# BNL ALARA Center Data Base

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## SECONDARY HYDRIDING OF DEFECTED ZIRCALOY-CLAD FUEL RODS

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**Objectives:** To examine the secondary hydriding of Zircaloy cladding in a breached LWR fuel rod and evaluate its role in the fuel rod degradation process.

**Comments:** This study began with a literature review to summarize the current status and understanding of processes pertinent to breached cladding. Analysis of these processes led to initial governing equations, which when solved, enable investigators to determine the location at which secondary hydriding can occur in a fuel rod.

- The source of steam in secondary hydriding is the flashing of coolant through the primary defect. However, the fuel pellets are unlikely to be oxidized by the steam at prevailing temperatures.
- Fission fragments can generate substantial quantities of reactive species such as hydrogen peroxide, which are quite capable of oxidizing the fuel pellets. Such oxidation is a potentially larger source of hydrogen that can cause secondary hydriding in the cladding.

**Remarks/Potential for dose limitation:** It was shown that a primary defect in the Zircaloy cladding can lead to conditions that may cause secondary hydriding of the cladding. The cladding may subsequently become hydrogen-embrittled, or local massive hydride regions may form. In either case, a rupture in the cladding is possible, often far removed from the primary defect location. Thus, a small through-wall breach in the Zircaloy cladding of an LWR fuel rod can lead to a rapid degradation of the fuel rod. This causes a large quantity of radioactivity to be released into the primary coolant system.

**References:** "Secondary Hydriding of Defected Zircaloy-Clad Fuel Rods," EPRI TR-101773, Final Report, January 1993.

**Duration:** from: 19 to: 1993

**Funding:** N/A

**Status:** Completed

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