

NE-19-18484, Advanced Metallic U-Zr Fuel for LWR Applications

Framatome is developing a fuel design using Lightbridge technology. The Lightbridge Fuel™ design will utilize solid metallic, helically-twisted, multi-lobed fuel rods whose unique composition and geometry provide potential advantages versus conventional UO₂ fuel. Since the NRC's Standard Review Plan was developed for zirconium-clad UO₂ fuel, new design-specific criteria and design-basis limits will need to be established for the Lightbridge Fuel™ U-Zr design.

The Lightbridge Fuel™ U-Zr fuel design will have failure/damage modes associated with fuel rod failure or damage mechanisms that are unique to the design. These failure/damage modes need to be identified and the failure/damage mechanisms developed to define design-specific criteria to address. Framatome will use failure modes and effects analysis to determine and define potential failure mechanisms for the Lightbridge Fuel™ design. For each failure or fuel system damage mode, phenomenon associated with the failure/damage mechanisms will be identified. A phenomenon identification and ranking (PIRT analysis) will be performed to identify phenomenon that need more understanding through research or testing.

Based on the results of the initial phenomenon identification and ranking completed by Framatome, experts from Idaho National Laboratory (INL) with consultation by experts at Pacific Northwest National Laboratory (PNNL), will review and address phenomena identified as having both importance to the mechanism and a lack of knowledge or understanding of the phenomena. Specific outcomes of this collaboration between INL and Framatome will include recommended experimental (ex- and in-situ reactor) verification of failure/damage modes and associated mechanisms.