Fuel Safety Analysis of the Stagnation Feeder Break Accident for Wolsong1 NPP Loaded with CANFLEX-NU Fuel

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Abstract

The fuel safety analysis of the stagnation break is done for Wolsong1 Nuclear Power Plant(NPP) loaded with CANFLEX-NU fuel. The initiating event, a break in an inlet feeder, can lead to a reduction in coolant flow in the adjacent fuel channel with the channel remaining at power. Depending on the size of the break, a complete stagnation of channel flow can occur, resulting in fuel and channel heatup and channel failure. If the break is somewhat smaller, such that the channel remains intact with a very low flow, it can still lead to significant fuel failure and radionuclide release. Results are presented only for the former event, identified as " stagnation breaks" . Feeder breaks can be postulated to occur in any channel, with a wide range of consequences depending on break size, location, and the channel involved. Of this spectrum of events, a break in a high power channel is expected to lead to the limiting release and dose consequences. Thus, to ensure that the worst consequences are covered, a bounding channel is defined as a 7.3 MW(th) channel with a peaked flux shape. To analyze this bounding channel for radionuclide release from fuel, the geometry and parameters for channel O6 are used with power and radionuclide inventories scaled to the defined bounding channel (O6_mod channel) parameters. For a feeder stagnation break with ECC injection available, the total channel fission product release is calculated to be 67,285 TBq or approximately 25% of the total product inventory. This release occurs quickly, in the first 10 - 20 seconds, and prior to channel failure.