

already address crud and other phenomena that could potentially impact performance relative to the acceptance criteria. Furthermore, Exelon Nuclear stated that it and its predecessors have over 30 years of experience in monitoring fuel performance in numerous nuclear power plants (NPPs) and that they have identified only one cycle, in one unit, with crud induced failures. Exelon further stated that corrective actions taken after those observed failures have resulted in no further failures due to crud at this or any other Exelon unit. In Exelon's experience, crud is powdery, and its characteristics, in terms of size or strength, indicate that it would not block the coolant flow channels and lead to fuel failures.

In general, Exelon asserted, industry experience related to significant crud deposits has been that they are isolated cases, and that after extensive root cause evaluations, effective corrective actions have prevented recurrence. Exelon also stated that crud deposits are effectively controlled through the use of the Electric Power Research Institute (EPRI) Chemistry Guidelines.

Westinghouse Electric Company, LLC, a nuclear vendor, opposed the petition based on its extensive poolside and laboratory examinations of crud deposits on fuel rods used in pressurized-water reactors (PWRs), including cases in which abnormally high levels of crud could be detected during normal operation. Its results showed that it would be virtually impossible for any significant amount of the crud to contribute to flow blockage in the event of a large-break LOCA. Westinghouse also stated that most of any crud released would become suspended particles that would not affect core coolant flow. In one cited case, a water chemistry change resulted in a sudden release of all the accumulated crud in the core. A very small change in reactor coolant flow was observed as a result of this release.

GE Nuclear Energy, a nuclear vendor, opposed the proposed change on the basis that the event described in the petition was a unique event, not typical of crud buildup in boiling water reactors (BWRs). Even with that unusual buildup the core remained in a configuration that could be cooled throughout the cycle and would have remained in a configuration that could be cooled in the event of a LOCA. GE also stated that the safety evaluation concerning this event showed that, even with crud deposition, there would be substantial margin to the 2200° F peak cladding temperature acceptance criterion specified by 10 CFR 50.46.

The Nuclear Energy Institute (NEI), an industry group representing all U.S. commercial nuclear power plants, plant designers, architect/engineering firms, and fuel cycle facilities, opposed the petition. NEI stated that existing NRC regulations establish performance criteria for maintaining core cooling and specify realistic ECCS evaluation models that address potential impacts on these performance measures. NEI stated that numerous thermal-hydraulic phenomena are addressed in the technical evaluation models. However, the regulations are not overly prescriptive in terms of phenomena to be addressed, which allows for advances in the technical database and updating of the evaluation procedures without the need for rulemaking. Fuel performance and other performance measures are monitored routinely to ensure that core evaluation models accurately reflect real conditions.

NEI stated that considerable data has been accumulated on crud deposits and their impact on coolant flow properties. The data do not support the postulated existence of characteristics that might lead to a substantial blockage of flow. NEI believes that the provisions of 10 CFR 50.46 and Appendix K provide an adequate mechanism for ensuring that coolant flow and fuel performance are thoroughly monitored and maintained.

PRM 50-73A

Of the seven letters of public comment received in response to PRM-50-73A, two were submitted by the petitioner, and provided additional information and related technical support for his assertions in PRM-50-73 and PRM-50-73A. The other five letters opposed the request for rulemaking contained in PRM-50-73A.

NEI noted that it had commented on the initial PRM-50-73 and provided a copy of the initial NEI comment letter. With respect to the changes to the regulations for normal operating conditions requested in this supplemental petition, NEI stated that the changes are not needed. In NEI's view the NRC Standard Review Plan (SRP) specifies a comprehensive set of acceptance criteria that specifically address the impact of fuel crud deposits and ensure that fuel design limits are not exceeded during any conditions of normal operation, including the effects of anticipated operational occurrences. NEI stated that any accumulation of crud that interfered with coolant flow would be detected quickly by pressure drop monitoring throughout the reactor cooling system.

A consortium of nuclear power plants, Strategic Teaming and Resource

Sharing (STARS), supported the arguments against the petition presented by NEI and stated that STARS opposed the subject petition. STARS stated that chemistry controls and core design constraints are in place to reduce susceptibility to heavy crud deposition and that during operation, chemistry indicators and core power measurements are evaluated continuously for evidence of heavy crud deposition or movement. STARS also stated that visual inspections of fuel assemblies during refueling have found no evidence of heavy crud deposits. STARS stated that it does not believe that nuclear safety would be enhanced by adopting the requested rulemaking.

GE Nuclear Energy stated that the supplemental petition for rulemaking held no technical merit. GE stated that the requested revision of the ECCS evaluation basis and criteria is based on a single event that occurred at one plant during one cycle of operation; that the unique condition of heavy crud buildup has occurred only once in over 1,000 reactor years of BWR operation, and the postulated scenario (rapid and uncontrollable fuel and core melt) is not a credible scenario as shown by the damage characteristics observed for the cited event; and that the postulated inability to effectively detect and mitigate the occurrence of a heavy-crud-induced fuel damage condition during normal operation is invalid, as was adequately shown by the responsible and effective actions taken by the affected plant.

Tennessee Valley Authority (TVA), a nuclear power plant licensee, stated that the requested revisions in the supplemental petition are unnecessary because current regulations adequately address the impact of fuel crud deposits on the cooling of nuclear fuel during normal reactor operations. In addition, TVA supported the comments submitted by NEI.

Westinghouse Electric Company opposed the action requested in PRM-50-73, stating that the postulated scenario leading to rapid core melting is completely speculative and is not supported by technical or scientific data. Westinghouse also noted that the regulations recommended for modification in PRM-50-73A are not related to normal operating conditions, but rather apply to LOCAs.

NRC Technical Evaluation

The NRC reviewed each of the petitioner's claims and provides the following analysis.

1. The petitioner stated that a licensed power reactor operated with unusually heavy crud deposits on many of the fuel