7590-01 (P)

NUCLEAR REGULATORY COMMISSION

Proposed Generic Communication (TAC No. MB2788)

CONTROL ROOM ENVELOPE HABITABILITY

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice of opportunity for public comment.

SUMMARY: The Nuclear Regulatory Commission (NRC) is proposing to issue a generic letter concerning control room envelope (CRE) habitability determination. The purpose of the proposed generic letter is to: (1) alert addressees to findings at U.S. power reactor facilities that suggest that CRE licensing and design bases, and applicable regulatory requirements may not be met, and that a technical specification surveillance requirement may not be adequate to verify CRE operability, (2) emphasize the importance of reliable, comprehensive surveillance testing to verify CRE habitability, and (3) request addressees to submit information that demonstrates that the CRE at each of their respective facilities complies with the current licensing and design basis and applicable regulatory requirements, and that suitable design, maintenance and testing control measures are in place for maintaining this compliance. The NRC is seeking comment from interested parties regarding both the technical and regulatory aspects of the proposed generic letter, presented under the Supplementary Information heading.

The NRC will consider comments received from interested parties in the final evaluation of the proposed generic letter. The NRC's final evaluation will include a review of its technical positions and, as appropriate, an analysis of the value/impact on licensees. Should this generic letter be issued by the NRC, it will become available for public inspection in the NRC Public Document Room.

The NRC maintains an Agencywide Documents Access and Management System (ADAMS) which provides text and image files of NRC's public documents. These documents may be accessed through the NRC's Public Electronic Reading Room (PERR) on the Internet at < http://www.nrc.gov/reading-rm/adams.html >. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC Public Document Room (PDR) reference staff by phone at 1-800-397-4209 or 301-415-4737, by e-mail to < pdr@nrc.gov >, or by Fax at 301-415-3548. The ADAMS Accession No. for the document containing the proposed generic letter is ML021090031.

DATES: Comment period expires **[90 days after FRN is published]**. Comments submitted after this date will be considered if it is practical to do so, but assurance of consideration cannot be given except for comments received on or before this date.

ADDRESSES: Submit written comments to Chief, Rules and Directives Branch, Division of Administrative Services, U.S. Nuclear Regulatory Commission, Mail Stop T6-D59, Washington, DC 20555-0001. Written comments may also be delivered to 11545 Rockville Pike, Rockville, Maryland, between 7:45 am to 4:15 pm, Federal workdays. Copies of written comments received may be examined at the NRC Public Document Room, located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland.

FOR FURTHER INFORMATION CONTACT: W. Mark Blumberg, (301) 415-1083

SUPPLEMENTARY INFORMATION:

NRC GENERIC LETTER 2002-XX: CONTROL ROOM ENVELOPE HABITABILITY

Addressees

All holders of operating licenses for pressurized-water reactors (PWRs) and boiling-water reactors (BWRs), except those who have permanently ceased operations and have certified

that fuel has been permanently removed from the reactor vessel and that it has been more than one year since fuel was irradiated in the reactor vessel.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter to:

(1) alert addressees to findings at U.S. power reactor facilities that suggest that the control room envelope (CRE) licensing and design bases, and applicable regulatory requirements (see section below) may not be met, and that a technical specification surveillance requirement may not be adequate to verify CRE operability,

(2) emphasize the importance of reliable, comprehensive surveillance testing to verify CRE habitability, and

(3) request addressees to submit information that demonstrates that the CRE at each of their respective facilities complies with the current licensing and design basis and applicable regulatory requirements, and that suitable design, maintenance and testing control measures are in place for maintaining this compliance.

Background

The control room is the plant area where actions are taken to operate the plant safely under normal conditions, maintain the reactor in a safe condition, or mitigate the consequences of an accident. The CRE encompasses the control room and other rooms and areas that personnel must access to accomplish plant control functions in the event of an accident. The structures that make up the CRE are designed to limit the inleakage of contaminants such as radioactive materials, hazardous chemicals, and smoke from areas outside the CRE. CRE habitability systems (CREHSs) typically provide the functions of shielding, isolation, pressurization, heating, ventilation, air conditioning and filtration, monitoring, and the sustenance and sanitation necessary to ensure that the control room operators can safely remain in the CRE. The

personnel protection features incorporated into the design of a plant's CREHSs depend on the nature and scope of the plant-specific challenges to maintaining CRE habitability. Isolation of the CRE atmosphere from the atmosphere of adjacent areas is fundamental to ensuring a habitable environment.

During the design of a nuclear power plant, licensees perform analyses to demonstrate that the CRE and the CREHSs, as designed, provide a habitable environment during postulated design basis events. These design analyses model the transport of potential contaminants into the CRE and their removal. The amount of inleakage of contaminants assumed is important to these analyses. Unaccounted-for contaminants entering the CRE may impact the ability of the operators to perform plant control functions. If contaminants impair the response of the operators to an accident, there could be increased consequences to the public health and safety.

Typically, there are two CRE designs. These designs are referred to as positive-pressure and neutral-pressure CREs. Both designs focus on limiting the amount of contaminant entering the CRE. The positive-pressure CRE intentionally pressurizes the CRE with air from outside the CRE. The pressurization air is treated by a high-efficiency particulate air filter and iodine absorption media to remove contaminants. The neutral-pressure CRE does not intentionally pressurize the CRE, but limits inleakage of contaminants by isolating controlled flow paths into the CRE. Plants with a positive-pressure CRE have generally implemented testing programs. These programs verify those ventilation systems serving the CRE can maintain the CRE at a positive differential pressure relative to adjacent areas. These testing programs are generally implemented through a technical specification surveillance requirement for the CREHSs. The tests are typically referred to as a ΔP test. Plants with a neutral-pressure CRE design typically do not have a CRE integrity testing program. (The term *neutral-pressure* means only that the

CRE is not intentionally pressured. The actual pressure of the CRE may be positive, neutral, or negative relative to adjacent areas.)

In addition to the ΔP surveillance testing described above, approximately 30 percent of all addressees have performed CRE integrity testing using the standard test method described in American Society for Testing and Materials (ASTM) consensus standard E741, "Standard Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution." Unlike the ΔP test, the E741 test measures the total CRE inleakage from all sources. It is well suited for assessing the integrity of positive-pressure or neutral-pressure CREs. The test basically involves homogeneously dispersing a nontoxic tracer gas throughout the CRE and measuring the dilution of the tracer gas caused by inleakage.

The results of the E741 tests indicate that the ΔP testing is not a reliable method for demonstrating CRE integrity. For all but one facility tested using the E741 standard, the measured inleakage was greater than the inleakage assumed in the design basis analyses. In some cases the measured inleakage was several orders of magnitude greater than the value previously assumed even though some licensees had routinely demonstrated a positive ΔP relative to adjacent areas at their facilities. Affected facilities were subsequently able to achieve compliance with the CRE radiation protection regulatory requirements by sealing, adding new duct work, changing their CRE or by re-analysis of their CRE habitability.

The ΔP surveillance test has two deficiencies. First, it does not measure CRE inleakage. The ΔP surveillance test infers that contamination cannot enter the CRE if the CRE is at a higher pressure than adjacent areas. Second, the ΔP test cannot determine whether there may be unrecognized sources of pressurization of the CRE that could introduce contaminants into the CRE under accident conditions. Two possible contamination pathways are the CREHS fan suction duct work that is located outside the CRE, and the pressurized ducts that traverse the lower pressure CRE en route to another plant area.

The E741 testing has helped to identify a spectrum of CREHS deficiencies that affect system design, construction, and quality; system boundary construction and integrity; and technical specification surveillance requirements. Licensees have determined that the performance of the CRE and the CREHSs can be affected by (1) the gradual degradation in associated equipment such as seals, floor drain traps, fans, duct work, and other components; (2) the drift of throttled dampers; (3) maintenance on the CRE boundary or the CREHSs; and (4) inadvertent misalignments of the CREHSs. Since inleakage is influenced by pressure differentials between the CRE and adjacent areas, changes in ambient pressure in these adjacent areas can affect the CRE inleakage. These changes can be the result of a modification, the degradation of the ventilation systems serving these areas, or inadequate preventive and corrective maintenance programs.

Licensees and NRC staff have identified other deficiencies in CREHS design, operation, and performance from the review of license amendments, Licensee Event Reports, and records and reports prepared pursuant to 10 CFR 50.59. These deficiencies showed that the licensees' CREs did not meet their design bases. Some of these deficiencies are discussed in Regulatory Issue Summary 2001-19, "Deficiencies in the Documentation of Design Basis Radiological Analyses Submitted in Conjunction With License Amendment Requests." For example, some licensees credited the operation of CREHSs based upon actuation of high-radiation signals from instrumentation. Further investigation revealed that the system would not be actuated due to incorrect setpoints or placement of the instrumentation. Other CRE designs appear not to have considered unfiltered or once-filtered inleakage through idle CREHS ventilation trains. Without adequate consideration of such design deficiencies, design basis radiation exposure limits may be exceeded.

Previous to the E741 testing, a group of licensees had trouble meeting the CRE criteria in Three Mile Island (TMI) Action Item III.D.3.4, "Control Room Habitability Requirements," that the

NRC ordered most licensees to implement after the accident at TMI. At that time, radiological source term research suggested that the distribution of the chemical forms of iodine released during an accident could be different from the distribution in the traditional source term defined in U. S. Atomic Energy Commission Technical Information Document (TID) 14844, "Calculation of Distance Factors for Power and Test Reactor Sites." Because of the possible differences, the staff allowed licensees to postpone changing their CREs until the ongoing source term research was completed or until a generic letter on CRE habitability was issued. The staff believed that postponing changes were reasonable since the source term research or improved methods of analyses might prove that they were unnecessary. Many of these licensees incorporated compensatory actions into their operating procedures to assure that the control room operators would be protected in case of an accident. Since then, other licensees have found that they could not meet the thyroid dose limits for habitability without using compensatory actions. The NRC also allowed these facilities to use compensatory actions until completion of the source term research. In August 2000, the NRC staff incorporated the results of the source term into Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," and it is now available for use by licensees.

Although many CRE integrity testing programs focus on radiological concerns, radiation is only one potential design basis challenge to the protection of the operators. The inleakage of other contaminants may have a greater impact on CRE habitability. An inleakage rate that is tolerable for one contaminant may not be tolerable for another. The CRE licensing basis describes the hazardous chemical releases considered in the CRE design, the design features, and the administrative controls implemented to mitigate the consequences of these releases to the control room operators. Smoke and other byproducts of fire within the CRE or in adjacent areas are among the contaminants that can have an adverse impact on CRE habitability.

Discussion

The NRC is concerned that some licensees have not maintained adequate configuration control over their CREs and have not corrected identified design and performance deficiencies. Errors of omission and commission are more likely if CREHSs and CREs do not properly perform as intended in response to challenges from off-normal or accident situations. The CRE must be safe so that operators remain in the CRE to monitor plant performance and take appropriate mitigative actions. This is an underlying assumption in both the design basis and severe accident risk analyses. It is, therefore, imperative to the health and safety of the public that operators are confident of their safety in the CRE at all times.

The scope and magnitude of the problems that NRC staff and licensees have identified raise concerns about whether similar design, configuration, and operability problems exist at other reactor facilities. The NRC staff is particularly concerned about whether licensees' programs to maintain configuration control of CREHSs are sufficient to demonstrate that the physical and functional characteristics of CREHSs are consistent with and are being maintained according to their design bases. It is emphasized that the NRC's position has been, and continues to be, that it is the responsibility of individual licensees to know the licensing basis for the CRE and associated CREHSs. Licensees should also have appropriate documentation of the design basis, and procedures in place, in accordance with NRC regulations, for performing necessary assessments of plant or procedure changes that may affect the performance of the CRE and CREHSs.

The technical specifications for about 75 percent of the CREs (comprised mostly of positive-pressure CREs) have a Surveillance Requirement (SR) to measure the ΔP from the CRE to adjacent areas. The bases of the Improved Standard Technical Specifications say that this SR demonstrates CRE integrity with respect to unfiltered inleakage. The E741 integrated testing proves that it does not. Because 10 CFR 50.36 requires technical specifications to be

derived from the safety analyses, the staff feels that the existing deficiency should be corrected. This correction is consistent with the NRC Administrative Letter 98-10, “Dispositioning Of Technical Specifications That Are Insufficient To Assure Plant Safety,” which describes the staff’s expectation that licensees correct technical specifications that are found to “contain non-conservative values or specify incorrect actions.”

Because of the importance of ensuring habitable CREs under all normal and off-normal plant conditions, the addressees are requested to provide certain information that will enable the NRC staff to verify whether addressees can demonstrate and maintain the current design bases for the CRE at their facilities. Addressees are encouraged, but not required, to work closely with industry groups on the coordination of their responses. Coordinating the responses is more efficient and public confidence may ensue from a uniform approach to demonstrating compliance with the design bases of their CREs.

NEI 99-03, “Control Room Habitability Assessment Guidance,” provides industry generic guidance on CRE habitability. The NRC staff reviewed NEI 99-03, but rather than fully endorse NEI 99-03, the NRC staff developed its own guidance. Draft Regulatory Guide DG-1114, “Control Room Habitability at Nuclear Power Reactors,” endorses NEI 99-03 to the extent possible and provides additional guidance. Licensees are not required to comply with DG-1114, but may find it useful in responding to this generic letter. Licensees unable to confirm item 1 under the Required Information section may also use DG-1114 to develop and implement corrective actions.

Requested Information

Addressees are requested to provide the following information within 180 days of the date of this generic letter.

1. Confirmation that your facility’s CRE meets its applicable habitability regulatory requirements (e.g., GDC 1, 3, 4, 5, and 19) and that the CRE and CREHSs are designed,

constructed, configured, operated, and maintained in accordance with the facility's design and licensing basis. 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 CRE habitability. Describe how and when you performed the analyses, tests, and measurements for this confirmation.

(b) That the most limiting unfiltered inleakge into your CRE (and filtered inleakage if applicable) is incorporated into your fire and hazardous chemical assessment, and the CRE integrity preserves the reactor control capability from either the CRE or the alternate shutdown panel in the event of a fire.

(c) That your technical specifications are adequate to demonstrate the OPERABILITY of your CRE (where OPERABILITY is defined by your technical specifications). If you currently have a ΔP surveillance requirement to demonstrate CRE integrity, provide the basis for your conclusion that it remains adequate to demonstrate CRE integrity in light of the E741 testing results. If your facility does not currently have a technical specification surveillance requirement for your CRE, explain how and on what frequency you confirm your CRE integrity.

(2) If you currently use compensatory measures to demonstrate CRE habitability, describe the compensatory measures at your facility and the corrective actions to retire these compensatory measures in accordance with your related commitments.

(3) If you believe that your facility is not required to meet either the GDC, draft GDC, or "Principle Design Criteria" regarding CRE habitability, provide documentation (e.g. PSAR, FSAR sections etc.) of the basis for this conclusion and identify your actual requirements.

Requested Response

If an addressee cannot provide the information or cannot meet the requested completion date, the addressee should submit a written response indicating this within 60 days of the date of this generic letter. The response should address any alternative course of action the addressee proposes to take, including the basis for the acceptability of the proposed alternative course of action.

The written response should be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001. A copy of the response should be sent to the appropriate regional administrator.

NRC staff will review the responses to this generic letter and, if concerns are identified, will notify affected addressees. The staff may conduct inspections to determine licensees' effectiveness in addressing this generic letter.

Applicable Regulatory Requirements

Several provisions of the NRC regulations and plant operating licenses (technical specifications) pertain to the issue of CRE habitability. The general design criteria (GDC) for nuclear power plants (Appendix A to 10 CFR Part 50), or, as appropriate, quality assurance requirements in the licensing basis for a reactor facility, stated in Appendix B of 10 CFR Part 50, and the technical specifications, are the bases for the NRC staff's assessment of CRE habitability.

Appendix A to 10 CFR Part 50, "General Design Criteria (GDC) for Nuclear Power Plants," and the plant safety analyses require or commit licensees to design and test safety-related structures, systems, and components (SSCs) to provide adequate assurance that they can perform their safety functions. The NRC staff applies these criteria to plants with construction permits issued on or after May 21, 1971, and to those plants whose licensees have committed to them. The applicable GDC are GDC 1, 3, 4, 5, and 19. GDC 1 requires quality standards commensurate with the importance of the safety functions performed. GDC 3

requires SSCs to be designed and located to minimize the effects of fires. GDC 4 requires SSCs to be designed to accommodate the effects of accidents. GDC 5 requires that an accident in one unit will not significantly impair orderly shutdown and cooldown of the remaining unit.

GDC 19 specifies that a control room be provided from which actions can be taken to operate the nuclear reactor safely under normal conditions and maintain the reactor in a safe condition under accident conditions, including a loss-of-coolant accident (LOCA). There must be adequate radiation protection to permit personnel to access and occupy the control room under accident conditions without receiving radiation exposures in excess of specified values.

Before the issuance of the GDC, proposed GDC (sometimes called “principal design criteria”) were published in the *Federal Register* for comment. As they evolved, several of the proposed GDC addressed CRE habitability. A facility may have been licensed before the issuance of the GDC, but licensees may have committed to the proposed GDC as they existed at the time of licensing.

Following the accident at Three Mile Island (TMI), TMI Action Plan Item III.D.3.4, “Control Room Habitability Requirements,” as clarified in NUREG-0737, “Clarification of TMI Action Plan Requirements,” required all licensees to assure that control room operators would be adequately protected against the effects of accidental releases of toxic and radioactive gases and that the nuclear power plant could be safely operated or shut down under design basis accident conditions. When licensees proposed modifications, the NRC issued orders confirming licensee commitments. As a result, most plants licensed before the GDC were formally adopted were then required to meet the TMI Action Plan III.D.3.4 requirements.

Appendix B to 10 CFR Part 50, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” establishes quality assurance requirements for the design, construction, and operation of those SSCs that prevent or mitigate the consequences of

postulated accidents that could cause undue risk to the health and safety of the public. Criterion III of Appendix B, “Design Control,” requires that design control measures be provided for verifying or checking the adequacy of design. A suitable testing program is identified as one method of accomplishing this verification.

Section 36 of 10 CFR Part 50, “Technical Specifications,” requires technical specifications to be derived from the safety analyses.

If, in the course of preparing a response to the requested information, an addressee determines that its facility is not in compliance with the Commission’s requirements, the addressee is expected to take appropriate action in accordance with requirements of Appendix B to 10 CFR Part 50 and the plant technical specifications to restore the facility to compliance.

Reasons for Information Request

This generic letter transmits an information request that is necessary to permit the assessment of plant-specific compliance with applicable regulatory requirements. Specifically, this information will enable the NRC staff to determine whether the CREs at power reactor facilities comply with the current licensing bases.

The habitability of the CRE and the operability of the CREHS in the event adverse environmental conditions prevail external to the CRE have a direct nexus to maintaining public health and safety. Plant design bases and severe accident risk analyses both assume that the control room operators remain safely within the CRE to monitor plant performance and take appropriate mitigative actions. It is essential that operators be confident of their safety within the CRE at all times.

Backfit Discussion

This generic letter transmits an information request for the purpose of verifying compliance with existing applicable regulatory requirements (see the applicable regulatory requirements section

of this generic letter). This generic letter does not constitute a backfit as defined in 10 CFR 50.109(a)(1) since it does not impose modifications or additions to structures, systems, and components or to the design or operation of an addressee's facility. Nor does it impose an interpretation of the Commission's rules that is either new or different from a previous staff position. Therefore, no backfit is either intended or approved by this generic letter, and the staff has not performed a backfit analysis.

Small Business Regulatory Enforcement Fairness Act

The NRC has determined that this action (a generic letter) is not subject to the Small Business Regulatory Enforcement Fairness Act of 1996.

Federal Register Notification

(To be completed after the public comment period.)

Paperwork Reduction Act Statement

This generic letter contains an information collection that is subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). This information collection was approved by the Office of Management and Budget, clearance number 3150-0011, which expires July 31, 2003.

The burden to the public for this information collection is estimated to average 200 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. The NRC is seeking public comment on the potential impact of the information collection contained in the generic letter and on the following issues:

1. Is the proposed information collection necessary for the proper performance of the functions of the NRC? Will the information have practical use?
2. Is the burden estimate accurate?
3. Can the quality, utility, or clarity of the information to be collected be improved?

4. How can the burden of the information collection be minimized? Can automated collection techniques be used?

Comments on any aspect of this information collection, including suggestions for reducing the burden, should be sent to Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001 or by Internet electronic mail to infocollects@nrc.gov; and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0011), Office of Management and Budget, Washington, DC 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, an information collection unless the requesting document displays a currently valid OMB control number.

Questions about this matter should be addressed to the technical contact or the Office of Nuclear Reactor Regulation project manager for your facility.

Dated at Rockville, Maryland, this 3rd day of May 2002.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/
William D. Beckner, Program Director
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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*See previous concurrence
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