AREVA Cr_2O_3-DOPED FUEL DEVELOPMENT FOR BWRs

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The search for improvements in nuclear fuel cycle economics results in increasing demands for fuel discharged burnup and reliability, plant maneuverability and power uprating. To achieve these objectives without any reduction of safety margins, fuel design and materials that enable enhanced performance capabilities have been developed or are under investigations. Research on fuel pellets focuses on the modification of the microstructure to increase fission product retention and pellet mechanical compliance. Currently, production of the desired large grain viscoplastic UO_2 fuel microstructures has been deeply investigated for long by AREVA NP through the use of doping elements. This track is nowadays a worldwide working field. In that area, AREVA NP has launched the development of a new UO_2 fuel pellet obtained by optimum chromium oxide doping.

The purpose of this paper is first to present the current results with the AREVA optimized chromia doped fuel and to discuss the key advantages in terms of fuel performance for BWR applications. In particular, the development relies on ramp testing results, fuel temperature and fission gas release values acquired at high burnup with high power levels.

Second, the paper focuses on the qualification process implemented by AREVA to assess the margins of the optimized Cr_2O_3-doped UO_2 fuel towards safety criteria at high burnup and the risk of PCI failure, as well as to develop calculation tools to support design. The driving force in this qualification plan is to gain the accurate knowledge of the optimized doped fuel behaviour under normal, transient and anticipated accident conditions. To support this effort, irradiation campaigns are under progress in PWR and BWR plants to cover a wide range of existing operating conditions and to anticipate future demands. Considering only the BWR part, the program has successfully run since 2005 and is designed to produce data up to high burnup, at least 70 GWd/tU The aim is to define the range of operational conditions for application of chromia-doped fuel in combination with LTP2 non-liner cladding as an alternative to the present standard Fe-enhanced Zr liner cladding.