NRC Status on RPV Integrity Issues

June 6, 2013



Protecting People and the Environment

10 CFR Part 50, Appendix G Background



- "Fracture Toughness Requirements"
 - Reactor Vessel Charpy Upper-Shelf Energy (USE)
 - Includes a miminum requirement on the Charpy USE of the beltline materials to protect against low energy ductile failure of the reactor pressure vessel (RPV).
 - Pressure-Temperature (P-T) Limits and Minimum Temperature
 - Methodology in Appendix G of Section III of the ASME Code be used to establish P-T limits for heatup, cooldown and hydrostatic tests of the RPV.



- As the RPV ages and neutron irradiation accumulates, the upper limits on allowed operating temperatures and pressures become progressively more restrictive.
- Staff initiated work to revise Appendix G (risk-informed).
- Industry publication MRP-250.

10 CFR Part 50, Appendix G U.S.NRC United States Nuclear Regulatory Commission Protecting People and the Environment

- Staff CPF analyses identified loading scenarios on the P-T limit curves that generate risk estimates of vessel failure requiring further analysis:
 - cooldowns in PWRs and BWRs, and leak tests in BWRs.
- Predicated on the existence of small, surface breaking flaws on the ID
 - Consistent with 50.61a model
- Evaluation of actual operating events lowers CPF.

10 CFR Part 50, Appendix G^o – Plans



- Complete analysis of small surface breaking flaws.
- Staff analyses must be completed to determine whether Appendix G will be revised or whether the analyses support maintaining the current 10 CFR Part 50, Appendix G.
 - If Appendix G is not revised, additional actions may be required of licensees.

RG 1.99 – Status and Plans



- RG 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988.
- Draft RG and Technical Basis under internal review.
 - Embrittlement trend curve identical to 10 CFR 50.61a.
- Staff is still evaluating the need to revise.

Alternate PTS Rule



- 10 CFR 50.61a, "Alternate Fracture Toughness Requirements for Protection Against Thermal Shock Events," January 4, 2010.
- No operating PWR RPV is projected to exceed the 10 CFR 50.61 screening criteria prior to expiration of 40 year operating license.
- Five are projected to exceed the 10 CFR 50.61 screening criteria prior to expiration of 60 year operating license.
 - One plant scheduled to perform RPV exam in January 2014
- Draft Regulatory Guide and Technical Basis under internal review.

10 CFR Part 50, Appendix H



- Reactor Vessel Material Surveillance Program.
- ASTM E185-82.
- Draft revision under internal review.
- Staff plans to pursue Rulemaking.

Other Issues



- Forthcoming Regulatory Issue Summary (RIS): Clarification of Fracture Toughness Requirements for Ferritic Reactor Coolant Pressure Boundary Components.
- Forthcoming Information Notice (IN): Quasi-Laminar Indications.