, the amount of unfiltered inleakage to the CRE that is not provided by filtered makeup airflow was determined.

To ensure thorough mixing took place in the CRE, various ceiling tiles in the outer periphery of the control room were removed, and various fans were staged in the control room proper and in the false ceiling area above the control room proper.

During each tracer gas unfiltered inleakage test, differential pressures between the control room and various surrounding areas were measured using two highly accurate digital barometers. Initially, both barometers were placed next to each other in the control room and the units were 'zeroed'. One unit was then moved to the various locations and the pressure values noted at time intervals. The indicated pressure values of the unit that remained in the control room were also recorded at the same time intervals. The mobile unit was then returned to the control room and both readings were recorded. This allowed a correction to be made for drift between the responses of the two units.

Differential pressure of the control room with respect to the adjacent areas was then calculated using the various readings obtained via the two digital barometers. Elevation corrections were made to the readings of the mobile barometer to ensure that the appropriate differential pressure was determined.

Results

The following tabulates the results of the above testing and associated acceptance criteria:

Test	CREVS Mode	Train In Service	Outside Air Makeup Flow (SCFM)	PBAPS TID-14844 Source Term Assumption for Maximum Unfiltered CRE In-Leakage (SCFM)	Unfiltered Inleakage Test Results (95% Upper Confidence Limit on Measured Inleakage) (SCFM)	AST Methodology Re-Analysis Maximum Inleakage (w/dose results within GDC 19 limits) (SCFM)
1	Radiation/ Pressurization	A	3212 +/- 275*	10	369**	500***
2	Radiation/ Pressurization	B	3219 +/- 142*	10	21**	500***

* *Mean of six measurements*

** *Measured Inleakage values were statistically zero with large uncertainty limits encompassing a zero value. Statistically this implies that the Inleakage value is consistent with a zero value but with a large 95% Upper and Lower Confidence Limit. Use of the 95% Upper Confidence Limit is a conservative value.*

*** *Ref. PBAPS License Amendment Request to use Alternate Source Term dated July 14, 2003.*

Results of the two tests while in a radiation isolation (pressurization) mode indicate that the unfiltered inleakage into the CRE was greater than the currently approved maximum dose analysis assumption unfiltered inleakage of 10 scfm.

Operability of the CRE Envelope

The Control Room HVAC system and the CREV system ensure the control room is habitable for continuous occupancy of personnel and equipment during normal and design bases accident conditions, respectively. With the measured unfiltered inleakage greater than the 10 scfm assumed in the radiological dose calculations currently approved, operator dose exposures may exceed the limits specified in GDC 19 during an accident condition. With operators exposed to higher doses, the potential exists that the control room would not be habitable for safe plant operation and that control room habitability (operator dose) is potentially challenged.

Habitability of the control room was evaluated, and it was verified that the increased inleakage values do not challenge operability of the control room envelope. The Control Room HVAC system and CREV system are still capable of performing all of the safety related design functions even with an unfiltered inleakage value exceeding that assumed in the currently approved radiological dose analyses.

Based on TID-14844 source term, the current PBAPS design basis accident analysis control room operator dose is 0.012 rem whole body and 1.64 rem thyroid, assuming 10 scfm unfiltered inleakage in the Radiation Isolation Mode (Reference UFSAR Table 14.9.6). The maximum conservatively established inleakage rate of 369 scfm, described above, results in a control room operator dose that would exceed the GDC 19 limit of 30 rem thyroid.

PBAPS has submitted a License Amendment Request to revise the licensing basis to use the Alternative Source Term (AST) methodology. This License Amendment Request was submitted to the NRC on July 14, 2003. A reanalysis of the PBAPS design basis accident radiological dose calculations, using Alternative Source Term methodology in accordance with 10 CFR 50.67 and Regulatory Guide 1.183, concluded that with control room envelope unfiltered inleakage as high as 500 scfm in the Radiation Isolation Mode, the bounding dose to the control room operator is 4.8 rem TEDE. This value includes several design basis relaxations such as increased allowable Main Steam Isolation Valve (MSIV) and containment leakage, and the elimination of credit for Standby Gas Treatment System (SGTS) filtration.

Use of AST analytical results for operability determinations involving control room envelope inleakage is consistent with the NEI Final White Paper, "Use of the Generic Letter 91-18 Process and Alternative Source Terms in the Context of Control Room Habitability,"

dated June 2004. Although the NRC staff has not yet approved the PBAPS License Amendment Request, use of AST analytical results were reviewed in terms of whole body and thyroid dose. After conservative adjustment for currently licensed MSIV and containment leakage, and SGTS filtration, operator doses are determined to be 0.53 rem whole body and 14.7 rem thyroid, assuming an unfiltered inleakage rate of 500 scfm. Therefore, since these dose results are less than the 10 CFR 50, Appendix A, GDC 19 limits (5 rem whole body, 30 rem thyroid), the PBAPS control room envelope remains operable.

The above information completes the Peach Bottom Atomic Power Station response to Generic Letter 2003-01, "Control Room Habitability," requested information Item 1(a).

No new regulatory commitments are established by this submittal. If you have any questions or require additional information, please contact Mr. David J. Distel at (610) 765-5517.

Sincerely,

R. C.

Robert C. Braun
Site Vice President
Peach Bottom Atomic Power Station

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