POLICY ISSUE
INFORMATION

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FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: FINAL REGULATORY GUIDE 1.183 (FORMERLY DG-1081), "ALTERNATIVE RADIOLOGICAL SOURCE TERMS FOR EVALUATING DESIGN-BASIS ACCIDENTS AT NUCLEAR POWER PLANTS," AND STANDARD REVIEW PLAN SECTION 15.0.1, "RADIOLOGICAL CONSEQUENCE ANALYSES USING ALTERNATIVE SOURCE TERMS"

PURPOSE:

To provide for information final drafts of Regulatory Guide (RG) 1.183 (formerly Draft Guide (DG)-1081), "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Plants," and Standard Review Plan (SRP) Section 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms." These documents address the voluntary use of alternative source terms (ASTs) at current operating power reactors. The regulatory guide provides guidance to licensees for operating power reactors on acceptable applications of ASTs; the scope, nature, and documentation of associated analyses and evaluations; consideration of impacts on risk; and acceptable radiological analysis assumptions. The guide establishes an acceptable AST and identifies the significant attributes of other ASTs that might be found acceptable by the staff. The SRP provides guidance to the staff on the review of AST submittals. Also attached is a summary of the public comments received on the draft documents and their disposition.

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BACKGROUND:

In SECY-96-242, "Use of the NUREG-1465 Source Term at Operating Reactors," dated November 25, 1996, the staff described its proposed approach for allowing licensees of operating reactors to voluntarily amend their facility design basis to use the revised source terms provided in NUREG-1465 "Accident Source Terms for Light-Water Nuclear Power Plants". The Commission approved the staff's approach in a staff requirements memorandum (SRM) dated February 12, 1997. In SECY-98-154, "Results of the Revised (NUREG-1465) Source Term Rebaselining for Operating Reactors," dated June 30, 1998, the staff reported on the results of its rebaselining analysis of the potential impacts of the revised source terms. In SECY-98-158, "Rulemaking Plan for Implementation of Revised Source Term at Operating Reactors," dated June 30, 1998, the staff provided a rulemaking plan for the proposed rulemaking. The Commission directed the staff to proceed with expedited rulemaking in an SRM dated September 4, 1998.

In SECY-98-289, "Proposed Amendments to 10 CFR Parts 21, 50, and 54 Regarding Use of Alternative Source Terms at Operating Reactors," dated December 15, 1998, the staff requested the Commission's approval to publish proposed revisions to 10 CFR Parts 21, 50, and 54 to provide for the use of ASTs at operating reactors. The Commission approved publication of the proposed rule in an SRM dated February 25, 1999. The proposed rule was published in the Federal Register on March 11, 1999. The SRM also directed the staff to prepare a regulatory guide and an Standard Review Plan (SRP) section to provide regulatory guidance in support of the rule. In SECY-99-240, "Final Amendments to 10 CFR Parts 21, 50, and 54 and Availability for Public Comment of Draft Regulatory Guide DG-1081 and Draft Standard Review Plan Section 15.0.1, Regarding Use of Alternative Source Terms at Operating Reactors," dated October 5, 1999, the staff requested the Commission's approval to publish the final amendments, and to announce the availability of the draft guide DG-1081 and the draft SRP Section 15.0.1 for public comment. The Commission approved publication of the final rule and the announcements in an SRM dated December 8, 1999. The final rule and the announcements were published in the Federal Register on December 23, 1999. The public comment period ended on March 31, 2000.

DISCUSSION:

Formal public comments were received from the Nuclear Energy Institute (NEI), Duke Energy Corporation, Virginia Power, Florida Power Corporation, South Texas Project Nuclear Operating Company, and the Nuclear Utility Group on Equipment Qualification (NUGEQ). There were some informal comments received verbally (e.g., at the Regulatory Information Conference) and by E-mail. In addition, there were two staff commitments made to the Advisory Committee on Reactor Safeguards (ACRS) in a letter dated October 25, 1999, in response to an ACRS letter to the Commission dated September 17, 1999. In addition to comments on the draft documents, NEI responded to the series of questions posed in the Federal Register announcement. All of these comments were considered and appropriate revisions made to the RG (Attachment 1) and the SRP section (Attachment 2). A summary of all the comments received and their disposition is attached (Attachment 3). Some of the more significant comments and their resolution are discussed below.

Selective Implementation

NEI recommended that the final guide and the final SRP be revised to allow licensees to perform the following:

- evaluate selective AST applications approved for other plants to determine if they are appropriate for application at their own plant, and

- extend the AST and total effective-dose equivalent (TEDE) criteria to additional technically appropriate applications at their plant.

NEI based these comments on the revised § 50.59 rule, which was completed in parallel with the § 50.67 rulemaking and the development of the final guide and final SRP. NEI notes that NEI 99-07, Revision 1, "Guidelines for 10 CFR 50.59 Evaluations," would allow licensees to implement alternative analysis methodologies, including source terms, approved by the NRC for the intended application.

The final guide and SRP continue to state that prior staff approval is necessary for the use of other AST characteristics or the use of TEDE criteria that are not part of the approved design basis and for changes to previously approved AST characteristics, as required by § 50.67. The specific change for provisions in § 50.67 supersede the general provisions in § 50.59, as provided in § 50.59(c)(4).

However, the staff reviewed the draft guide and the SRP and determined that the revised § 50.59 and supporting guidance did make it possible to provide some additional flexibility consistent with the language of the existing § 50.67. In a selective application, the licensee proposes to use one or more characteristics of the AST (i.e., magnitude and mix, chemical and physical form, and timing of release) in a limited application. For a timing-only application, dose calculations may not be necessary and, as a result, the TEDE criteria may not be applicable. When the staff approves the initial AST application, those selected characteristics and, as applicable, the TEDE criteria, become part of the facility design basis, pursuant to § 50.67. The language in the final guide and final SRP will allow licensees to make subsequent modifications on the basis of the selected AST characteristics incorporated into the facility's design basis. Depending on the particular application, this may also include the TEDE dose criteria.

Equipment Environmental Qualification

There were comments on issues involving the need to re-analyze equipment environmental qualification doses due to the impact of increased cesium concentration in the containment sump. As discussed in SECY-99-240, the staff has initiated a generic safety issue (GSI) to address the impact of the increased cesium concentration. This effort is not complete. The final guide and the final SRP have language allowing licensees pursuing AST applications to use either the AST or the traditional TID-14844 source term in performing required EQ analyses pending the outcome of the GSI.

Core Fission Product Release Fractions

The draft guide proposed core inventory and fuel release fraction data for a design-basis loss-of-coolant accident (LOCA) and for the other non-LOCA design-basis accidents (DBAs). The LOCA data were derived directly from NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants." The staff considered the NUREG-1465 data and determined that the data could be used in DBA LOCA analyses involving fuel with peak rod average burnup to 62 GWD/MTU with only minor adjustment. The non-LOCA data were developed by the staff on the basis of previous staff guidance and were intended to address fuel with peak rod average burnup to 62 GWD/MTU.

NEI expressed the position that the non-LOCA data in the draft guide were overly conservative and proposed changes to the guidance in the draft guide. NEI correctly indicates that the traditional staff analysis approach could overestimate the radioactivity release from the damaged fuel since the approach conservatively assumes the unlikely situation of a high-burnup assembly in a peak power position in the core. NEI proposed a table of non-LOCA release fractions that would vary as a function of fuel burnup to 75 GWD/MTU. NEI also proposed that the maximum core radial peaking factor be reduced on the basis of the bounding power history curve for higher burnup fuel.

In the period since the draft guide was published, Pacific Northwest National Laboratories (PNNL) completed an evaluation of the environmental impacts of increasing fuel burnup from the current maximum of 60 GWD/MTU. This contractor evaluation was performed in support of revisions to an earlier environmental assessment (53 FR 30355, August 11, 1988) on the use of extended burnup fuel. PNNL determined release fractions for peak rod average burnup to 62 GWD/MTU, concluding that there were insufficient data to benchmark analyses for burnups greater than 62 GWD/MTU. The release fractions determined by PNNL are less than those proposed in the draft guide.

There have only been a few experiments involving the measurement of fission gas releases for fuel with burnup to 60 GWD/MTU or higher. Of the experiments performed to date, the iodine release fractions have generally not been measured directly but were extrapolated from measurements of stable gases or noble gases. Given the significant uncertainties in these data, the staff has determined that the release fractions proposed by NEI are not sufficiently conservative. However, the staff did determine that there was a reasonable basis in the PNNL work for revising the release fractions in the final guide, provided that a limitation is placed on the linear heat generation rate at higher burnups. The values in the final guide are less than those in draft guide. For example, the iodine release fraction was reduced from 12 percent to 8 percent, a reduction of 30 percent. Although the staff believes that these values are reasonable, the conservatism associated with the traditional radial peaking factor assumption is needed to compensate for the uncertainties inherent in the assessment of release fractions.

Determining Increases in Consequences

One commenter identified a potential deficiency in the guidance associated with determining whether a plant modification constituted more than a minimal increase in consequences under § 50.59. Although the § 50.67 rule requires prior staff review for the initial use of an AST, the

licensee is allowed to make changes to its facility and procedures under the provisions of § 50.59. Under an AST implementation, it is possible to have some design-basis calculations based on the traditional whole body and thyroid dose quantities, and some based on the newer TEDE dose quantity. It is also possible that a particular analysis may be updated to the TEDE dose quantity in a change subsequent to approval for use of an AST. In order to make a change under § 50.59, a licensee must establish (among other prerequisites) that there will not be more than a minimal increase in the postulated consequences of a previously analyzed accident or malfunction. Since the dose quantities are different, a direct comparison is not possible. The final guide contains guidance on converting the traditional whole body and thyroid results to TEDE for the purposes of comparison pursuant to § 50.59.

ACRS Comments

In its letter of September 17, 1999, the ACRS provided comments to the Commission on the proposed final rule, the draft regulatory guide, and the SRP. In a letter dated October 25, 1999, the staff responded to these comments. There were three recommendations. As discussed in the October 25 letter, the staff determined that no action was needed for ACRS Recommendation No. 2. Recommendations No. 1 and No. 3, respectively, are addressed below.

- The ACRS recommended that the staff modify the proposed redefinition of the source term to eliminate the connotation that the release is necessarily to the containment but retain the wording "...release from the (RCS)...." In the October 25 response, the staff declined to revise the definition since the suggested definition would be limited to a LOCA. However, the staff agreed to review the draft guide and draft SRP section during the public comment period to verify that the description of the AST for the LOCA did not misrepresent its NUREG-1465 basis. During this review, the staff determined that Regulatory Position 3.5 of the final guide might not be clear in this regard. Accordingly, the staff clarified the language of Position 3.5, addressing not only the LOCA, but the other accidents addressed in the final guide as well.

- The ACRS recommended that the requirement to have prior NRC approval for "changes...that result in a reduction in safety margins" be reevaluated for removal in light of the analytical assessments performed by the Office of Nuclear Regulatory Research (RES), and the results of the pilot applications of the AST and the revised § 50.59 guidance. The staff reconsidered Regulatory Position 1.1.1 of the guide with regard to the revised § 50.59 guidance and concluded that no substantive change was necessary. The position provides for consideration of the impact on safety margins of the modifications proposed in the *initial* amendment request pursuant to § 50.67. Section 50.59 evaluations are not required for amendments pursuant to § 50.90-50.92. Language was added to Regulatory Position 1.1.1 to reference the use of § 50.59 for evaluating *subsequent* plant modifications once the initial AST implementation is approved. Although the rebaselining study and the pilot plant reviews provided meaningful insights, the limited plant sample involved in the study does not provide an a priori basis to summarily disposition all potential plant-specific and modification-specific impacts.

COORDINATION:

The ACRS and the Committee to Review Generic Requirements (CRGR) have reviewed the final regulatory guide and the final SRP section and have no objection to their use. The Office of the General Counsel has reviewed the documents and has no legal objection to their being issued for use.

CONCLUSION:

The staff has issued Regulatory Guide 1.183 (DG-1081) and SRP Section 15.0.1 for publication, distribution, and use in parallel with this Commission information paper.

/RA/

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Executive Director
for Operations

Attachments: 1. Final Regulatory Guide 1.183 (formerly DG-1081)
2. Final Standard Review Plan Section 15.0.1
3. Summary of Public Comments

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