

RIC 2013
GSI-191 Resolution: An Industry Perspective

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GSI-191 Resolution: An Industry Perspective

- Background
- Industry Response
- NEI Proposed Resolution Path
- NRC SECY-12-0093 and SRM
- STP Risk Informed Pilot
- Ongoing Activities
- Conclusions



GSI-191 Resolution: An Industry Perspective
Background

- GSI-191 concludes that debris (fibrous and particulate) has the potential to clog containment sump strainers, and impede or prevent long term core cooling (LTCC).
- NRC issues GL-2004-02 requiring that licensees address the issues raised by GSI-191, including the impact of debris on recirculation.
- Testing shows that debris may have a significant impact on the recirculation function.
- Bulletin 2003-01 and GL-2004-02 required development of compensatory measures to address sump strainer blockage.



GSI-191 Resolution: An Industry Perspective Industry Response

- Goal: Stable closure of a long-standing issue
- All U.S. PWRs have taken numerous actions to improve safety and reliability of ECCS recirculation systems including increased size of their recirculation strainers and reduction or elimination of potential debris sources.
- Compensatory measures developed including operations procedures and training.
- "Clean Plant Criteria" proposed by NEI to support quick closure for plants with little or no fiber.
- Testing established bounding in-vessel fiber criteria that may be problematic for many plants.



GSI-191 Resolution: An Industry Perspective Industry Response

- STP initiated a pilot project to develop a risk-informed approach for resolution of GSI-191 based on Reg. Guide 1.174.
- NEI provided the May 4, 2012 letter to the NRC recommending actions for resolution based on fiber content in containment, i.e. Minimal, Low to Medium and Substantial.
- PWROG initiated program of additional testing to establish more realistic criteria for in-vessel fiber.
- NRC staff proposed three resolution options in SECY-12-0093 which were endorsed by the Commission SRM:
 - Option 1 Compliance with 10 CFR 50.46 based on currently approved models
 - Option 2 Mitigative Measures and Alternative Methods
 - Option 3 Different Regulatory Treatment for Suction Strainer and In-Vessel Effects



GSI-191 Resolution: An Industry Perspective Industry Response

- Industry develops Closure Option Template to guide development of resolution option selection and path forward letters.
 - Aligns with SECY-12-0093 and establishes templates for each option
 - Option 1: Compliance with 10 CFR 50.46 Based on Currently Approved Models
 - Option 2a: Deterministic Resolution Path
 - Option 2b: Risk-Informed Resolution Path
 - Option 3: Different Regulatory Treatment for Suction Strainer and In-Vessel Effects (Deterministic for Strainer Head Loss /Risk-Informed for In-Vessel Effects Resolution Path)
- Licensees would identify and implement measures to mitigate the residual risk from unresolved issues while testing, analysis, and modifications to resolve GSI-191 are being completed.



GSI-191 Resolution: An Industry Perspective Option 1

- Demonstrate compliance with 10 CFR 50.46 through approved deterministic models for analyses, strainer head loss testing, and in-vessel effects.
- Plants will need to demonstrate that they meet “clean plant criteria” issued by the NRC on May 2, 2012 (ML 120730181) or have sufficiently low strainer bypass to meet the 15 grams per fuel assembly limit that is expected to be endorsed by the NRC in their SE for WCAP-16793, Rev. 2, and any limitations and conditions in the SE.
- Plants will be subject to operational constraints based on the current deterministic guidance. Additional margin may be achieved through application of alternative in-vessel limits established through ongoing PWROG test and analysis efforts.



GSI-191 Resolution: An Industry Perspective Option 2: Deterministic or Risk-Informed

- The SECY paper identifies two separate resolution paths (deterministic or risk-informed).
- Both rely on mitigation measures while alternative (new) resolution methods and acceptance criteria are established.
- Measures to mitigate residual risk would be credited to address issues that have not been resolved.



GSI-191 Resolution: An Industry Perspective Option 2a- Deterministic

- Allows a period of time to complete testing and analysis to support alternative methods and to complete necessary plant modifications.
- The plant will evaluate the applicability of alternative resolution and acceptance criteria being developed by the new PWROG test and analysis program.
- It is anticipated that application of new in-vessel criteria will minimize or eliminate the need for additional plant modifications.



GSI-191 Resolution: An Industry Perspective Option 2b –Risk Informed

- Allows plants to utilize risk-informed resolution methods that are currently being piloted by STPNOC.
- Plants choosing this option will be required to develop risk assessment models and perform plant-specific testing necessary to justify major assumptions.
- A plant specific resolution schedule would be established in discussion with NRC



GSI-191 Resolution: An Industry Perspective STP Risk Informed Pilot

- The Risk-Informed Pilot Project has progressed to the point of a license submittal
 - Demonstrates the feasibility of the Risk-Informed approach
 - Expect to work with NRC Staff over the next few months to resolve questions and finalize licensing approach
- The supporting engineering analyses and experimental results show that the many efforts taken by the industry, partly in response to NRC concerns, to maintain defense-in-depth and safety margin have been highly effective



GSI-191 Resolution: An Industry Perspective STP Risk-Informed Pilot

- The Pilot Project is innovative and creative, enhancing results obtained from deterministic engineering models within a risk framework quantifying uncertainty and risk
 - Time dependencies are included
 - Uncertainty in input parameters is included
 - Model results are propagated in an uncertainty quantification
- The method may be applicable to support resolution for other plants.
- The Pilot Project framework may provide guidance for the development of solutions to other NRC risk initiatives such as Fire Risk and Fukushima-related issues.



GSI-191 Resolution: An Industry Perspective Option 3-Different Regulatory Treatment

- Separate resolution paths for strainer performance and in-vessel effects.
- Strainer resolution using approved deterministic methods.
- In-vessel effects may be resolved using a risk-informed approach which may or may not require an exemption to 10 CFR 50.46.
- One or more plants expected to pilot this approach



GSI-191 Resolution: An Industry Perspective Ongoing Activities

- Final version of the Safety Evaluation Report for WCAP-16793 not publicly available.
- Choice of resolution path for some plants awaits publication of the SER.
- PWROG Testing and Analysis Program is underway to support resolution of in-vessel effects.
- Proper sequencing of In-Vessel Testing
 - Complete testing necessary to resolve GSI-191 and inform boric acid precipitation testing.
 - Complete testing necessary to resolve remaining questions regarding boric acid precipitation.
- The Risk-Informed Pilot Project has progressed to the point of a license submittal



GSI-191 Resolution: An Industry Perspective Conclusions

- Modifications to plants and other measures assure safe continued operation.
- Actions taken to mitigate the residual risk associated with strainer blockage and in-vessel effects.
- Industry-developed closure options align closely with SECY-12-0093.
- Closure options and supporting industry programs provide a path for closure of this long-standing issue.


