FENOC
FirstEnergy Nuclear Operating Company

Perry Nuclear Power Station
10 Center Road
Perry, Ohio 44081

L. William Pearce
Vice President

440-280-5382
Fax: 440-280-8029

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United States Nuclear Regulatory Commission
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Subject: Perry Nuclear Power Plant Final Response to Generic Letter 2003-01, "Control Room Habitability" (TAC No. MB9839)

Attachment 1 provides the final FirstEnergy Nuclear Operating Company (FENOC) response to Generic Letter (GL) 2003-01, "Control Room Habitability" for the Perry Nuclear Power Plant (PNPP). A 60-day response to the GL dated August 11, 2003 (PY-CEI/NRR-2725L) discussed ongoing actions at PNPP, including control room analysis and testing. An integrated tracer gas test was performed in December 2004, to verify control room unfiltered inleakage assumptions. The final report documenting acceptable results for the inleakage testing was issued in June 2005. Control room radiological dose calculations and toxic gas calculations necessary to support this Generic Letter response have been completed.

The reviews performed in response to the GL concluded that the control room habitability systems remain in accordance with design and licensing bases, and meet the applicable regulatory requirements.

Regulatory commitments are identified in Attachment 2. If there are any questions or if additional information is required, please contact Mr. Gregory A. Dunn, Manager – FENOC Fleet Licensing, at (330) 315-7243.

L. William Pearce

Attachment 1: Final Response to Generic Letter 2003-01, "Control Room Habitability"
Attachment 2: Regulatory Commitment Listing

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

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Final Response to Generic Letter 2003-01, "Control Room Habitability"

This attachment provides the final FirstEnergy Nuclear Operating Company (FENOC) response to Generic Letter (GL) 2003-01, "Control Room Habitability" for the Perry Nuclear Power Plant (PNPP). A 60-day response to the GL dated August 11, 2003 (PY-CEI/NRR 2725L) discussed actions planned at PNPP to support this final response.

Background/System Description

A general description of the Control Room Habitability Systems (CRHS) is provided in Updated Safety Analysis Report (USAR) Section 6.4, "Habitability Systems." This includes the normal ventilation mode, entitled the Control Room HVAC (CRHVAC) system, and the emergency mode, entitled the Control Room Emergency Recirculation (CRER) system. Section 6.4 also includes descriptions of the Control Room Envelope (CRE). Additional information on the CRER system is provided in USAR Section 6.5, "Fission Product Removal and Control Systems."

The normal CRHVAC system operates continuously to provide heating, ventilating and cooling to various equipment and personnel areas in the control room. The CRER system is automatically activated by a Loss of Coolant Accident (LOCA) signal, a control room ventilation high radiation signal, or a Loss of Offsite Power (LOOP) signal. The system can also be manually initiated. In the event of a high smoke condition, except during the conditions listed above, the smoke can be purged by manually initiating the "smoke clear" mode, which brings in outside air at a high flow rate. When switched into emergency mode, the CRER system provides supplemental particulate and halogen filtration of the air supplied to the control room areas and offices during emergency periods and other abnormal conditions for personnel protection.

The CRHS are designed so that when operating in a normal mode, admitting outside air, a positive differential pressure is maintained between the control room and adjacent spaces. When the system operates in the recirculation mode, with no designed admittance of outside air, no attempt is made to pressurize the control room. Thus, the CRER system that provides the emergency filtration function is designated as a neutral-pressure system.

The NRC information requests from the Generic Letter are reproduced below in bold type, followed by the PNPP-specific responses.

1. Provide confirmation that your facility's control room meets the applicable habitability regulatory requirements (e.g., GDC 1, 3, 4, 5, and 19) and that the CRHSs are designed, constructed, configured, operated, and maintained in accordance with the facility's design and licensing bases.

Confirmation is hereby provided that the PNPP control room meets the habitability regulatory requirements in GDC 1, 3, 4, and 19, and that the CRHS are designed, constructed, configured, operated, and maintained in accordance with the facility's design and licensing bases. This confirmation is based on engineering and operations staff walkdowns, analyses, tests, and reviews of drawings, procedures, calculations, reports, historical information, and the USAR. With respect to GDC 5, "Sharing of structures, systems, and components," PNPP was originally designed as a two unit site and some Unit 2 structures, systems, and components are required to support Unit 1. However, since Unit 2 was never licensed for operation, PNPP is operated as a single unit; therefore GDC 5 does not apply.

Ongoing compliance with the design and licensing bases is provided by administrative control programs. This includes procedure control, design configuration control, control room envelope maintenance and breach controls, and hazardous chemical assessments.

The procedure change process requires consideration of 10CFR50.59 applicability and of the plant's design bases. For changes to which 10CFR50.59 is applicable, a Design Basis Impact Review (DBIR) process requires consideration of control room habitability issues when processing procedure changes. The Design Engineering Section may be required to review the procedure change as a result of this DBIR review.

Plant design configuration control is addressed in a similar manner. The design change process for permanent and temporary modifications and for calculations requires completion of a Design Interface Review Checklist (DIRC). The DIRC screens plant modifications for potential impacts, and contains a section dedicated to control room habitability.

Ongoing plant maintenance and surveillance procedures also address control room habitability. A PNPP administrative procedure provides the methods used to control inspection, testing and maintenance on components associated with the control room boundary and tornado depressurization barriers. Requirements for emergent conditions and for pre-planned work are addressed. For pre-planned work, controls are established to provide for restoration of any required breach of the boundary should it become necessary, as well as for determination of the necessary post-maintenance testing.

With respect to onsite hazardous chemicals, hazard screening is performed on an ongoing basis per the site's chemical control program. With respect to offsite hazardous chemicals, a survey of the location, types and quantities of the offsite mobile and stationary hazardous chemical sources will be conducted at least once every 3 years. New information will be provided to engineering for evaluation of impact on the offsite chemical calculations.

Emphasis should be placed on confirming:

(a) That the most limiting unfiltered inleakage into your CRE (and the filtered inleakage if applicable) is no more than the value assumed in your design basis radiological analyses for control room habitability. Describe how and when you performed the analyses, tests, and measurements for this confirmation.

Filtered inleakage – Filtered inleakage is not applicable to PNPP, since the emergency mode of the PNPP Control Room ventilation system (the Control Room Emergency Recirculation System) is a neutral pressure system which does not depend on pressurization using air from outside the envelope.

Tracer gas testing at PNPP was originally performed in 1985 prior to initial plant licensing, as described in the PNPP 60 day response to the Generic Letter.

A second tracer gas test was performed in December of 2004 by a team of test engineers from NCS Corporation (NCS) and Lagus Applied Technology, Inc. (LAT). As discussed below, unfiltered inleakage into the Control Room Envelope (CRE) was determined to be 257 ± 15 cubic feet per minute (cfm), significantly below the 1375 cfm limiting value assumed in the current design basis analyses for control room habitability.

The type of test performed was a tracer concentration decay test, based on the methodology in ASTM Standard E741-00, "Standard Test Method for Determining Air Change Rate in a Single Zone by Means of a Tracer Gas Dilution." The data from this test was used to determine the normalized air inleakage rate in terms of air changes per hour (ACH). Using this ACH value and a conservative value for the volume of the CRE, the air inleakage rate in terms of cubic feet per minute (cfm) was calculated.

A total of five different test configurations were utilized to examine the effects of different system lineups within and external to the CRE. The CRER system was operated in emergency recirculation mode, in both single-train and dual-train alignments, with adjacent ventilation systems operating in various lineups. The limiting test configuration resulted in an unfiltered inleakage value of 257 ± 15 cfm.

In order to determine the unfiltered inleakage acceptance criteria for the above test, it is necessary to determine the most limiting event for the control room. As discussed in the Control Room Habitability Regulatory Guides, in order to determine the most limiting event, it is necessary to evaluate control room doses for events other than the LOCA. Therefore, additional control room dose calculations were necessary for PNPP, because at the time of initial licensing in 1986, the only event for which formal control room dose calculations were performed was the LOCA.

Subsequent to initial licensing, from 1996 through 1999, PNPP served as a pilot plant for implementation of Alternative Source Term (AST) at operating plants. This effort included recalculation of control room doses for a LOCA. That calculation assumed an unfiltered inleakage value of 1375 cfm into the control room. The calculation showed that the operator doses remained less than the 5 rem Total Effective Dose Equivalent (TEDE) acceptance limit with this amount of unfiltered inleakage*. In order to verify this 1375 cfm value is the most limiting inleakage value, and that the LOCA event is therefore the most limiting event overall, several other events have subsequently been analyzed.

In 2003, a PNPP fuel handling accident (FHA) analysis using AST was reviewed by the NRC, resulting in Amendment 122 to the PNPP Operating License NPF-58. That FHA analysis assumes that the normal ventilation system continues to run (i.e., no attempt to isolate the control room envelope). The analysis shows operator doses remain acceptable, assuming that the radionuclides available at the outside air intake are swept into the control room by a 6600 cfm intake flow rate from the normal system (i.e., the normal intake flow rate of 6000 cfm + 10% = 6600 cfm). This flow rate is much greater than the 1375 cfm unfiltered inleakage value in the LOCA calculations.

More recently, in support of this Generic Letter response, additional dose calculations were performed for a Main Steam Line Break (MSLB) Outside Containment, an Instrument Line Break, and a Control Rod Drop Accident (CRDA). Because control room dose calculations had never been performed for these events, the results of the analyses were reported in terms of total effective dose equivalent (TEDE), so a valid comparison could be made with the results of the TEDE numbers for the LOCA and the FHA. As in the FHA described above, the base case for each of these events was analyzed assuming the normal ventilation system continues to run. The largest dose to the control room operators for any of these analyses was 0.62 rem for the Main Steam Line Break event. This value is much less than the 5 rem TEDE criteria for control room dose. Sensitivity analyses were also performed for each of these events, assuming that the CRER system is shifted into emergency recirculation mode and that unfiltered inleakage occurred at 1385 cfm (10 cfm more than assumed for the LOCA analysis). Filtration efficiency for these sensitivity analyses was only credited at 50% for both the High-Efficiency Particulate Air (HEPA) filters and the charcoal adsorption filters, and credit for filtration of the radioactivity introduced by the inleakage did not start until after 1800 seconds (30 minutes). Even with these conservative assumptions, the highest calculated dose from the sensitivity analyses was 0.12 rem, which is lower than the base case values and the 5 rem TEDE criteria.

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* Current calculated control room operator dose, which was updated as part of the PNPP power uprate, is 4.3 rem TEDE, which remained acceptable because it is less than the 5 rem TEDE acceptance limit.

Engineering personnel considered other events listed in the USAR to determine if control room dose calculations were necessary. The conclusion was that the other events did not require formal analysis. The overall engineering conclusion was that the LOCA is clearly the most limiting event at PNPP for control room habitability. Therefore, the1375 cfm value is the design basis acceptance criteria for control room unfiltered inleakage.

The largest tracer gas testing result (257 ± 15 cfm unfiltered inleakage) is approximately 20% of the limiting 1375 cfm design basis inleakage value, thereby confirming significant margin for the radiological analyses.

(b) That the most limiting unfiltered inleakage into your CRE is incorporated into your hazardous chemical assessments. This inleakage may differ from the value assumed in your design basis radiological analyses. Also, confirm that the reactor control capability is maintained from either the control room or the alternate shutdown panel in the event of smoke.

When determining the most limiting control room unfiltered inleakage value, hazardous chemical analyses must be evaluated in addition to the radiological analyses. However, at PNPP, the control room habitability analyses for hazardous chemicals stored or transported onsite or near PNPP do not credit isolation of the normal control room ventilation system. For chemical calculations that require an assumption for unfiltered air inlet flow rate, the CRHVAC system intake flow rate assumed is much greater than the 1375 cfm unfiltered inleakage value in the LOCA radiological calculations.

As described in section 6.4 of the USAR, oxygen monitors alarm on a loss of oxygen if carbon dioxide is released from the Control Room subfloor fire protection system. No other hazardous chemicals stored or transported onsite or near PNPP are considered a threat based on hazard evaluations performed per RG 1.78 Revision 0[†], Standard Review Plan NUREG-0800 Section 2.2.3, and NUREG/CR-2650 dated October 1982.

With respect to smoke, a smoke assessment consistent with the guidance in Regulatory Guide 1.196 and NEI 99-03 Revision 0 was performed. The assessment demonstrated that safe shutdown capability is maintained during a smoke event. Success paths exist that provide confidence that a smoke event can be mitigated, and that reactor control capability can be maintained from either the Control Room or the remote shutdown controls during a smoke event.

(c) That your technical specifications verify the integrity of the CRE, and the assumed inleakage rates of potentially contaminated air. If you currently have a DP surveillance requirement to demonstrate CRE integrity, provide the basis for your conclusion that it remains adequate to demonstrate CRE integrity in light of the ASTM E741 testing results. If you conclude that your DP surveillance requirement is no longer adequate, provide a schedule for: 1) revising the surveillance requirement in your technical specification to reference an acceptable surveillance methodology (e.g., ASTM E741), and 2) making any necessary modifications to your CRE so that compliance with your new surveillance requirement can be demonstrated.

If your facility does not currently have a technical specification surveillance requirement for your CRE integrity, explain how and at what frequency you confirm your CRE integrity and why this is adequate to demonstrate CRE integrity.

Because the CRER system is a neutral pressure design, the PNPP Technical Specifications do not currently have a differential pressure (DP) surveillance requirement for CRE integrity. However, a

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[†] As committed to in PNPP USAR Table 1.8-1 "Conformance to NRC Regulatory Guides"

recent tracer gas test in December 2004 was performed, which confirmed that CRE integrity is acceptable. In addition to this test, periodic (24 month) leakage tests on the outside air intake and exhaust dampers are performed per Technical Specification Surveillance Requirement 3.7.3.4, to confirm that this portion of the CRE is maintained.

In combination with this 24-month leakage rate test, CRE integrity is confirmed on an ongoing basis per plant procedures, which continue to provide controls over issues such as:

- maintaining design and configuration control,
- managing planned breaches of the CRE,
- correcting unplanned breaches of the CRE, including those that exceed analyzed inleakage values, and
- performing ongoing preventive maintenance for doors, walls, floor penetrations, dampers and drains that are part of the CRE.

The above procedures address areas very similar to those included in the 'Control Room Envelope Habitability Program' that has been a topic of discussion between the industry and the NRC staff for the past several years (see Technical Specification Task Force (TSTF) traveler TSTF-448). TSTF-448 identifies methods and frequencies for periodic tracer gas testing and control room integrity assessments. The final version of TSTF-448 will be evaluated. Based on the results of that evaluation:

1) modifications to the PNPP Technical Specifications will be requested based on TSTF-448, or
2) an appropriate alternative program including periodic tracer gas testing and control room integrity assessments will be implemented.

2. If you currently use compensatory measures to demonstrate control room habitability, describe the compensatory measures at your facility and the corrective actions needed to retire these compensatory measures.

There are no compensatory measures being used to demonstrate control room habitability at the Perry Nuclear Power Plant.

3. If you believe that your facility is not required to meet either the GDC, the draft GDC, or the "Principal Design Criteria" regarding control room habitability, in addition to responding to 1 and 2 above, provide documentation (e.g., Preliminary Safety Analysis Report, Final Safety Analysis Report sections, or correspondence) of the basis for this conclusion and identify your actual requirements.

This item is not applicable to the Perry Nuclear Power Plant.

Regulatory Commitments

The following list identifies the actions considered to be regulatory commitments in this submittal. Any other actions discussed in this submittal represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments. If there are any questions or if additional information is required, please contact Mr. Gregory A. Dunn, Manager – FENOC Fleet Licensing, at (330) 315-7243.

Commitments

1. A survey of the location, types and quantities of the offsite mobile and stationary hazardous chemical sources will be conducted at least once every 3 years. New information will be provided to engineering for evaluation of impact on the offsite chemical calculations.

2. TSTF 448 identifies methods and frequencies for periodic tracer gas testing and control room integrity assessments. The final version of TSTF-448 will be evaluated. Based on the results of that evaluation:
   1) modifications to the PNPP Technical Specifications will be requested based on TSTF-448, or
   2) an appropriate alternative program including periodic tracer gas testing and control room integrity assessments will be implemented.