U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH

March 2002
Division 1

DRAFT REGULATORY GUIDE

Contact: W.M. Blumberg (301)415-1083

DRAFT REGULATORY GUIDE DG-1114

CONTROL ROOM HABITABILITY AT LIGHT-WATER NUCLEAR POWER REACTORS

A. INTRODUCTION

This guide is being developed to provide guidance and criteria acceptable to the Nuclear Regulatory Commission (NRC) staff for implementing the NRC's regulations in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," regarding control room habitability (CRH). The guide will outline a process that licensees may apply to control room envelopes (CREs) that are modified, newly designed, or need to reconfirm their conformance to the regulations. In Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 1, 3, 4, 5, and 19 apply to control room habitability. A summary of these GDCs follows.

GDC 1, "Quality Standards and Records," requires that structures, systems, and components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions performed.

GDC 3, "Fire Protection," requires SSCs important to safety be designed and located to minimize the effects of fires and explosions.

GDC 4, "Environmental and Dynamic Effects Design Bases," requires SSCs important to safety to be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents (LOCAs).

GDC 5, "Sharing of Structures, Systems, and Components," requires that SSCs important to safety not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, the orderly shutdown and cooldown of the remaining units.

GDC-19, "Control Room," requires that a control room be provided from which actions can be taken to operate the nuclear reactor safely under normal conditions and to maintain the reactor in a safe condition under accident conditions, including a LOCA. Adequate radiation protection is to be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of specified values.

Regulatory guides are issued to describe to the public methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, to explain techniques used by the staff in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required. Regulatory guides are issued in draft form for public comment to involve the public in developing the regulatory positions. Draft regulatory guides have not received complete staff review; they therefore do not represent official NRC staff positions.

The information collections contained in this draft regulatory guide are covered by the requirements of 10 CFR Part 50, which were approved by the Office of Management and Budget (OMB), approval number 3150-3011. If a means used to impose an information collection does not display a currently valid 0MB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

B. DISCUSSION

The control room is the plant area in which actions are taken to operate the plant safely under normal conditions and to maintain the reactor in a safe condition during accident situations. The CRE encompasses the control room and may encompass the alternate shutdown panel and other rooms and areas to which personnel access may be necessary 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 radioactive and toxic materials[1] from areas external to the CRE. Control room habitability systems (CRHSs) include the CRE. CRHSs typically provide the functions of shielding, isolation, pressurization, heating, ventilation, air conditioning and filtration, monitoring, and the necessary sustenance and sanitation to ensure that the control room operators can remain in the control room and take actions to operate the plant under normal and accident conditions. The personnel protection features incorporated into the design of a

[1] See Regulatory Guide 1.78, Revision 1, "Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release" (Ref. 1), for guidance on identifying hazardous chemicals that may impact CRE habitability.

particular plant's CRHSs depend on the nature and scope of the plant-specific challenges to maintaining CRE habitability. In the majority of the CRHS designs, isolation of the CRE atmosphere from that of adjacent areas is fundamental to ensuring a habitable control room.

A licensee may use this guide for assessing CRHSs following changes to these systems or the sources that would lead to consequences to the operator. Examples of changes that may impact the existing CRH assessments and may result in a reanalysis of the licensee's CRH are:

- Changes in procedures, operation, performance,[2] alignment, or function of the CRHS,
- New hazardous chemicals or radioactive sources introduced onsite or in the vicinity of the plant,
- Increases in hazardous chemical or radioactive source quantities, concentrations, locations, or shipments.

The primary design function of CRHSs is to protect the public and the control room operator. If the response of the operator is impaired during an accident, there could be increased consequences to the public health and safety. It is important for the operators to be confident of their safety in the control room to minimize errors of omission and commission. The Regulatory Positions below provide methods acceptable to the NRC staff for ensuring the public and the control room operators are protected.

When possible, this guide has incorporated guidance contained in NEI 99-03, "Control Room Habitability Assessment Guidance" (Ref. 2). The staff has reviewed this document and has concluded that portions of this document can serve as a valuable resource on CRH. Only the sections of NEI 99-03 that are specifically stated in the Regulatory Position should be considered to be endorsed by the staff. The staff's endorsement of these sections should not be considered an endorsement of the remainder of NEI 99-03 nor any other document referenced in NEI 99-03.

C. REGULATORY POSITION

1. GENERAL CONSIDERATIONS

1.1 Overview of the Process of Demonstrating and Maintaining CRH

In demonstrating that a facility's CRE conforms to the GDCs, the following CRH aspects are typically assessed.

- Radiological doses
- Protection from the effects of hazardous materials
- Control of the reactor from either the control room or the alternate shutdown panel.

The process of demonstrating the above three aspects includes the following actions:

---

[2] An example of a changed performance parameter that may require re-analysis is an increase in CRE inleakage beyond that assumed in previous CRH assessments.

1. Identification of the licensing bases for the (a) CRHS, (b) areas adjacent to the CRE, and (c) ventilation systems that serve or traverse the CRE and those adjacent to the CRE.

2. Determinations of whether the design, configuration, and operation of the systems and areas identified in action 1 are consistent with the licensing bases.

3. Determination of the performance characteristics for operating modes associated with radiological and hazardous chemical accidents.

4. Calculation of the radiological dose consequences.

5. Calculation of the hazardous chemical release consequences.

6. Assessment of whether a radiological, hazardous chemical, or fire challenge could result in the inability of the control room operators to control the reactor from either the control room or the alternate shutdown panel.

7. Maintenance and monitoring of the CRHS.

1.2 Applicability of Prior Licensing Basis[3]

The application of this regulatory guide may involve a licensee-initiated voluntary change to the licensing basis of the facility. To issue a license amendment on the basis of this guide, the NRC staff must make a current finding of compliance with regulations applicable to the amendment. The staff may find that new or unreviewed issues are created by a particular site-specific application of this guide, warranting review of past staff positions on a particular licensing basis. A licensee who voluntarily seeks to modify its licensing basis through a license amendment is not protected by the backfit as defined by 10 CFR 50.109, "Backfitting." Backfitting occurs only when the NRC imposes a new or changed position on a licensee, which is not the case when a licensee voluntarily seeks an amendment.

Plants were licensed with various trade-offs of conservatisms compensating for non-conservatisms in radiological dose analyses. The trade-offs for each plant were different. The NRC staff has integrated the accumulated technical knowledge to the year 2001 in this regulatory guide and has offered a package of more realistic analysis methods and limits along with reduced conservatism and appropriate reconciliation of nonconservatisms. The staff believes that only by implementing the integrated package as presented within the Regulatory Positions will the design bases be preserved.

2. DEMONSTRATING AND MAINTAINING CRH

Regulatory Positions 2.1 through 2.7 provide guidance on the process of demonstrating and maintaining CRH.

---

[3] As used in this guide, the licensing basis is the documentation that describes how the plant meets applicable regulations. Design bases are defined in 10 CFR 50.2. Regulatory Guide 1.186, "Guidance and Examples for Identifying 10 CFR 50.2 Design Bases" (Ref. 3), provides additional guidance. The design bases are a subset of the licensing bases. Thus, licensing bases will be used in this guide to refer to both.

2.1 Identification of the Licensing Bases for the CRE

2.1.1 Determination of the CRE

Confirmation of a facility's ability to meet CRH requirements begins with the identification of the CRE. The CRE is usually defined by the licensee. The CRE encompasses the main control room and may encompass the alternate shutdown panel and other rooms and areas to which personnel access may be necessary to accomplish plant control functions in case of an accident. Typical CREs may include cable spreading rooms, process instrumentation rooms, switchgear rooms, a technical support center (TSC), the operations support center, controlled document rooms, process computer rooms, a kitchen and restrooms, and heating, ventilation, and air conditioning equipment rooms.

A description of the CRE may be contained in a number of plant documents. These documents might include the Updated Final Safety Analysis Report (UFSAR), the original Final Safety Analysis Report (FSAR), the Safety Evaluation for the Operating License (OL), system descriptions, plant drawings, operating procedures, plant amendment requests, NRC safety evaluations, TMI Action Item III.D.3.4 submittals, and responses to staff questions at the construction permit and OL stages.

2.1.2 Determination of the Licensing Bases

In demonstrating the habitability of a facility's CRE, it is essential that the licensee know the facility's licensing bases for their CRHSs. The sources of the licensing bases of the CRHSs should be identified. Licensees should consider the documents identified in Section 4.3 of NEI 99-03 (Ref. 2) as potential sources that define the licensing bases for CRHS. Focusing on the events that may have established or changed these bases may help narrow this search.

Over the facility's lifetime the licensing bases change. The staff may have reviewed and approved the licensing bases of facilities licensed before the issuance of this guide. The original licensing basis may have been submitted as part of the construction permit application. Licensees may have modified it in response to NRC questions. In addition, the licensing bases were part of the application for the OL (FSAR). Depending on the plant vintage, licensees may have modified their licensing bases in response to TMI Action Item III.D.3.4. Amendments to the OL may have resulted in changes to the licensing bases of the CRHSs. Licensees should review the applicable plant changes to their licensing bases to determine the current bases.

A group of reactors received their construction permits or OLs before the GDCs were promulgated. During this time, proposed GDCs (sometimes called "Principal Design Criteria") were published in the *Federal Register* for comment. These proposed GDCs addressed CRH. Although facilities may have been licensed before the promulgation of the GDCs, licensees may have committed to the form of the GDCs as they existed at the time of licensing. A review of the record associated with the construction permit and OL proceedings should confirm whether licensees made such a commitment. Therefore, licensees that received their construction permits or OLs before the GDCs were promulgated should review their commitments to the draft form of the GDC to understand their CRH licensing bases.

For facilities licensed following the issuance of this regulatory guide, the sources for the description of the licensing bases are likely to be the documents filed in support of the licensing application (under 10 CFR Parts 50 and 52).

2.2 Determination of Whether the CRHSs are Consistent with the Licensing Bases

2.2.1 Comparison of System Design, Configuration, and Operation with the Licensing Bases

Licensees should compare the design, configuration, and operation of their CRHSs and the systems that are in adjacent areas and could interact with the CRE to their licensing bases to ensure consistency. The review of the configuration of the CRHSs should include the construction and the alignment of the systems and structures that make up the CRHSs. For new reactors and existing CRHSs undergoing redesign, this comparison should be made upon completion of construction. Section 5 of NEI 99-03 (Ref. 2) provides a method of comparing the plant's configuration and operations of ventilation systems with the licensing bases that is acceptable to the NRC staff. Licensees should employ similar methods when they perform these comparisons for other CRHS.

2.2.2 Interactions Between the CRE and Adjacent Areas

The conditions that exist in the areas adjacent to the CRE influence the performance of the CRE and associated CRHSs. Although these systems might not be expected to operate during an emergency, during a loss of offsite power, or with a single failure, inleakage may be increased if they do operate. Potential interactions between the CRE and adjacent areas that may increase the transfer of contaminants to the CRE should be identified. These interactions may be caused by ventilation systems that supply or exhaust air from areas adjacent to the CRE, are located in areas adjacent to the CRE, or have ductwork that traverses the CRE or areas adjacent to the CRE.

2.3 Determination of Performance Characteristics

2.3.1 Performance of the CRE and CRH Ventilation Systems

The licensee should determine the performance characteristics of the CRE, its ventilation systems, and systems that serve or traverse areas within or adjacent to the CRE. Performance characteristics are needed to:

- Establish the operating parameters for incorporation into the licensing basis (for new reactors or those that have modified their CRE or associated ventilation systems),
- Determine the impact on systems caused by changes in the operation, design, alignment, or procedures,
- Define the limiting condition for the applicable design bases events,
- Determine new limiting conditions or perform new analyses.

Technical specifications require licensees to periodically perform measurements of several parameters important to maintaining CRH. These parameters may include system flow rates, carbon filter efficiencies, actuation signals, and CRE integrity tests. Engineered-safety-feature atmospheric clean up systems in light-water-cooled nuclear power plants should be tested and evaluated per Regulatory Guide 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident

Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants" (Ref. 4).[4]

In recent CRE integrity tests performed by approximately 30 percent of the licensed facilities, all but one facility have measured greater inleakage than that assumed in the original design analyses. In some cases, the measured inleakage exceeded the amount assumed in the original design analyses by several orders of magnitude. DG-1115, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors" (Ref. 9), is being developed to provide guidance on this issue and provide an approach acceptable to the NRC staff to determine CRE integrity. As discussed in Regulatory Position 2.2.2, systems outside the CRE may impact CRE integrity. Testing may also be needed to understand the influence of these systems on CRH.

Licensees should establish the performance characteristics of ventilation systems and fix any deficiencies before testing for CRE integrity. This is because CRE inleakage may be altered by a change in ventilation system performance. Licensees should know how these ventilation systems perform under varying conditions. The response to a particular challenge, e.g., radiological, may vary depending on the accident. Licensees may need to conduct a variety of performance assessments for the same type of challenge.

2.3.2 Identification of the Limiting Condition

The limiting condition for CRH is the configuration that results in the maximum consequences. Sometimes the limiting condition will arise from the configuration that produces the greatest inleakage and sometimes it will not. The latter situation can occur because the configuration that results in the largest inleakage may have mitigative features that result in smaller consequences to the control room operators. As an example, CRE inleakage may be greatest for a radiological accident that does not have a LOOP. However, the absence of a LOOP could provide mitigative features that reduce the overall consequences to the control room operators.

In the determination of the limiting condition for potential radiological accidents, it should not be presumed that the LOCA is the limiting accident because it has the largest initial source of activity. Other accidents, e.g., fuel handling accidents, may produce larger control room operator doses because the manner in which the CRHSs respond may provide less protection to the operators. Therefore, licensees should perform an analysis of the consequences of each potential radiological accident to ensure that they have identified the limiting accident.

Unless a facility relies on a common control room isolation process for all types of radiological accidents, the limiting accident may not be obvious. There are several reasons for this. The inleakage characteristics of the envelope may vary with the CRE's response to an accident. The mitigative equipment used to reduce the radioactivity

---

[4] Guidance is being developed in Draft Regulatory Guide DG-1113, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors" (Ref. 5), that will supersede guidance in Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors" (Ref. 6); Regulatory Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors" (Ref. 7); and Regulatory Guide 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors" (Ref. 8). These guides are presently referenced in Regulatory Guide 1.52.

released to the environment may vary with the accident. The location of the release points for the various accidents relative to the control room intakes may result in less favorable atmospheric dispersion and higher magnitude intake concentrations. Licensees should factor all the potential differences in accidents and CRE performance in order to determine the limiting condition.

For hazardous chemicals, a logic process similar to that employed for radiological accidents should be used to determine the limiting condition.

2.4 Radiological Consequence Analysis

Licensees should calculate control room operator doses for the accidents identified in Regulatory Position 1.2 using guidance that is being developed in Draft Regulatory Guide DG-1113 (Ref. 5) or Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (Ref. 10). For CREs under construction, the control room operators' doses should be based on expected CRHS performance values. When the envelope is operational, the inleakage value should be determined by guidance being developed in Draft Regulatory Guide DG-1115 (Ref. 9).

2.5 Hazardous Chemical Analysis

Licensees should perform analyses of the impact of hazardous chemicals on control room operators using the methodology of Regulatory Guide 1.78, "Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release" (Ref. 1). Regulatory Guide 1.78 encourages licensees to conduct periodic surveys of stationary and mobile sources of hazardous chemicals in the vicinity of their plant sites. The periodicity should be based on the number, size, and type of industrial and transportation activities in the vicinity of the plant and regional and local changes in uses of land. The staff recommends conducting a survey of the location, types, and quantities of the mobile and stationary hazardous chemical sources at least once every 3 years, or more frequently as applicable. The staff also recommends annual performance of an onsite survey of hazardous chemical sources.

For CREs under construction, the hazardous chemical analysis should be based on the expected performance values. When the envelope and associated ventilation systems are operational, the calculation should be based on an inleakage value determined according to guidance being developed in Draft Regulatory Guide DG-1115 (Ref. 9).

2.6 Reactor Control

This Regulatory Position provides guidance to address potential consequences to the environment in the control room and the alternate shutdown panel room. This Regulatory Position does not address the performance of the reactor controls and instrumentation systems that are affected by environmental conditions caused by a radiological, toxic gas, or fire event.

Demonstrating a facility's CRH includes ensuring that an accident arising from a radiological event, hazardous chemicals, or a fire would not prevent the control room operators from controlling the reactor. Facilities should demonstrate that they meet the reactor control aspects of their design basis (typically GDC-19). The specific acceptance criteria for radiological events are provided in 10 CFR 50.67, "Accident Source Term," and guidance being developed in Regulatory Position 4.5 of Draft Regulatory Guide DG-1113 (Ref. 5). The specific acceptance criterion for chemical events is given in Regulatory Position 3.1 of Regulatory Guide 1.78 (Ref. 1).

Smoke may be a CRH concern if there is significant inleakage from outside the envelope. In this situation, smoke from external sources could challenge the ability of the operator to shut down the reactor from within the control room or remotely. No regulatory limit exists on the amount of smoke allowed in the control room. Therefore, the plant's ability to manage smoke infiltration is assessed qualitatively. Section 6.3 and Appendix E of NEI 99-03 (Ref. 2) provides guidance for this assessment. The staff believes the guidance in NE 99-03 concerning smoke is prudent and should be adopted until further guidance becomes available.

2.7 Maintaining and Monitoring CRHSs

CRH is maintained and monitored during the operating life of the plant by a CRHS program. A CRHS program includes periodic evaluations, maintenance, configuration control, and training. This Regulatory Position covers CRHS programs and it provides methods to mitigate degraded and nonconforming conditions when the plant does not meet the specific acceptance criteria given in Regulatory Position 2.6 or is outside its licensing basis. The following methods of maintaining and monitoring CRHSs should be used.

2.7.1 Periodic Evaluations and Maintenance

Periodic evaluations demonstrate that the CRHSs meet their functional criteria. These include evaluations of system material condition, testing, and toxic gas evaluations. CRHS programs should evaluate the system and material conditions as described in Section 9.3.1, "System Material Condition," of NEI 99-03 (Ref. 2). Licensees should perform testing to ensure they maintain CRH. Routine performance measurements are described in Regulatory Position 2.3.1. The complexity of testing following modifications should depend on the effect of the modification on CRH. DG-1115 (Ref. 9) provides a method for verification of CRE integrity. A frequency for CRE integrity testing is proposed in Regulatory Position 3 of Draft Regulatory Guide DG-1115. Regulatory Position 2.5 above provides a method and a suggested frequency to evaluate the impact of hazardous chemicals on control room operators.

A proposed technical specification acceptable to the NRC staff that incorporates the above aspects of CRE integrity testing is contained in Appendix A to this guide. Appendix A provides proposed changes to the Westinghouse Standard Technical Specification (STS) 3.7.10 (Ref. 11), "Control Room Emergency Filtration System (CREFS)," and its associated bases. Similar changes to Babcox and Wilcox (B&W) STS 3.7.10 (Ref. 12), Combustion Engineering (CE) STS 3.7.11 (Ref. 13), General Electric (GE) Boiling Water Reactor (BWR) 4 STS 3.7.4 (Ref. 14), and GE BWR 6 STS 3.7.3 (Ref. 15) and their associated bases would be acceptable to the staff.

A maintenance program should be established for the CRHS and the areas adjacent to the envelope. Table H-1 of NEI 99-03 (Ref. 2) should be used as guidance for developing a maintenance program. Guidance on air filtration and adsorption units of post-accident engineered-safety-feature atmosphere cleanup and normal atmospheric cleanup system maintenance is provided in Regulatory Position 5 of Regulatory Guides 1.52 (Ref. 4) and 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants" (Ref. 16). ASHRAE Guideline 1-1996 (Ref. 17) may be used to establish a maintenance program for systems that handle hazardous chemical and fire challenges.

2.7.2 Configuration Control and Training

Configuration control and training are effective tools that can minimize the impact that changes to CRHSs can have on CRH. Section 9.4 of NEI 99-03 (Ref. 2) provides configuration controls that include CRE boundary and breach control, procedure control, toxic gas control, design change, and safety analysis controls. The staff endorses the controls discussed in Sections 9.4.1 through 9.4.5 of NEI 99-03 with one exception. The staff does not endorse Appendix K, "Control Room Envelope Boundary Control Program," referenced in Section 9.4.1, "CRE Boundary/Breach Control." An acceptable method of breach control is contained in Westinghouse STS 3.7.10 (Ref. 11), B&W STS 3.7.10 (Ref. 12), CE STS 3.7.11 (Ref. 13), GE BWR 4 STS 3.7.4 (Ref. 14), and GE BWR 6 STS 3.7.3 (Ref. 15) and their associated bases. This acceptable breach control method is incorporated in the example provided in Appendix A. Furthermore, the staff endorses Section 9.5, "Training," of NEI 99-03 with one exception. Section 9.5 recommends training using NEI 99-03. Instead, the NRC staff endorses training using only the sections of NEI 99-03 that the staff has endorsed.

2.7.3 Degraded and Nonconforming Conditions

Methods available to address short term degraded or nonconforming conditions are provided in Section 8.4, "Methods Available to Address Degraded or Nonconforming Conditions" of NEI 99-03 (Ref. 2). Section 8.4 includes guidance on compensatory measures such as self-contained breathing apparatus (SCUBA) and potassium iodide (KI) tablets. These methods are acceptable with the following exceptions. Appendices C and D are not endorsed, instead, guidance is being developed in Draft Regulatory Guides DG-1111, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants" (Ref. 18), and DG-1113 (Ref. 5), or Regulatory Guide 1.183 (Ref. 10) should be used. The staff endorses the use of the guidance in Appendix F of NEI 99-03 on an interim basis while corrective actions are being taken to resolve CRHSs that do not meet their licensing bases, subject to the following:

- Section 2.2 of Appendix F addresses the training and qualification of control room operators for SCBA. If SCBA units will be used as an interim compensatory measure for greater than 90 days while the plant is in Operating Condition or Mode 1, simulator crew training accident scenarios in which operators wear SCBAs should be performed. These scenarios should last about 2 hours and include a simulated watch turnover.

- Section 2.6 of Appendix F addresses the availability of adequate methods to refill depleted SCBA cylinders. The impact of a loss of offsite power or airborne contamination at the refill compressor stations should be considered.

Some licensees were allowed to leave TMI Action Item III.D.3.4 actions open until the alternative source term rulemaking and regulatory guidance were published. These actions have been completed with the issuance of 10 CFR 50.67 and Regulatory Guide

1.183 (Ref. 10). Therefore, to demonstrate CRH all affected licensees should take the appropriate actions defined in this guide to close these outstanding commitments.

D. IMPLEMENTATION

This section provides information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

This draft regulatory guide has been released to encourage public participation in its development. Except in those cases in which an applicant or licensee proposes an acceptable alternative method for complying with specified portions of the NRC's regulations, the methods to be described in the final version of this guide reflecting public comments will be used by the NRC staff in the evaluation of CRH for nuclear power plants for which the construction permit or license application is docketed after the issue date of this guide and plants for which the licensees voluntarily commit to all of the provisions of this guide.

REFERENCES

1. USNRC, "Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release," Regulatory Guide 1.78, Revision 1, December 2001.[1]

2. Nuclear Energy Institute, "Control Room Habitability Assessment Guidance," NEI 99-03, Revision 0, June 2001.[2]

3. USNRC, "Guidance and Examples for Identifying 10 CFR 50.2 Design Bases," Regulatory Guide 1.186, December 2000.[1]

4. USNRC, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Regulatory Guide 1.52, Revision 3, USNRC, June 2001.[1]

5. USNRC, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Plants," Draft Regulatory Guide DG-1113, December 2001.[1]

6. USNRC, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors," Regulatory Guide 1.3, Revision 2, June 1974.[1]

7. USNRC, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors," Regulatory Guide 1.4, Revision 2, June 1974.[1]

8. USNRC, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," Regulatory Guide 1.25, March 1972.[1]

9. USNRC, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Draft Regulatory Guide DG-1115, March 2002.[1]

10. USNRC, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Regulatory Guide 1.183, July 2000.[1]

---

[1] Requests for single copies of draft or active regulatory guides (which may be reproduced) or for placement on an automatic distribution list for single copies of future draft guides in specific divisions should be made in writing to the U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Reproduction and Distribution Services Section, or by fax to (301)415-2289; email <DISTRIBUTION@NRC.GOV>. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 11555 Rockville Pike (first floor), Rockville, MD; the PDR's mailing address is USNRC PDR, Washington, DC 20555; telephone (301)415-4737 or 1-(800)397-4209; fax (301)415-3548; e-mail <PDR@NRC.GOV>.

[2] Copies are available for inspection or copying for a fee from the NRC Public Document Room at 11555 Rockville Pike (first floor), Rockville, MD; the PDR's mailing address is USNRC PDR, Washington, DC 20555; telephone (301)415-4737 or 1-(800)397-4209; fax (301)415-3548; e-mail <PDR@NRC.GOV>.

11. USNRC, “Standard Technical Specifications Westinghouse Plants: Specifications,” NUREG-1431, Volume 1, Revision 2, June 2001.[3] (Accession Number ML011840223)

12. USNRC, “Standard Technical Specifications Babcock and Wilcox Plants,” NUREG-1430, Volume 1, Revision 2, June 2001.[3] (Accession Number ML011770186)

13. USNRC, “Standard Technical Specifications Combustion Engineering Plants,” NUREG-1432, Volume 1, Revision 2, June 2001.[3] (Accession Number ML011930335)

14. USNRC, “Standard Technical Specifications General Electric Plants, BWR/4,” NUREG-1433, Volume 1, Revision 2, June 2001.[3] (Accession Number ML011780639)

15. USNRC, “Standard Technical Specifications General Electric Plants, BWR/6,” NUREG-1434, Volume 1, Revision 2, June 2001.[3] (Accession Number ML011780537)

16. USNRC, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Regulatory Guide 1.140, Revision 2, USNRC, June 2001.[1]

17. American Society of Heating, Refrigeration and Air Conditioning Engineers, "The HVAC Commissioning Process," ASHRAE Guideline 1-1996, June 1996.

18. USNRC, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," DG-1111, December 2001.[1]

[3] Available through NRC’s Electronic Reading Room (using the accession number) and online at <www.nrc.gov/reactors/operating/licensing/techspecs.html> .

Appendix A

PROPOSED CRH TECHNICAL SPECIFICATION AND BASES FOR WESTINGHOUSE PLANTS

Proposed Revisions to Revision 2 of NUREG-1431, Volume 1 and 2

June 2001
(Manuscript completed April 30, 2001)

3.7 PLANT SYSTEMS

3.7.10 Control Room Emergency Filtration System (CREFS)

LCO 3.7.10 Two CREFS trains shall be OPERABLE.

- NOTE -

The control room boundary may be opened intermittently under administrative control.

APPLICABILITY: MODES 1, 2, 3, 4, [5, and 6],
During movement of [recently] irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CREFS train inoperable.	A.1 Restore CREFS train to OPERABLE status.	7 days
B. ~~Two CREFS trains inoperable due to~~ ~~i~~Inoperable control room boundary in MODE 1, 2, 3, or 4 for reasons other than failure to meet SR 3.7.10.4.	B.1 Restore control room boundary to OPERABLE status.	~~24 hours~~ 14 days

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Inoperable control room boundary because of failure to meet SR 3.7.10.4.	C.1 Initiate action to restore control room boundary to OPERABLE status.	Immediately
	AND	
	C.2 Initiate compensatory measures to comply with GDC-19.	Immediately
	AND	
	C.3 Provide NRC with corrective action plan including completion schedule.	90 days
~~C~~D. Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4.	~~C~~D.1 Be in MODE 3.	6 hours
	AND	
	~~C~~D.2 Be in MODE 5.	36 hours
~~D~~E. Required Action and associated Completion Time of Condition A not met [in MODE 5 or 6, or] during movement of [recently] irradiated fuel assemblies.	~~D~~E.1 ----------------------------- **- NOTE -** **[** Place in toxic gas protection mode if automatic transfer to toxic gas protection mode is inoperable. **]** -----------------------------	
	Place OPERABLE CREFS train in emergency mode.	Immediately
	OR	
	~~D~~E.2 Suspend movement of [recently] irradiated fuel assemblies.	Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~E~~F. Two CREFS trains inoperable [in MODE 5 or 6, or] during movement of [recently] irradiate fuel assemblies.	~~E~~F.1 Suspend movement of [recently] irradiated fuel assemblies.	Immediately
~~F~~G. Two CREFS trains inoperable in MODE 1, 2, 3, or 4 for reasons other than Condition B or C.	~~F~~G.1 Enter LCO 3.0.3	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.10.1	Operate each CREFS train for [≥ 10 continuous hours with the heaters operating or (for systems without heaters) ≥ 15 minutes].	31 days
SR 3.7.10.2	Perform required CREFS filter testing in accordance with the [Ventilation Filter Testing Program (VFTP)].	In accordance with [VFTP]
SR 3.7.10.3	Verify each CREFS train actuates on an actual or simulated actuation signal.	[18] months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.10.4	Verify one CREFS train can maintain a positive pressure of ≥ [0.125] inches water gauge, relative to the adjacent [turbine building] during the pressurization mode of operation at a makeup flow rate of ≤ [3000] cfm. that unfiltered inleakage into the control room envelope while in the limiting radiological mode of operation is ≤______ cfm.	[24] months [18] months on a STAGGERED TEST BASIS [Reviewers Note: Based on actual industry-integrated and plant-specific experience from the initial and first 24 months follow-on testing, the NRC staff will work with industry to develop an appropriate performance based frequency]

B 3.7 PLANT SYSTEMS

B 3.7.10 Control Room Emergency Filtration System (CREFS)

BASES

BACKGROUND

The CREFS provides a protected environment from which operators can control the unit following an uncontrolled release of radioactivity[, chemicals, or toxic gas].

The CREFS consists of two independent, redundant trains that recirculate and filter the control room air. Each train consists of a prefilter or demister, a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of gaseous activity (principally iodines), and a fan. Ductwork, valves or dampers, and instrumentation also form part of the system, as well as demisters to remove water droplets from the air stream. A second bank of HEPA filters follows the adsorber section to collect carbon fines and provide backup in case of failure of the main HEPA filter bank.

The CREFS is an emergency system, parts of which may also operate during normal unit operations in the standby mode of operation. Upon receipt of the actuating signal(s), normal air supply to the control room is isolated, and the stream of ventilation air is recirculated through the system filter trains. The prefilters or demisters remove any large particles in the air, and any entrained water droplets present, to prevent excessive loading of the HEPA filters and charcoal adsorbers. Continuous operation of each train for at least 10 hours per month, with the heaters on, reduces moisture buildup on the HEPA filters and adsorbers. Both the demister and heater are important to the effectiveness of the charcoal adsorbers.

Actuation of the CREFS places the system in either of two separate states (emergency radiation state or toxic gas isolation state) of the emergency mode of operation, depending on the initiation signal. Actuation of the system to the emergency radiation state of the emergency mode of operation, closes the unfiltered outside air intake and unfiltered exhaust dampers, and aligns the system for recirculation of the control room air through the redundant trains of HEPA and the charcoal filters. The emergency radiation state also initiates pressurization and filtered ventilation of the air supply to the control room.

Outside air is filtered, diluted with building air from the electrical equipment and cable spreading rooms, and added to the air being recirculated from the control room. Pressurization of the control room prevents infiltration of unfiltered air from the surrounding areas of the building. The actions taken in the toxic gas isolation state are the same, except that the signal switches control room ventilation to an isolation alignment to prevent outside air from entering the control room.

The air entering the control room is continuously monitored by radiation and toxic gas detectors. One detector output above the setpoint will cause

BACKGROUND (continued)

actuation of the emergency radiation state or toxic gas isolation state, as required. The actions of the toxic gas isolation state are more restrictive, and will override the actions of the emergency radiation state.

~~A single train will pressurize the control room to about [0.125] inches water gauge.~~ The CREFS operation in maintaining the control room habitable is discussed in the FSAR, Section [6.4] (Ref. 1).

Redundant supply and recirculation trains provide the required filtration should an excessive pressure drop develop across the other filter train. Normally open isolation dampers are arranged in series pairs so that the failure of one damper to shut will not result in a breach of isolation. The CREFS is designed in accordance with Seismic Category I requirements.

The CREFS is designed to maintain the control room environment for 30 days of continuous occupancy after a Design Basis Accident (DBA) without exceeding a 5 rem whole body dose or its equivalent to any part of the body.

APPLICABLE SAFETY ANALYSES

The CREFS components are arranged in redundant, safety related ventilation trains. The location of components and ducting within the control room envelope ensures an adequate supply of filtered air to all areas requiring access. The CREFS provides airborne radiological protection for the control room operators, as demonstrated by the control room accident dose analyses for the most limiting design basis ~~loss of coolant~~ accident, fission product release presented in the FSAR, Chapter [15] (Ref. 2).

The analysis of toxic gas releases demonstrates that the toxicity limits are not exceeded in the control room following a toxic chemical release, as presented in Reference 1.

The worst case single active failure of a component of the CREFS, assuming a loss of offsite power, does not impair the ability of the system to perform its design function.

The CREFS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two independent and redundant CREFS trains are required to be OPERABLE to ensure that at least one is available assuming a single failure disables the other train. Total system failure could result in exceeding a dose of 5 rem to the control room operator in the event of a large radioactive release.

LCO (continued)

The CREFS is considered OPERABLE when the individual components necessary to limit operator exposure are OPERABLE in both trains. A CREFS train is OPERABLE when the associated:

a. Fan is OPERABLE,

b. HEPA filters and charcoal adsorbers are not excessively restricting flow, and are capable of performing their filtration functions, and

c. Heater, demister, ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

In addition, the control room boundary ~~must be maintained~~, including the integrity of the walls, floors, ceilings, ductwork, ~~and~~ access doors, and the unfiltered inleakage must be maintained within the assumptions of the design analysis.

The LCO is modified by a Note allowing the control room boundary to be opened intermittently under administrative controls. For entry and exit through doors, the administrative control of the opening is performed by the person(s) entering or exiting the area. For other openings, these controls consist of stationing a dedicated individual at the opening who is in continuous communication with the control room. This individual will have a method to rapidly close the opening when a need for control room isolation is indicated.

APPLICABILITY

In MODES 1, 2, 3, 4, [5, and 6,] and during movement of [recently] irradiated fuel assemblies, CREFS must be OPERABLE to control operator exposure during and following a DBA.

In [MODE 5 or 6], the CREFS is required to cope with the release from the rupture of an outside waste gas tank.

During movement of [recently] irradiated fuel assemblies, the CREFS must be OPERABLE to cope with the release from a fuel handling accident [involving handling recently irradiated fuel]. [The CREFS is only required to be OPERABLE during fuel handling involving handling recently irradiated fuel (i.e., fuel that has occupied part of a critical reactor core within the previous [ ] days), due to radioactive decay.]

APPLICABILITY (continued)

ACTIONS

A.1

When one CREFS train is inoperable, action must be taken to restore OPERABLE status within 7 days. In this Condition, the remaining OPERABLE CREFS train is adequate to perform the control room protection function. However, the overall reliability is reduced because a single failure in the OPERABLE CREFS train could result in loss of CREFS function. The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and ability of the remaining train to provide the required capability.

B.1

- REVIEWER'S NOTE -

Adoption of Condition B is dependent on a commitment from the licensee to have written procedures available describing compensatory measures to be taken in the event of an intentional or unintentional entry into Condition B.

If the control room boundary is inoperable in MODE 1, 2, 3, or 4, the CREFS trains cannot perform their intended functions. Actions must be taken to restore an OPERABLE control room boundary within ~~24 hours~~14 days. During the period that the control room boundary is inoperable, appropriate compensatory measures (consistent with the intent of GDC 19) should be utilized to protect control room operators from potential hazards such as radioactive contamination, toxic chemicals, smoke, temperature and relative humidity, and physical security. Preplanned measures should be available to address these concerns for intentional and unintentional entry into the condition. The ~~24 hour~~14 day Completion Time is reasonable based on the low probability of a DBA occurring during this time period, and the use of compensatory measures. The ~~24 hour~~14 day Completion time is a typically reasonable time to diagnose, plan and possibly repair, and test most problems with the control room boundary.

C.1, C.2 and C.3

- REVIEWER'S NOTE -

Condition C is to be supported by a licensee written program and procedures describing compensatory measures to be taken in the event of an intentional or unintentional entry into Condition C.

With unfiltered inleakage greater than that assumed in the design analysis, the control room envelope is inoperable. However, rather than requiring a

ACTIONS (continued)

plant shut down, compensatory measures adequately protect control room operators. This ACTION also requires a thorough and prompt action plan to restore the control room envelope to OPERABLE status.

~~C~~D.1 and ~~C~~D.2

In MODE 1, 2, 3, or 4, if the inoperable CREFS train or control room boundary cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that minimizes accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

~~D~~E.1 and ~~D~~E.2

[In MODE 5 or 6, or] during movement of [recently] irradiated fuel assemblies, if the inoperable CREFS train cannot be restored to OPERABLE status within the required Completion Time, action must be taken to immediately place the OPERABLE CREFS train in the emergency mode. This action ensures that the remaining train is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure would be readily detected.

An alternative to Required Action ~~D~~E.1 is to immediately suspend activities that could result in a release of radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes risk. This does not preclude the movement of fuel to a safe position.

Required Action ~~D~~E.1 is modified by a Note indicating to place the system in the toxic gas protection mode if automatic transfer to toxic gas protection mode is inoperable.

~~E~~F.1

[In MODE 5 or 6, or] during movement of [recently] irradiated fuel assemblies, with two CREFS trains inoperable, action must be taken immediately to suspend activities that could result in a release of radioactivity that might enter the control room. This places the unit in a condition that minimizes accident risk. This does not preclude the movement of fuel to a safe position.

ACTIONS (continued)

~~F~~G.1

If both CREFS trains are inoperable in MODE 1, 2, 3, or 4 for reasons other than an inoperable control room boundary (i.e., Condition B or C), the CREFS may not be capable of performing the intended function and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 3.7.10.1

Standby systems should be checked periodically to ensure that they function properly. As the environment and normal operating conditions on this system are not too severe, testing each train once every month provides an adequate check of this system. Monthly heater operations dry out any moisture accumulated in the charcoal from humidity in the ambient air. [Systems with heaters must be operated for ≥ 10 continuous hours with the heaters energized. Systems without heaters need only be operated for ≥ 15 minutes to demonstrate the function of the system.] The 31 day Frequency is based on the reliability of the equipment and the two train redundancy availability.

SR 3.7.10.2

This SR verifies that the required CREFS testing is performed in accordance with the [Ventilation Filter Testing Program (VFTP)]. The [VFTP] includes testing the performance of the HEPA filter, charcoal adsorber efficiency, minimum flow rate, and the physical properties of the activated charcoal. Specific test Frequencies and additional information are discussed in detail in the [VFTP].

SR 3.7.10.3

This SR verifies that each CREFS train starts and operates on an actual or simulated actuation signal. The Frequency of [18] months is specified in Regulatory Guide 1.52 (Ref. 3).

SR 3.7.10.4

This SR verifies the integrity of the control room enclosure, and the assumed inleakage rates of ~~the~~ potentially contaminated air. ~~The control room positive pressure, with respect to potentially contaminated adjacent areas, is periodically tested to verify proper functioning of the CREFS. During the emergency mode of operation, the CREFS is designed to pressurize the control room ≥ [0.125] inches water gauge positive pressure with respect to adjacent areas in order to prevent~~

SURVEILLANCE REQUIREMENTS (continued)

~~unfiltered inleakage. The CREFS is designed to maintain this positive pressure with one train at a makeup flow rate of [3000] cfm. The Frequency of [18] months on a STAGGERED TEST BASIS is consistent with the guidance provided in NUREG-0800 (Ref. 4).~~ It addresses both radiological and hazardous chemical challenges. This test is performed using the protocol of [ASTM E741-95]. The test is performed in the configuration which will result in the operating condition which results in the largest inleakage.

Based on actual industry-integrated and plant-specific experience from the initial and first 24 months follow-on testing, the NRC staff will work with industry to develop an appropriate performance based frequency. As envelope integrity is demonstrated through satisfactory test results, the testing frequency can be extended. Similarly, if test results indicate that envelope integrity criteria is not met, testing would become more frequent.

REFERENCES

1. FSAR, Section [6.4].
2. FSAR, Chapter [15].
3. Regulatory Guide 1.52, Rev. [2].
4. NUREG-0800, Section 6.4, Rev. 2, July 1981.

APPENDIX B

ACRONYMS

ASHRAE	American Society for Heating, Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
B&W	Babcock and Wilcox
BWR	Boiling Water Reactor
CE	Combustion Engineering
ASTM	American Society for Testing and Materials
ESF	Engineered Safety Feature
FSAR	Final Safety Analysis Report
GE	General Electric
GDC	General Design Criteria
LOCA	Loss-of-Coolant Accident
LOOP	Loss of Offsite Power
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
OL	Operating License
OMB	Office of Management and Budget
SCBA	Self-Contained Breathing Apparatus
SRP	Standard Review Plan
STS	Standard Technical Specification
TMI	Three Mile Island
TSC	Technical Support Center
UFSAR	Updated Final Safety Analysis Report

REGULATORY ANALYSIS

I. STATEMENT OF PROBLEM

The NRC staff is proposing to develop and issue a new regulatory guide, "Control Room Habitability at Light Water-Nuclear Power Reactors," that will endorse, with exceptions and clarifications, the Nuclear Energy Institute (NEI) report NEI 99-03, "Control Room Habitability Assessment Guidance," which is dated June 2001 (Ref. RA-1). The staff proposes to issue a draft guide for public review and comment, and upon resolution of public comments, to finalize and implement the guide.

The control room is that plant area in which actions are taken to operate the plant safely under normal conditions and to maintain the reactor in a safe condition during accident situations. The control room envelope (CRE) encompasses the control room and may encompass the alternate shutdown panel and other rooms and areas to which personnel access may be necessary 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 radioactive and toxic materials from areas external to the CRE. Control room habitability systems (CRHSs) include the CRE. CRHSs typically provide the functions of shielding, isolation, pressurization, heating, ventilation, air conditioning and filtration, monitoring, and the necessary sustenance and sanitation to ensure that the control room operators can remain in the control room and take actions to operate the plant under normal and accident conditions. The personnel protection features incorporated into the design of a particular plant's CRHSs depend on the nature and scope of the plant-specific challenges to maintaining habitability of the CRE. In the majority of the CRHS designs, isolation of the CRE atmosphere from that of adjacent areas is fundamental to ensuring a habitable control room.

The primary design function of CRHSs is to protect the public and the control room operator. If the response of the operator is impaired during an accident, there could be increased consequences to public health and safety. It is important for the operators to be confident of their safety in the control room to minimize errors of omission and commission.

The NRC identified CRE integrity as one of the control room habitability problems during a series of plant visits conducted between 1985-1987 as a part of the staff response to concerns and recommendations of the Advisory Committee on Reactor Safeguards (ACRS). NUREG/CR-4960, "Control Room Habitability Survey of Licensed Commercial Nuclear Power Generating Stations" (Ref. RA-2), presents the results of this survey. The major conclusion of the report is that the numerous observed discrepancies may be indicative of similar discrepancies throughout the industry. The issue of CRE integrity was identified by the NRC in Information Notice 86-76, "Problems Noted In Control Room Emergency Ventilation Systems" (Ref. RA-3), at various DOE/NRC Air Cleaning Conferences and at industry engineering society and engineering organizational meetings (e.g., American Society of Mechanical Engineers or Nuclear Heating, Ventilation, and Air Conditioning Users Group). In 1992, Zion became the first nuclear power plant to rigorously test its CRE for integrity. Since then, approximately 30 percent of the licensed facilities have performed integrated inleakage testing and have measured inleakage rates greater than that assumed in the original design analyses, in some cases by several orders of magnitude.

In March 1998, the staff briefed the Office of Nuclear Reactor Regulation (NRR) Executive Team (ET) on its concerns regarding control room habitability. The ET directed the staff to work with NEI to resolve the issues. The staff co-hosted a control room habitability workshop in July 1998 with NEI and the Nuclear Heating, Ventilation, and Air Conditioning Users Group (NHUG). NEI prepared draft versions of a report entitled "Control Room Habitability Assessment Guidance," NEI 99-03. The staff reviewed the October 13, 2000, revision and determined that, while there was much agreement on positions taken in the document, areas remained in which the staff and industry were in disagreement. It was determined at that time that the staff would prepare and issue formal guidance. A task action plan was prepared. The action plan called for the preparation of a generic letter and four supporting regulatory guides, including the guide considered here.

II. OBJECTIVE OF THE REGULATORY ACTION

This proposed guide would provide guidance and criteria acceptable to the Nuclear Regulatory Commission (NRC) staff for implementing the NRC's regulations in Appendix A to 10 CFR Part 50 regarding control room habitability (CRH). The guide outlines a process that licensees may apply to CREs that are modified, newly designed, or those that need to reconfirm their conformance to the regulations.

III. EXISTING REGULATORY FRAMEWORK

In Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," General Design Criteria (GDC) 1, 3, 4, 5, and 19 apply to control room habitability. A summary of these GDCs follows.

GDC-1, "Quality Standards and Records," requires that structures, systems, and components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standard commensurate with the importance of the safety functions performed.

GDC-3, "Fire Protection," requires SSCs important to safety to be designed and located to minimize the effects of fires and explosions.

GDC-4, "Environmental and Dynamic Effects Design Bases," requires SSCs important to safety to be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents (LOCAs).

GDC-5, "Sharing of Structures, Systems, and Components," requires that SSCs important to safety not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, the orderly shutdown and cooldown in the remaining units.

GDC-19, "Control Room," requires 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 LOCA.

Adequate radiation protection is to be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of specified values.

IV. ALTERNATIVE APPROACHES

1. Alternative 1 – Do Not Provide Guidance

Under this alternative, the staff would not issue regulatory guidance on CRH. This is the no action alternative. Since only about 30 percent of the existing plants have performed integrated testing, the status of CREs at plants that have not tested is unknown. Extrapolation of the integrated testing experience to date suggests that many of these plants may also have inleakage rates in excess of their licensing bases and may not be in compliance with GDC-19. Not providing the needed guidance to demonstrate CRH will result in increased unnecessary burden for the licensee and the staff in the form of preparation and response to requests for additional information (RAIs), re-analyses, and supplementation of license amendment applications. As such, this option is not supportive of any of the four nuclear reactor safety performance goals.

2. Alternative 2 – Endorse an Industry Initiative Addressing Control Room Habitability

Under this alternative, the staff would not develop its own regulatory guidance, but instead would endorse an acceptable industry document. As discussed above, NEI has prepared NEI 99-03, "Control Room Habitability Assessment Guidance" (Ref. RA-1). The staff has determined that it could not fully endorse NEI 99-03. After review and comment by the staff, areas remained in which the staff and industry were in disagreement. For example, the staff found much of the guidance in Section 8.4, "Methods Available to Address Degraded or Nonconforming Conditions," of NEI 99-03 to be acceptable, but there are some provisions that the staff finds unacceptable. The staff believes that Appendices C and D could not be endorsed, but could be replaced by staff guidance given in Draft Regulatory Guides DG-1111, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants" (Ref. RA-4), and DG-1113, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors" (Ref. RA-5), or Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (Ref. RA-6). Similarly, the staff has found other parts of NEI 99-03 to be acceptable with exceptions and clarifications.

This alternative would be supportive of the four reactor safety performance goals.

Issuing a regulatory guide that endorses sections of NEI 99-03 would:

- Maintain public safety by providing needed guidance on ensuring that the CRE is consistent with the plant's licensing basis.

- Improve efficiency and effectiveness by minimizing reiterative discussions between staff and licensees to establish acceptable approaches by providing adequate formal guidance through the use of acceptable work already performed by the industry.

- Minimize unnecessary regulatory burden by providing guidance on implementing a CRE integrity testing program that provides a basis for replacing the non-conclusive surveillance test currently used.

- Maintain public confidence by providing guidance that supports improved confidence in the ability of the control room operators to take necessary actions during an emergency condition.

The staff has determined that this alternative, issuing a new regulatory guide that endorses parts of NEI 99-03, with exceptions and clarification, is the most advantageous approach to addressing the need for additional regulatory guidance on performing assessments of CRH.

3. Alternative 3 – Endorse a National Consensus Standard

Although there are national consensus standards that address measurements of air exchange in buildings and flow in ventilation system components, the staff was not able to identify any national consensus standards that provide higher-level guidance on CRH for a nuclear power plant. As such, this alternative is not viable.

4. Alternative 4 – Issue New Regulatory Guide

This alternative would have the staff prepare a new regulatory guide to provide guidance on methods acceptable to the NRC staff for CRH, including development of a testing program, attributes of an acceptable test, and acceptable test methods.

This alternative would be supportive of the four reactor safety performance goals. Issuing a new regulatory guide would:

- Maintain public safety by providing needed guidance on ensuring that a plant's CRE is consistent with the plant's licensing basis.

- Improve efficiency and effectiveness by minimizing reiterative discussions between staff and licensees to establish acceptable approaches by providing adequate formal guidance. However, this alternative would not be as efficient as Alternative 2 in that acceptable work already performed by the industry would not be used.

- Minimize unnecessary regulatory burden by providing guidance on implementing a CRE integrity testing program that provides a basis for replacing the non-conclusive surveillance test currently used.

- Maintain public confidence by providing guidance that supports improved confidence in the ability of the control room operators to take necessary actions during an emergency condition.

V. EVALUATION OF VALUES AND IMPACTS

Since the proposed action is a new regulatory guide that endorses sections of NEI 99-03, compliance with the regulatory positions is voluntary for currently licensed operating reactors. As with all regulatory guides, an applicant may propose alternative approaches to demonstrating compliance with the NRC's regulations.

- Regulatory efficiency would be improved by reducing uncertainty as to what is acceptable and by encouraging consistency in the performance of CRH assessments. The benefit to the industry and the NRC will be to the extent this occurs. The availability of this guidance should benefit licensees and applicants in structuring acceptable test programs, performing evaluations of radiological, hazardous chemicals, and smoke hazards, and maintaining CRH. Therefore, this guide would reduce the likelihood for follow-up questions and possible revisions in licensees' programs.

- A new regulatory guide endorsing industry guidance on the performance of CRH assessments would result in some cost savings to both the NRC and industry. The NRC would incur one-time incremental costs to develop the draft regulatory guide for comment and to finalize the regulatory guide. However, the NRC should also recognize cost savings associated with endorsing existence guidance in lieu of preparing its own guidance. The staff believes that the continuous and on-going cost savings associated with these reviews should offset the one-time development costs.

  This regulatory guide would provide an acceptable method to the NRC staff that is voluntarily initiated by the licensee. Since the described methods in the regulatory guide and in sections of NEI 99-03 may require more resources than the currently performed assessments, there would be an increase in costs, especially at facilities that have not performed CRH assessments or have no CRH maintenance program or no CRE integrity testing program.

- CRE integrity is fundamental in providing an environment in which control room personnel can take actions to mitigate the consequences of certain postulated accidents, thereby providing for the health and safety of the public.

  There are expected increases in resources needed to develop a CRE integrity testing program and to perform periodic testing, especially at facilities that do not have current technical specification surveillance requirements for CRE integrity. This expense would be incurred only by licensees that voluntarily commit to this regulatory guide.

- With the possible exception of applicant agencies, such as TVA or municipal licensees, no other governmental agencies are affected by the proposed regulatory guide. Pursuant to the categorical exclusion in 10 CFR 51.22(c)(16), the issuance of the proposed regulatory guide does not require an environmental review. Under the provisions of the National Technology Transfer Act of 1995, Pub. L. 104-113, no voluntary consensus standard has been identified that could be used instead of the proposed regulatory guide (government-unique standard).

The proposed regulatory guide was reviewed in regard to its impact on existing regulations and regulatory guidance. No changes in regulations are necessary to implement this regulatory guide. Regulatory Guide 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants" (Ref. RA-7), needs updating in the future to incorporate new references. There is no short-term need to revise Regulatory Guide 1.52 since only the references need updating to current guides. The proposed new regulatory guide on CRH adequately addresses this issue for the short term. For plants that voluntarily commit to this new regulatory guide, changes to existing technical specification surveillance requirements would be necessary. This new regulatory guide was prepared in conjunction with three other draft regulatory guides as part of the task action plan on control room habitability.

VI. CONCLUSION

Experience with CRE integrity testing and the review of licensing amendments concerning CRH has demonstrated the need for guidance in performing CRH assessments and integrated tests of CRE inleakage to demonstrate compliance with the plant's licensing bases. Recent expressions of interest related to future licensing of new reactors also indicate a need for updated regulatory guidance. Based on this regulatory analysis, it is recommended that the NRC prepare a regulatory guide that would endorse, with exceptions and clarifications, sections of NEI 99-03; issue the draft regulatory guide for public comment; and upon resolution of public comments, finalize the regulatory guide.

REFERENCES FOR REGULATORY ANALYSIS

RA-1. "Control Room Habitability Assessment Guidance," NEI 99-03, Revision 0, Nuclear Energy Institute, June 2001.[1]

RA-2. John Driscoll, "Control Room Habitability Survey of Licensed Commercial Nuclear Power Generating Stations," NUREG/CR-4960, USNRC, October 1988.[2]

RA-3. USNRC Information Notice 86-76, "Problems Noted In Control Room Emergency Ventilation Systems," August 28, 1986.[1]

RA-4. USNRC, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," DG-1111, December 2001.[3]

RA-5 USNRC, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors," Draft Regulatory Guide DG-1113, January 2002.[3]

RA-6 USNRC, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Regulatory Guide 1.183, July 2000.[3]

RA-7 USNRC, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Regulatory Guide 1.52, Revision 3, USNRC, June 2001.[3]

[1] Copies are available for inspection or copying for a fee from the NRC Public Document Room at 11555 Rockville Pike (first floor), Rockville, MD; the PDR's mailing address is USNRC PDR, Washington, DC 20555; telephone (301)415-4737 or 1-(800)397-4209; fax (301)415-3548; e-mail <PDR@NRC.GOV>.

[2] Copies are available at current rates from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328 (telephone (202)512-1800); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161; (telephone (703)487-4650; <http://www.ntis.gov/ordernow>. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 11555 Rockville Pike, Rockville, MD; the PDR's mailing address is USNRC PDR, Washington, DC 20555; telephone (301)415-4737 or (800)397-4209; fax (301)415-3548; email is PDR@NRC.GOV.

[3] Single copies of regulatory guides, both active and draft, and draft NUREG documents may be obtained free of charge by writing the Reproduction and Distribution Services Section, OCIO, USNRC, Washington, DC 20555-0001, or by fax to (301)415-2289, or by email to <DISTRIBUTION@NRC.GOV>. Active guides may also be purchased from the National Technical Information Service on a standing order basis. Details on this service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161; telephone (703)487-4650; online <http://www.ntis.gov/ordernow>. Documents are also available through the NRC's Electronic Reading Room at <www.NRC.GOV>.

BACKFIT ANALYSIS

The regulatory guide does not require a backfit analysis as described in 10 CFR 50.109(c) because it does not impose a new or amended provision in the NRC's rules or a regulatory staff position interpreting the NRC's rules that is either new or different from a previous applicable staff position. In addition, this regulatory guide does not require the modification or addition to systems, structures, components, or design of a facility or the procedures or organization required to design, construct, or operate a facility. Rather, a licensee or applicant may select a preferred method for achieving compliance with a license or the rules or orders of the Commission as described in 10 CFR 50.109(a)(7). This regulatory guide provides an opportunity to use part of an industry-developed standard.