# Bruce B Low Void Reactivity Fuel-Safety Analysis For The Demonstration Irradiation[1]

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## ABSTRACT

Bruce Power has undertaken a project to improve safety margins for large break loss of coolant (LBLOCA) accidents and to mitigate the effects of plant aging with respect to critical heat flux (CHF) and critical channel power (CCP). This project is called the New Fuel Project, and it involves replacing the current 37-element natural uranium (NU) fuel bundles with CANFLEX® low void reactivity fuel (CANFLEX-LVRF) bundles. CANFLEX-LVRF will result in lower coolant void reactivity, which will improve LBLOCA safety margins. CANFLEX-LVRF also has improved CHF performance relative to 37-element NU fuel, which will result in improved CCP and will mitigate some of the adverse effects of aging, such as the CCP reduction associated with diametral pressure tube creep.

part of the New Fuel Project, a Demonstration Irradiation (DI) of 24 CANFLEX-LVRF bundles in two fuel channels will take place in Bruce B Unit 7. The DI entails the fuelling of two fuel channels with CANFLEX-LVRF bundles, using established fuelling practices. The primary objective of the DI is to confirm, before beginning large-scale implementation of the new fuel design, that the fuel is fully compatible with all interfacing systems and that fuel performance will be acceptable.

The detailed objectives of the DI are to confirm by operation under reactor conditions that:

- There are no unacceptable or unexpected effects on fuel, pressure tube, other reactor components, or reactor operation and maintenance, as a result of use of CANFLEX-LVRF fuel when manufactured with prototypical production techniques.
- Performance of CANFLEX-LVRF fuel is acceptable when the fuel is manufactured with prototypical production techniques. This includes considerations such as mechanical performance (i.e., fretting, endplate cracking, bearing pad wear, etc.), flow resistance, power generation, and fuel-element performance (i.e., fission gas release, sheath strain, deuterium pickup, etc.).

A set of criteria has been identified to select the fuel channels for the DI. The safety analysis in support of the DI takes into account that the DI will likely occur in the pre-selected fuel channels. However, the safety analysis also recognizes that due to considerations that may arise closer to the time of the DI, the DI may take place in other fuel channels.

This paper documents the safety analysis performed in support of the DI. Analysis or assessment was performed for each of the accident categories addressed in the Bruce B Safety Report. In each case, the aspects of the accident scenario that are not affected by the presence of CANFLEX-LVRF or the DI are summarized. Aspects that may be affected are then identified, to establish the context and scope for the subsequent analysis or assessment. The methodology and assumptions are identified and justified and

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key results and conclusions of the analyses and assessments are then provided, along with an overview of design or operational restrictions that may be required during the DI.