

June 3, 2016

Dr. Dennis C. Bley, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: APRIL 19, 2016 LETTER FROM THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS REGARDING REGULATORY GUIDE 1.229, "RISK-INFORMED APPROACH FOR ADDRESSING THE EFFECTS OF DEBRIS ON POST-ACCIDENT LONG-TERM CORE COOLING"

Dear Dr. Bley:

The staff appreciates the insights provided by the Advisory Committee on Reactor Safeguards (ACRS) and the substantial amount of time the ACRS has devoted to Regulatory Guide (RG) 1.229, "Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident, Long-Term Core Cooling." The purpose of this RG is to support the Title 10 of the *Code of Federal Regulations* 50.46c rulemaking and resolution of Generic Safety Issue-191, "Assessment of Debris Accumulation on PWR Sump Pump Performance." In your letter, you recommend that the Nuclear Regulatory Commission (NRC) issue RG 1.229 after the staff addresses the following ACRS recommendations (renumbered from your letter):

1. Clarify expectations for the assessment of scenarios that involve recirculation from the containment sump, but are not initiated by a loss-of-coolant accident (LOCA).
2. Clarify expectations for the assessment of uncertainties, with particular attention to how uncertainties about debris generation, transport, and deposition on strainers and downstream coolant flow paths are used to support the risk-informed conclusions.
3. Clarify how the "base PRA [probabilistic risk assessment]" or other techniques should be used to define the most limiting equipment operating configurations and flow scenarios for a simplified assessment.
4. Clarify that the post-assessment PRA models should be updated to include the risk from debris-related scenarios consistently with the scope and level of detail applied in these analyses.

The NRC staff modified RG 1.229 to address Recommendation 4 prior to initial issuance but would like to postpone making changes to address Recommendations 1, 2, and 3 until the next revision of RG 1.229, which is planned for the near future. This is because, in accordance with Commission requirements related to the Cumulative Effects of Regulation, RG 1.229 needs to be issued along with the new 10 CFR 50.46c rule, which is currently with the Commission. Also, industry representatives have stated that they need the final RG to be available in order to support their GSI-191 submittals. Making changes to address Recommendations 1, 2, and 3 at

this time would involve several organizations and disciplines in the Office of New Reactors, the Office of Nuclear Reactor Regulation, and the Office of Nuclear Regulatory Research and thus would take considerable time and resources to develop and reach consensus.

The staff believes that the current version of RG 1.229 adequately addresses the first two recommendations, until further clarification can be added to the next revision.

Recommendation 1 concerns assessment of scenarios that involve recirculation from the containment sump, but that are not initiated by a LOCA. RG 1.229 addresses this issue in Appendix A, item A-1, and Appendix B, Item B-1a (which refers back to item A-1).

Recommendation 2 concerns the assessment of how uncertainties related to debris generation, transport, and deposition on strainers and downstream coolant flow paths are used to support the risk-informed conclusions. These uncertainty issues are addressed in RG 1.229, Section C, "Staff Regulatory Guidance," item 4 on uncertainty.

The staff agrees that RG 1.229 could address Recommendation 3 in greater detail. This recommendation asks the staff to, "Clarify how the 'base PRA' or other techniques should be used to define the most limiting equipment operating configurations and flow scenarios for a simplified assessment." The staff notes that Appendix A of the RG does include the requested content in the detailed approach. For the simplified approach set forth in Appendix B, the requirement to identify the most limiting scenario is not directly stated but is implied through reference to key sections of RG 1.82, Revision 4, "Water Sources for Long-Term Recirculation Cooling Following a Loss-Of-Coolant Accident." Specifically, RG 1.82, Section C.1.3.12.a directs users to refer to Nuclear Energy Institute (NEI) 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology" and the associated NRC staff safety evaluation for direction on performing head loss evaluations for sump strainers. The NEI guidance, as supplemented by the safety evaluation, contains conservatism in each subpart of the evaluation including debris generation and debris transport. Section C.1.3.12.h of RG 1.82, Rev. 4 provides guidance that users consider the worst-case single failures that could be associated with emergency core cooling system operation following an event. The net effect is that, although not explicitly stated, the most limiting equipment operating configuration must be considered when using the simplified approach. The staff believes that this guidance is sufficient for initial issuance of RG 1.229 and can be clarified in the next revision.

Regarding Recommendation 4, which recommends that the staff, "Clarify that the post-assessment PRA models should be updated to include the risk from debris-related scenarios consistent with the scope and level of detail applied in these analyses," the NRC staff agrees. Changes to a plant's licensing basis should be reflected in future risk-informed submittals and this guidance is, in fact, already in place. The so-called "parent"¹ regulatory guides of RG 1.229 (RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" and RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities") state that the base PRA should realistically model the as-built, as-operated plant. Similar guidance is contained in ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release

¹ RGs 1.174 and 1.200 are sometimes referred to as the "parent" risk-informed RGs because they provide general guidance for a variety of risk-informed applications. There are various "daughter" RGs that adhere to the same principles and format but provide application-specific guidance. For example, RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications" is the daughter RG for risk-informed changes to technical specifications.

Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications,” which is endorsed by RG 1.200. Therefore, so-called daughter regulatory guides (which include RG 1.229) do not need to contain duplicative guidance stating that risk-informed changes need to be reflected in future applications.

Regarding Recommendation 4, repeating the expectation for model update that is in the “parent” regulatory guides in RG 1.229, while not required, is straightforward and will help ensure this guidance is not overlooked by licensees using RG 1.229. Therefore, to address Recommendation 4, the staff has added additional guidance in two places in the RG. At the end of RG 1.229, Appendix A, step A-14, the staff added the statement: “Section 6.3.2 of RG 1.174 states that the base PRA used for risk-informed licensing applications should already model the effects of past applications. Therefore, prior to use in future risk-informed licensing applications, the base PRA should be updated to reflect the detailed assessment of debris effects for the as-left condition of the plant.” The staff added the following statement to the end of RG 1.229, Appendix B, step B-4: “Section 6.3.2 of RG 1.174 states that the base PRA used for risk-informed licensing applications should already model the effects of past applications. Therefore, prior to use in future risk-informed licensing applications, the base PRA should be updated to reflect the simplified assessment of debris effects for the as-left condition of the plant.”

In conclusion, the staff modified RG 1.229 to address ACRS Recommendation 4. In addition, the agency commits to addressing the other three recommendations during the next revision of RG 1.229. As discussed with the ACRS at the full committee meeting on April 7, 2016, the staff is planning a near-term revision to RG 1.229 to add additional guidance on more realistic LOCA frequency allocation methods.

Sincerely,

/RA Michael R. Johnson Acting for/

Victor M. McCree
Executive Director
for Operations

cc: Chairman Burns
Commissioner Svinicki
Commissioner Ostendorff
Commissioner Baran
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