[7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

[NRC-2007-0016]

[PRM-50-87]

Raymond A. Crandall;
Denial of Petition for Rulemaking

AGENCY: Nuclear Regulatory Commission.

ACTION: Denial of petition for rulemaking.

SUMMARY: The Nuclear Regulatory Commission (NRC) is denying the petition for rulemaking (PRM) filed by Mr. Raymond A. Crandall on May 17, 2007, and docketed on June 22, 2007 (Docket No. PRM-50-87). In his petition, the petitioner requested that the NRC amend the regulations that govern domestic licensing of production and utilization facilities to eliminate the specific criteria related to the radiological doses for control room habitability at nuclear power plants. The petitioner stated that the current deterministic radiological dose requirements for control room habitability have resulted in several negative safety consequences, including an increased risk to public safety. He requested that the NRC delete the 5 rem whole body dose limit and the 0.05 sievert (Sv) (5 rem) total effective dose equivalent (TEDE) limit specified in the current regulations.

DATES: The docket for PRM-50-87 is closed as of **[Insert date of publication in the Federal Register]**

ADDRESSES: Publicly available documents related to this petition, including the PRM and the NRC's letter of denial to the petitioner may be viewed using the following methods:

Federal e-Rulemaking Portal: Go to http://www.regulations.gov and search for documents related to this PRM filed under docket ID NRC-2007-0016.

NRC's Public Document Room (PDR): The public may examine publicly available documents and have them copied for a fee at the NRC's PDR, Public File Area O-1 F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland.

NRC's Agencywide Document Access and Management System (ADAMS): Publicly available documents created or received at the NRC are available electronically via the NRC's Electronic Reading Room at http://www.nrc.gov/NRC/reading-rm/adams.html. From this page, the public can gain entry into ADAMS, which provides text and image files of the NRC's public documents. If you do not have access to ADAMS or have any problems in accessing the documents located in ADAMS, contact the NRC PDR Reference staff at 1-800-397-4209, or 301-415-4737, or by e-mail to PDR.resource@nrc.gov.

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I. Background

On May 17, 2007, the NRC received a PRM from Raymond A. Crandall (ADAMS Accession No. ML071490250); the PRM was docketed by the NRC as PRM-50-87. The petitioner requested that the NRC amend Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR Part 50), ''Domestic Licensing of Production and Utilization Facilities" to remove the specific criteria related to the radiological doses for control room habitability at nuclear power plants from 10 CFR 50.67, ''Accident source term,'' and General Design Criterion (GDC) 19, "Control room,'' in Appendix A, ''General Design Criteria for Nuclear Power Plants," to

10 CFR Part 50. The NRC published a notice of receipt and request for public comment in the *Federal Register* on July 12, 2007 (72 FR 38030). The 75-day public comment period ended on September 25, 2007.

The petitioner noted that the current regulations provide specific dose criteria for demonstrating the acceptability of the control room design during radiological release events. These criteria are based on deterministic radiological dose analyses performed by the licensee and reviewed by the NRC. NRC regulatory guides and standard review plans provide acceptable methodologies that can be used by licensees to perform dose analyses, which are then incorporated, as appropriate, into the licensing basis for the licensee's facility. The petitioner stated that the deterministic dose analysis methodology and associated regulatory process result in several negative safety consequences:

(1) Current Designs Not Optimum

"Control room designs that are not optimum for ensuring continued control room habitability. Current designs required in order to meet the current dose methodology criteria may actually increase the probability of having to evacuate the control room compared to establishing the design based on good engineering principles."

(2) Procedures Not Optimized

"Site procedures for mitigation of the dose consequences to control room personnel that are not optimum for ensuring control room habitability. The procedures designed to ensure consistency with the dose analysis assumptions are inconsistent with more effective mitigation strategies."

(3) Challenges to Safety Systems

"Unnecessary challenges to safety systems, such as increased challenges to the Emergency Diesel Generators if control room ventilation system fans are loaded on the diesels early in the accident to meet analysis assumptions."

(4) Inappropriate Technical Specification (TS) Action Statements

"Technical Specifications Action Statement requirements that result in a net increase in the risk to the public. This specifically refers to Technical Specifications that require a plant shutdown for failure to meet a control room dose analysis input assumption."

(5) Unjustified Technical Specification Surveillances

"Technical Specifications Surveillance requirements that cannot be cost-justified based on the risk-significance. This results in the required expenditure of resources that could be used on risk-significant improvements."

The petitioner suggested amendments that would eliminate the specific radiological dose acceptance criteria and, thereby, the need for deterministic dose analyses and the associated regulatory processes, including the need for applicable TSs. He stated that the proposed changes would not eliminate the requirement for the control room to be designed to ensure safe conditions under accident conditions, but it would address his safety concerns with the current regulations.

II. Petitioner's Request

In PRM-50-87 the petitioner requested that the NRC take the following actions:

1. Revise the regulations related to control room habitability at nuclear power plants by deleting the following sentences from GDC 19:

"Adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. Applicants for and holders of construction permits and operating licenses under this part who apply on or after January 10, 1997, applicants for design certifications under part 52 of this chapter who apply on or after January 10, 1997, applicants for and holders of combined licenses under part 52 of this chapter who do not reference a standard design certification, or holders of

operating licenses using an alternative source term under § 50.67, shall meet the requirements of this criterion, except that with regard to control room access and occupancy, adequate radiation protection shall be provided to ensure that radiation exposures shall not exceed 0.05 Sv (5 rem) total effective dose equivalent (TEDE) as defined in § 50.2 for the duration of the accident."

2. Revise the regulations related to control room habitability at nuclear power plants to delete from paragraph (b)(2)](iii) in 10 CFR 50.67 this language:

"Adequate radiation protection is provided to permit access to and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 0.05 Sv (5 rem) total effective dose equivalent (TEDE) for the duration of the accident."

III. Reasons for Denial.

1. General

The NRC has reviewed Mr. Raymond Crandall's petition and has determined that it does not provide adequate justification to remove the control room radiological dose acceptance criteria from NRC regulations. The NRC does not agree with the petitioner's assertion that the control room radiological dose acceptance criteria have resulted in negative safety consequences.

Performance-based regulations, such as § 50.67 and Appendix A to 10 CFR Part 50, do not provide prescriptive requirements and, therefore, do not require licensees to use specific designs or methodologies to comply with the regulations. The NRC, however, does provide regulatory guidance to licensees that includes acceptable designs and methodologies for demonstrating compliance with the regulations. The use of the guidance is optional, and licensees are free to propose alternative means of complying with the NRC's regulations.

Design-basis dose consequence analyses are intentionally based upon conservative assumptions and are intended to model the potential hazards that would result from any credible

accident, not necessarily the most probable accident. As stated in footnotes to 10 CFR 100.11, "Determination of exclusion area, low population zone, and population center distance," and 10 CFR 50.67, "Accident source term," "[t]he fission product release assumed for these calculations should be based upon a major accident, hypothesized for purposes of site analysis or postulated from considerations of possible accidental events, that would result in potential hazards not exceeded by those from any accident considered credible. Such accidents have generally been assumed to result in substantial meltdown of the core with subsequent release of appreciable quantities of fission products."

The performance-based control room dose criterion is designed to maintain an acceptable level of control room habitability even under the maximum credible accident scenario. The NRC has determined that providing an acceptable level of control room habitability for design-basis events is necessary to provide reasonable assurance that the control room will continue to be effectively manned and operated to mitigate the effects of the accident and protect public health and safety. Meeting or exceeding the design-basis control room dose limit would not impose an immediate evacuation requirement on the control room operators. Moreover, by removing the 5 rem acceptance criterion, a regulatory basis for the acceptance of the radiological protection aspects of control room designs would no longer exist and would not support the Commission's policy regarding performance-based regulations.

The conservative assumptions used in design-basis dose consequence analyses need not and should not form the basis for restricting actions described in emergency operating procedures. These procedures are designed to ensure that during an accident all available means are used to assess actual radiological conditions and to maintain emergency worker doses As Low As Reasonably Achievable (ALARA), as required by 10 CFR Part 20, "Standards For Protection Against Radiation." Additionally, no NRC regulations, including 10 CFR Part 20, "Standards for Protection Against Radiation," require evacuation of the control room when the

design-basis control room dose limit is exceeded. Emergency operating procedures include guidance for controlling doses to workers under emergency conditions. This guidance would be applicable in the unlikely event that control room doses were projected to exceed the design-basis dose limit during an actual emergency.

2. NRC Staff Responses to the Petitioner's Assertions

A. Current Designs Are Not Optimum

1. The petitioner stated that because the primary objective of control room habitability is to ensure continuous occupancy, the primary focus should be on minimizing whole body doses from noble gases. He stated that some common control room designs, such as the filtered air intake pressurization design, focus on compliance with existing dose criteria. He concluded that the current requirements and operational criteria focus on minimizing the thyroid dose at the expense of increasing the whole body dose from noble gases which increases the probability that the control room will require evacuation.

The NRC reviewed the petitioner's concern regarding the increase in whole body dose from noble gases, which he believes results from the intentional intake of filtered air into the control room under design-basis accident (DBA) conditions. The NRC agrees that a relatively small increase in whole body dose due to noble gases may result from the intake of filtered air into the control room. However, this small increase in dose would not increase the probability of a control room evacuation. Therefore, operators would be able to monitor plant indications and take appropriate accident mitigating actions from the control room, and there would be no increase in risk to public health and safety. The NRC's conclusion is based on a review of several existing DBA control room dose analyses that determined the impact on whole body dose resulting from filtered air intake pressurization to the control room. The NRC performed parametric evaluations and determined that while filtered air intake pressurization may result in a small addition to the control room whole body dose from noble gases, the increase is more than

offset by the reduction in thyroid dose and TEDE from inhalation of radioactive particulates, such as iodine.

Based upon its analyses, the NRC does not agree with the petitioner's assertion regarding the negative safety impact of providing filtered intake flow into the control room. The NRC's performance-based criterion in GDC 19 requires that an applicant provide a control room habitability design that meets the specified dose criterion. Although NRC regulatory guidance provides examples of acceptable design approaches, the approach used to meet the criterion is largely under the control of an applicant. In order to meet this requirement, many licensees have chosen to incorporate filtered air intake pressurization into their control room emergency ventilation designs to reduce the cumulative dose to operators during a DBA. The purpose of providing filtered air intake pressurization flow is to establish positive pressure in the control room relative to the adjacent areas, thereby reducing the quantity of unfiltered air inleakage. Limiting unfiltered inleakage significantly reduces the thyroid dose from inhalation.

2. The petitioner also stated that the current regulation is inconsistent with the goal of allowing operators to remain in the control room in order to mitigate accident consequences. He stated that common designs, such as a filtered air intake pressurization system, which focus on compliance with existing criteria, increase the probability that the control room will have to be evacuated.

The 5 rem control room design criterion is not a maximum integrated dose above which control room evacuation is mandated during an accident. Rather, the criterion provides a design basis to ensure that the control room will maintain a habitable environment for operators to control the plant during a DBA.

The petitioner based his assertion on the assumption that filterable activity is not likely to be a significant contributor to dose in a reactor accident. As an example, the petitioner used the March 1979 Three Mile Island Unit 2 accident. Since the accident, the NRC has expended

considerable resources to better define the expected quantity and distribution of activity that could be released during a major reactor accident. As a result of this research, the NRC promulgated 10 CFR 50.67 on December 23, 1999 (64 FR 72001). Under 10 CFR 50.67, a licensee can apply for a license amendment to adopt an alternative source term (AST) that reflects a more realistic assessment of the timing of the release and the quantity and distribution of activity that could be released during a major accident hypothesized for purposes of design analyses. Many licensees have used this approach to comply with NRC regulations governing control room dose.

In addition, 10 CFR 50.67 revised the control room dose criterion from a 5 rem whole body dose, or its equivalent to any organ, to a 5 rem TEDE. The relatively low thyroid organ weighting factor, as defined in 10 CFR 20.1003, “Definitions,” and used in the calculation of TEDE, allows for a significant reduction in the controlling aspects of the thyroid dose, which normally governed compliance with control room dose guidelines. The NRC has significantly improved the accuracy of the source term and dose methodology used in design-basis dose consequence analyses. The updated source term and dose methodology address the petitioner’s concerns regarding the emphasis on thyroid dose in control room habitability analyses.

3. The petitioner noted that the dose from increased iodine concentration can be mitigated by use of potassium iodide (KI) or respiratory protection, but the current regulations do not permit these mitigation measures to be used in design analyses.

The NRC agrees that KI or Self-Contained Breathing Apparatuses (SCBAs) do have merit as short-term compensatory measures. However, the potential medical complications of KI and the potential adverse impacts to human performance of SCBAs make these measures unsuitable for long-term use. Further, the NRC’s policy of ensuring that process or other engineering controls are in place instead of relying on the use of personal protective equipment

is clearly set forth in 10 CFR 20.1701, “Use of process or other engineering controls” and 10 CFR 20.1702, “Use of other controls.” This policy is consistent with the recommendations of international and national radiation protection committees as described in Paragraph 167 of the International Commission on Radiological Protection (ICRP) Publication 26.

Paragraph 167 of ICRP Publication 26 recommends that “[a]s far as is reasonably practicable, the arrangements for restricting occupational exposure should be applied to the source of radiation and to features of the workplace. The use of personal protective equipment should in general be supplementary to these more fundamental provisions. The emphasis should thus be on intrinsic safety in the workplace and only secondarily on protection that depends on the worker’s own actions,” such as the ingestion of KI or use of respiratory equipment. Further, the use of respiratory equipment by control room personnel during an emergency condition would impede the performance of functions necessary for the protection of public health and safety. Therefore, the NRC has not permitted licensees to rely on either KI or respiratory protection as a permanent solution to demonstrate compliance with the control room radiological dose guidelines, although such measures are available if the fundamental dose design provisions are less effective than anticipated.

4. The petitioner stated that it is inconsistent to provide credit for respiratory protection in control room habitability toxic gas release evaluations, but not for design analyses.

The NRC does not agree with the petitioner. In the case of toxic gas releases, continued plant operation or a normal plant shutdown would be required. In the case of a major reactor accident involving radiological releases, control room personnel must implement extensive emergency operation procedures to ensure public health and safety. Wearing respiratory protection during normal operations or even during an orderly shutdown, should it be necessary as a result of a toxic gas release, would not be expected to present significant challenges to control room personnel equivalent to those present during a reactor accident. The NRC is

reluctant to place any more of a burden than is absolutely necessary on control room personnel, who would already be significantly tasked ensuring that all emergency procedures are carried out without error.

B. Procedures Are Not Optimized

The petitioner stated that control room dose mitigation procedures must be consistent with the licensing basis and may not be the optimum mitigation strategy for more likely conditions. For example, he stated that control room dose models do not model dispersion as a period during the day with higher concentrations while the plume is blowing towards the control room and then a period of zero concentration for the rest of the day. Instead, analysis methods simplify this effect by assuming that a lower concentration is present continuously. The petitioner claimed that if procedures were revised to include a control room purge mode strategy, a “calculated increase in consequences in the simplistic design basis analysis” would result.

The NRC disagrees with the petitioner. The NRC’s regulations do not require that procedures be limited to the most limiting licensing-basis assumptions. Further, the NRC expects licensees to develop procedures that address the full-scope review of design-basis events and conditions.

With respect to the petitioner’s example, procedures to operate the control room in its design-basis mode must be provided. These procedures do not preclude licensees from creating additional procedures to purge the control room if warranted by plant conditions. Licensees are permitted to develop and implement such procedures under existing NRC regulations.

The NRC agrees that control room purging may be a reasonable action during a reactor accident when the level of outside airborne concentration of radioactive material is less than the level inside the control room. However, the conditions favorable for control room purging cannot be predicted, and the NRC cannot credit control room purging in the DBA analysis unless the

timing of the release can be accurately established. For accidents where NRC regulatory guidance has established the release duration, the NRC has accepted credit for control room purging after the release has ended. As a design criterion, GDC 19 does not supplant the radiation protection standards of 10 CFR Part 20, which treat the radiation exposure of control room operators as occupational exposure. Therefore, the NRC expects licensees to maintain the accumulated dose of their radiation workers ALARA. During an accident, health physics personnel would monitor the radiological conditions in the control room and other emergency response facilities. These health physicists are responsible for making appropriate recommendations to plant personnel on actions that can be taken to maintain the dose to emergency responders ALARA.

C. Challenges to Safety Systems

The petitioner stated that the current design requirements, which are usually imposed to ensure the assumptions of the dose analysis are met, may not be optimum from an overall risk perspective. As an example, he stated that a common design requirement specifies that the normal control room ventilation must isolate on receipt of a safety injection or containment isolation signal during an assumed loss-of-coolant accident. The petitioner stated that it is more logical to delay control room isolation until radioactivity is detected in the control room or it is known that a radioactive plume is blowing towards the control room. The petitioner suggested that mitigating design strategies should be based on overall risk reduction designed for more likely conditions, not on one unlikely set of fixed hypothetical conditions.

The NRC does not agree with the petitioner. Contrary to the petitioner's assertion, the NRC's regulations do not require immediate control room isolation or immediate appearance at the control room intake of the radioactive plume assumed in design-basis dose consequence analyses. The NRC has approved, in accordance with its regulations, plant designs that do not immediately isolate the control room ventilation system. Further, design bases that include the

immediate startup of control room ventilation systems and loading of electrical buses and diesel generators with this equipment do not require operation of plant systems beyond their design capabilities; the diesels are specifically designed and sized to accommodate these safety loads. Therefore, the performance of these systems should not be impacted, and there is no increased risk to public health and safety.

D. Inappropriate Technical Specification Action Statements

The petitioner stated that the conservative nature of the current radiological dose mitigation analyses also results in inappropriate TS action statements. He stated that "there is insignificant safety significance to the TS associated with control room habitability and yet there are shutdown requirements.'' The petitioner believes that in order to evaluate the net public safety risk associated with these TS shutdown requirements, small but quantifiable public risks associated with the shutdown of a nuclear power plant must be considered, including but not limited to the following:

1. Risk associated with bringing the plant through a transient and another thermal cycle;
2. Airborne pollutants released by the fossil units required to operate to make up for lost power; and
3. Potential for challenging electric power grid stability with the public risk associated with the possibility of rolling blackouts or brownouts or, under the worst conditions of grid instability, the potential for a loss of offsite power at multiple nuclear power facilities.

The petitioner claimed that the shutdown requirement increases the net public risk and should be eliminated because it is only imposed as a ''matter of compliance."

The NRC disagrees with the petitioner. The NRC has approved license amendments to replace TS requirements for an immediate shutdown for an inoperable control room envelope boundary with requirements for immediate mitigating actions and restoration of the control room envelope to operable status within 90 days.

The NRC has determined that none of the regulations proposed to be changed by the petitioner directly require a plant shutdown in response to control room habitability issues. Existing NRC regulations permit a licensee to propose alternative TS action requirements to its plant shutdown requirements. The NRC notes that even if the petitioner's proposed regulatory changes were made, licensees would still need to submit a license amendment to justify changes to their TSs for NRC approval.

A controlled shutdown and cooldown of a plant is a safe evolution within the design capability of the plant and would not result in undue risk to public safety. In the event of unusual circumstances associated with adverse electrical power grid instability or other complicating issues that would be associated with a plant shutdown, there are processes available for a licensee to obtain regulatory relief to safely continue plant operation (e.g., emergency/exigent technical specification change, enforcement discretion).

E. Unjustified Technical Specification Surveillances

The petitioner stated that ''individual input assumptions for radiological dose analyses have no significance in predicting reality or the acceptability of results. Even if actual conditions were such that one of the assumptions was non-conservative by a couple orders of magnitude, the ultimate result (in this case habitability of the control room) would still be acceptable due to the significant conservatisms in the other assumptions and the simplicity of effective mitigating actions such as the use of KI.'' He stated that although most control room habitability surveillances can be performed with minimal resources, licensees have been required to demonstrate the accuracy of the assumption regarding unfiltered inleakage using an unjustified tracer gas testing method that costs approximately $100,000 per test. The petitioner stated these tests have demonstrated that although inleakage values assumed in the analyses were nonconservative, there was no safety significance and continued operation was justified. The petitioner concluded that the expenditure for tracer gas testing could be better used for

improvements that would likely be more beneficial to plant safety; therefore, the required performance of this test could have a net negative safety consequence. The petitioner stated that previous surveillances, such as a pressurization test, combined with lessons learned from tracer gas testing result in an effective preventative maintenance program.

The NRC does not agree with the petitioner's assertion that individual input assumptions for radiological dose analyses have no significance in predicting reality or the acceptability of results. The NRC places a high priority on operator safety; the requirements contained in GDC 19 should be retained because they provide physical and psychological protection for operators and ultimately for the general public. Therefore, the data used in the analyses to determine operator safety should be accurate, and when data are uncertain, appropriate conservatisms are applied.

The NRC does not agree with the petitioner's statement that the expenditure for tracer gas testing could be better used for improvements that would likely be more beneficial to plant safety nor does the NRC agree that the performance of tracer gas testing could have a net negative safety consequence. The potential dose to the operator must be quantified in order to ensure that the requirements of GDC 19 are met; the specific measurement of inleakage is one of the inputs to the analyses used to quantify the potential dose to the operator. Prior to the use of tracer gas to measure inleakage, the quantity of inleakage was assumed rather than measured and subsequently found to be nonconservative. Tracer gas testing is justified because it ensures operator safety. Other methods of measuring inleakage have not been successfully demonstrated.

F. Petitioner's Proposed Alternatives to Current NRC Guidance

The NRC has decided to deny this petition for rulemaking and would normally not discuss the petitioner's proposed guidance in this document. However, in order to clarify the

NRC's decision to maintain the current radiological dose requirements, the following discussion is provided.

Under Commission policy, the NRC's regulations for control room habitability provide performance-based requirements to ensure that plant personnel are adequately protected. The NRC has concluded that prescriptive requirements or guidance, such as that proposed by the petitioner, may unnecessarily restrict a licensee's options for complying with the NRC's regulations.

The petitioner proposed revisions to the NRC's regulatory guidance to help implement his proposed rule change. NRC regulatory guidance is not an appropriate subject for a PRM and the NRC will not generally consider such requests through this process. Further, current NRC regulatory guidance provides one acceptable mechanism for licensees and applicants to meet the requirements of the NRC's regulations. Applicants and licensees may propose alternative means of complying with the NRC's regulations, which will be evaluated by the NRC staff on a case-by-case basis.

1. The petitioner recommended that the control room ventilation system should isolate on the detection of high radiation or toxic intake. The NRC disagrees with the petitioner. All control rooms are required by TSs to take appropriate action upon detection of radiation or toxic gas. Appropriate action may differ from plant to plant depending on location, design, and TSs. Because plants are unique, licensees can demonstrate compliance with the control room design criteria by taking different approaches. The petitioner's suggestion does not address the long-term release situations that would be expected under a worst case accident scenario. Control room isolation alone would not be an acceptable solution because it does not adequately consider the long term breathing air requirements necessary to provide a safe working environment in the control room. After a relatively short period of time, an intake of air into the control room would be necessary. Licensees include these considerations in their site-specific

control room habitability analyses. Therefore, the NRC concludes that changing guidance to recommend control room isolation on detection of high radiation or toxic gas is an unnecessarily prescriptive recommendation in comparison to the existing performance-based dose criterion.

2. The petitioner recommended that the control room have a minimum of one foot of concrete shielding (or equivalent) on all surfaces. The NRC disagrees with the petitioner. The NRC believes that control rooms are adequately protected from the effects of direct radiation because current regulations require that either a 5 rem whole body or a 5 rem TEDE acceptance criterion be met under DBA conditions. Licensees include the effects of direct radiation from all potential sources in their control room dose consequence analyses. Typically these sources include the following:

- Contamination of the control room atmosphere by the intake and infiltration of the radioactive material contained in the radioactive plume released from the facility;
- Direct shine from the external radioactive plume released from the facility with credit for control room structural shielding;
- Direct shine from radioactive material in the containment with credit for both the containment and control room structural shielding; and
- Radiation shine from radioactive material in systems and components inside or external to the control room envelope, including radioactive material buildup on the control room ventilation filters.

Many control rooms already have one foot or more of concrete shielding on all surfaces. One foot of concrete shielding does not guarantee adequate protection from radiation. For example, surfaces with 1 foot of concrete with penetrations for various equipment, such as electrical wiring and ventilation ducts, may not provide any more protection than non-concrete surfaces or surfaces with less than 1 foot of concrete. To show compliance with the current

control room dose criterion, licensees provide detailed radiological calculations to ensure that under DBA conditions control room personnel will be adequately protected. Licensees have demonstrated compliance with the regulations crediting many different design approaches. The NRC concludes that recommending that the control rooms have one foot of concrete shielding is an unnecessarily prescriptive recommendation.

3. The petitioner recommended that because of the low risk significance of being outside the control room habitability program guidelines, a plant shutdown should not be required in this condition. Rather, the petitioner recommended that the program could specify that timely actions should be taken to return the plant to within the guidelines. If not complete within 30 days, the petitioner suggested that a special report would be sent to the NRC with a justification for continued operations and a proposed schedule for meeting the guidelines. The NRC disagrees with the petitioner that a regulatory change is required to permit these changes to plant TSs. The NRC allows deviations from the integrity of the control room envelope without requiring an immediate plant shutdown.

4. The petitioner recommended that as an alternative to the total removal of dose guidelines from the regulations, most of his concerns could be resolved if the dose criteria were based solely on the whole body dose from noble gases. The NRC does not agree with the proposition that the dose criteria should be based solely on the whole body dose from noble gases. The control room dose criterion of 5 rem whole body or its equivalent to any organ imposes two requirements on licensees: satisfaction of the whole body dose criterion, which is generally dominated by the dose from noble gases; and satisfaction of the organ-specific dose guidelines, which are generally dominated by the thyroid dose from the inhalation of iodine. In most cases, demonstrating compliance with thyroid dose guidelines poses a significantly greater challenge to licensees than does compliance with the whole body dose criterion.

The 1999 amendment to 10 CFR 50.67, revised the control room dose limit to allow licensees to show compliance with either the existing limits, using the traditional Technical Information Document (TID)-14844 source term assumptions, or a revised single control room dose criterion of 5 rem TEDE[1], if the licensee adopts the AST. With the ability to reassess a maximum credible radiological release using the AST, many licensees have shown compliance with the § 50.67 single control room dose criterion of 5 rem TEDE. Licensees have accomplished this while achieving an enhanced degree of operational flexibility not realized using the traditional TID-14844 source term with the associated whole body dose criterion and organ dose guidelines. Because compliance with § 50.67 is demonstrated by calculating the TEDE, the relative contribution of the thyroid dose to the demonstration of compliance with the control room criterion has been substantially and appropriately reduced. In addition, many licensees that continue to use the traditional TID-14844 source term have incorporated the guidance in Regulatory Guide (RG) 1.195, "Methods and Assumptions for Evaluating Radiological Consequences for Design-Basis Accidents at Light-Water Nuclear Power Reactors," to achieve operational flexibility. Following the guidance in RG 1.195, licensees are able to evaluate control room habitability using a 50 rem thyroid dose guideline. This represents a significant relaxation from the 30 rem thyroid dose guideline that was incorporated into previous guidance documents.

The petitioner also stated that the whole body dose from noble gases is likely to be the only possible dose impact that may result in control room evacuation. The NRC does not accept the premise that any maximum credible radiological release would result in the necessity for a control room evacuation. As stated previously, the 5 rem control room design criterion is not

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[1] As defined in 10 CFR 20.1003, "Total Effective Dose Equivalent (TEDE) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures)." The effective dose equivalent for external exposures includes the whole body dose from noble gases. The committed effective dose equivalent for internal exposure includes the thyroid dose from inhalation of iodine.

intended to be a maximum integrated dose level at which control room evacuation would be mandated during an accident. Rather, the criterion is used as a design basis to ensure that the control room, by design, will provide a habitable environment for the control of the plant under the maximum credible radiological release conditions, and as such will provide reasonable assurance of adequate protection.

The petitioner stated that most of his concerns would be resolved if credit for SCBAs or KI was allowed in the analysis of the dose from iodines and particulates. The NRC does not agree with the option of replacing engineering controls for radiological protection with credit for personal protective equipment. As discussed previously, the option of allowing credit for SCBAs or KI to show compliance with the control room performance-based design criterion is inimical to the NRC design philosophy incorporated into 10 CFR Part 20, as well as international standards for radiological protection as set forth in ICRP Publication 26.

IV. Public Comments

1. Overview of Public Comments

The NRC's notice of receipt and request for public comment invited interested persons to submit comments. The comment period for PRM-50-87 closed on September 25, 2007. The NRC reviewed and considered the comments in its decision to deny the petition. The NRC received two public comments, one from Mr. Walston Chubb, and one from Mr. James H. Riley on behalf of the Nuclear Energy Institute (NEI).

2. Mr. Walston Chubb Comment

Comment: Mr. Chubb recommended that operators be required to remain on duty until they are relieved or their short-time doses are between 100 and 200 rem.

NRC Response: The primary objective of GDC 19 is to ensure that the design of the control room and its habitability systems provide a "shirt-sleeved" environment for operators during both normal and accident conditions. This environment facilitates operator response to

normal and accident conditions while minimizing errors of omission or commission. Another objective is to ensure that the radiation dose levels in the control room would make it the safest location on site, thereby allowing the operators to remain in the control room. Any reduction in operator accident response capabilities may negatively impact public health and safety.

The NRC's decision to apply the 5 rem whole body dose criterion was based on the following:

- A whole body radiation exposure of 5 rem is considered unlikely to cause increased anxiety that would result in operator impairment, since the criterion is comparable to the occupational dose limits.
- A whole body radiation exposure of 5 rem would not result in any somatic response that could result in operator impairment. Generally, the onset of clinically observable somatic effects occurs between 25 and 50 rem.
- GDC 19, as a design criterion, does not supplant the radiation protection standards of 10 CFR Part 20. The radiation exposure of control room operators is controlled, as for any radiation worker at the facility, as occupational exposure under 10 CFR Part 20. In the statements of consideration for the 10 CFR Part 20 rulemaking (56 FR 23365; May 21, 1991), the NRC stated that the dose limits for normal operation should remain the primary guidelines for an emergency.

The statement of considerations in the proposed and final rule amending 10 CFR 50.67 and GDC 19 (64 FR 12117, March 31, 1999; and 64 FR 71990, December 23, 1999, respectively) included the NRC's basis for establishing the 5 rem TEDE as the GDC 19 numeric criterion for licensees applying for amendment under 10 CFR 50.67. It also reaffirmed the position that the criteria in GDC 19 and the final rule are based on occupational exposure limits.

The 5 rem control room design criterion is not intended to be a maximum integrated dose above which control room evacuation would be mandated during an accident. Rather, the 5 rem design criterion ensures that the control room, by design, will provide a habitable environment for the control of the plant under all DBA conditions.

Providing a safe working environment for the highly skilled professionals needed to operate a nuclear power plant is a primary objective of NRC regulations related to occupational and accident dose, and it is a paramount goal throughout the entire nuclear power industry. The NRC concludes that the proposal to set the control room design criterion at 100 rem, which is well above the level at which the onset of clinically observable somatic effects would occur, is antithetical to the fundamental principle of protecting public health and safety and is not acceptable.

3. NEI Comments

NEI provided the following comments:

Comment: "It is not so much the value of the exposure limits that is the problem. The NRC should be more open to other methods of analysis proposed by licensees. Every Regulatory Guide states that the guidance is one method acceptable to the staff and that other methods proposed by licensees will be evaluated on a case-by-case basis. However, in practice it is often difficult to justify different approaches."

NRC Response: To the extent that the comment implicitly criticizes the NRC for allegedly failing to consider alternatives for compliance with GDC 19 and 10 CFR 50.67 in a manner other than that suggested in a regulatory guide, that concern is beyond the scope of this petition for rulemaking. Further, the commenter presented no basis for this implicit criticism – the NRC routinely considers licensee and applicant-proposed alternatives to methods set forth in a Regulatory Guide. However, the NRC expects licensees and applicants to provide technically-sufficient basis for the use of an alternative for compliance with an NRC regulation, which is also

consistent with the regulatory policies of the NRC. That a licensee or applicant may find it difficult to provide sufficient basis justifying the use of an alternative approach, however, would not appear to present a valid regulatory concern.

Comment: Existing emergency filtration systems should be maintained to practical performance criteria. NEI stated that this area has a lot of potential for improvement and gave the following examples:

- The current practice (i.e., RG 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") is to apply a safety factor of 2 for laboratory testing of charcoal beds. The actual efficiencies are typically much higher than those allowed by RGs.
- Some plants have 8-inch charcoal bed, for which only 4 inches is allowed to be credited.
- Other plants have filtration systems in series, for which only one composite filter can be credited.

NRC Response: The NRC's position on existing emergency filtration systems is outlined in RG 1.52, Revision 3, issued June 2001. The previous revision of the RG included a safety factor as great as 7 whereas Revision 3 includes a safety factor of 2 to account for degradation of the system between test periods. A safety factor represents margin in the capability of the adsorbent (carbon) installed in the system to perform the required safety function. Because carbon can degrade between test periods, a safety factor provides confidence that the anticipated degradation will not be beyond the minimum level necessary to perform its required safety function.

RG 1.52, Revision 3, indicates that a 4-inch carbon bed in U.S. nuclear power plants is 99 percent efficient, with a safety factor of 2 and a penetration (as defined in American Society for Testing and Materials D 3803-89) of less than or equal to 0.5 percent. The NRC believes that a 4-inch carbon bed thickness is sufficient to provide adequate protection, and that the 4 inches, as reflected in the RG, is not intended to be an upper limit on bed thickness. It is acceptable to provide additional carbon that may include 6 inches, 8 inches, or even greater bed thickness. The NRC also believes there are benefits provided by carbon bed thicknesses greater than 4 inches that are not reflected in the RG. The benefits may include longer bed life contributing to lower overall cost.

With respect to filtration systems in series, they are treated as a composite because calculations demonstrate that a composite of equal bed thickness as the sum of systems in series behaves in the same manner as systems in series. For example, the efficiency of two 2-inch beds in series is the same as one 4-inch bed.

Comment: In response to the petitioner's statement that current TS for system performance should be eliminated and that the administrative portion of the TS could include a requirement to have a control room habitability program, NEI commented, "This recommendation is covered by TSTF-448 and GL 2003-01."

Response: NRC agrees with the comment. NRC prepared and made available a model safety evaluation (SE) and a model no-significant-hazards-consideration (NSHC) determination relating to the modification of technical specification (TS) requirements regarding the habitability of the control room envelope (CRE) for referencing in license amendment requests (LARs). NRC also made available an associated model LAR for use by licensees to prepare such LARs. The TS modification is based on NRC staff approved changes to the improved standard technical specifications (STS) (NUREGs 1430-1434) that were proposed by the pressurized and boiling water reactor owners groups' Technical Specifications Task Force (TSTF) on behalf of

the commercial nuclear electrical power generation industry, in STS change traveler TSTF-448, Revision 3. NRC published a Notice of Availability of the SER in the Federal Register on January 17, 2007 (72 FR 2022). Generic Letter (GL) 2003-01, dated June 12, 2003, is available on ADAMS (ML031620248).

Comment: In response to the petitioner's proposed guidance, NEI provided the following comments:

- The control room ventilation system should isolate on the detection of high radiation or toxic gas intake. NEI commented, "A good many control rooms in the industry already operate in this manner. Conversely, there are some plants that do not have automatic initiation of the emergency mode. Making this a requirement could result in an undue (and expensive) modification/backfit. For those plants susceptible to toxic gas intrusion, automatic initiation is typically the case (although not specifically implemented in all cases). If required, this also could result in undue (and expensive) modifications."
- The control room should have a minimum of one foot of concrete shielding (or equivalent) on all surfaces. NEI commented, "It is unlikely that all control room have one foot of concrete shielding on all surfaces. This requirement could result in undue (and expensive) modifications. A similar concern applies to the technical support center, which may also be affected by this requirement."
- SCBAs and KI tablets should be readily available for operator use. Operators should maintain training in SCBAs. NEI commented, "The use of these methods has merit, but additional evaluation of their effects is necessary. The medical complications of ingesting KI would have to be evaluated for all CR personnel. The use of SCBA credit would require specific training for which operators will need to demonstrate the ability to conduct their safety related functions while wearing a SCBA for several hours."

- Procedures should be developed to ensure control room purging is considered when the outside concentration is less than the inside concentration. NEI commented, “Although this appears to be a good practice, it can’t be credited in the operator dose analysis. The timing of purging could be critical based on the timing of the release and the release pathway. Therefore, this recommendation may not have any practical merit.”

The petitioner stated that because of the low risk significance of being outside the control room habitability program guidelines, a plant shutdown would not be required in this condition; rather, the program could specify that timely actions should be taken to return the plant within the guidelines. If not complete within 30 days, a special report would be sent to the NRC with a justification for continued operation and a proposed schedule for meeting the guidelines. NEI commented, “This is a valid point that the industry supports.”

The petitioner stated that as an alternative to total removal of dose guidelines from the regulations, most of his concerns could be resolved if the dose criteria were based solely on the whole body dose from noble gases that he believes is the only possible dose impact that may result tin control room evacuation. NEI commented, “It is not clear that the noble gas contribution would be limiting in all cases. However, this may be the case if KI were allowed to be credited.

Response: These comments have been addressed in Section III of this document.

V. Denial of Petition

Based upon review of the petition and comments received, the NRC has determined that the conclusions upon which the petitioner relies do not substantiate a basis to eliminate the control room radiological dose acceptance criteria from current regulations as requested. For the reasons discussed previously, the Commission denies PRM-50-87.

Dated at Rockville, Maryland, this _____ day of _____, 2008.

For the Nuclear Regulatory Commission.

Annette Vietti-Cook,
Secretary of the Commission

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For the Nuclear Regulatory Commission.

Annette Vietti-Cook,
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