LIGHT WATER REACTOR MATERIALS AND WATER CHEMISTRY STUDIES AT HALDEN

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Objectives: The objective of the PWR Test Facility experiments is to determine the effects of high lithium concentrations on the corrosion behavior of Zircaloy-4. The objective of the IASCC facility studies is to assess the effect of water chemistry environment on the cracking propensity of in-core structural materials commonly found in BWRs.

Comments: The Halden Reactor Project test facilities are designed to produce the radiation, thermal hydraulic, and water chemistry conditions representative of those found in commercial Light Water Reactors. The PWR facility is being used to determine the effects of high lithium concentration on the corrosion behavior of high burnup Zircaloy-4 fuel rods. 4-4.5 ppm lithium and 1000 ppm boron were added to the water. The pH was 7.2-7.3 at 300°C, and after 250 full power days, the boron concentration was reduced to 700 ppm (pH 7.4). Oxide thickness was measured in order to determine the effect of lithium concentrations on corrosion rates. Early results indicate that increased lithium concentrations have little effect on enhancing corrosion rates. The IASCC loop system is designed to operate under both Normal BWR Water Chemistry (NWC) and Hydrogen Water Chemistry (HWC) conditions. In order to determine the benefits of HWC in mitigating crack propagation, the specimens are exposed to NWC with the introduction of HWC at various stages during the course of irradiation. Corrosion potential and solution conductivity are closely monitored.

Remarks/Potential for dose limitation: It is hoped that future investigations at Halden will address the feasibility of applying chemical additives such as zinc to control radiation buildup in PWRs. Further investigations relating to IASCC behavior of structural component materials are also expected.

References: Karlsen, T., Gunnerud, P., and Vitanza, C., "Light Water Reactor Materials and Water Chemistry Studies at Halden," *Water Chemistry of Nuclear Reactor Systems 6*, Vol. 1, British Nuclear Energy Society, London, 1992.

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