BNL ALARA Center Data Base

U.S.A. R-352

DECOMPOSITION OF HYDROGEN PEROXIDE IN BWR COOLANT CIRCUIT

Keywords: CONTAMINATION PREVENTION; PRIMARY COOLANT CHEMISTRY; HYDROGEN PEROXIDE; CORROSION

Principal Investigator:

C. Lin
GE Nuclear Energy
P O Box 460
Pleasanton, CA 94566
U.S.A.
Phone: 510-862-4566

Project Manager:

Objectives: In a BWR primary coolant circuit, the coolant flow velocities and volume-to-surface ratios at various locations are taken into account for the estimation of the decomposition rate of hydrogen peroxide in the system. The decomposition half-times are estimated ranging from a few seconds in the core region to a few minutes in the recirculation piping system.

Comments: Although hydrogen peroxide is believed to exist in the coolant at approximately 280°C during power operation, the measurements has not been successful due mostly to surface catalytic effects in the sample line. Thus the actual level of hydrogen peroxide in an operating BWR is still not accurately known. The rate of a heterogeneous catalyzed reaction is dependent upon both mass transfer and chemical activation processes. In a recent laboratory study of hydrogen peroxide decomposition in aqueous solutions, it has been observed that at temperatures lower than ~200°C, the decomposition reaction is mostly activation-controlled, and above ~200°C the mass transfer process becomes an important factor in determining the overall reaction rate.

Remarks/Potential for dose limitation: By combining the above results and the laboratory test results for the activation-controlled rate constants extrapolated to 280°C, the overall rate constants at various locations in a BWR primary coolant circuit have been calculated. The decomposition half-times are estimated ranging from a few seconds in the core region to a few minutes in the recirculation piping system. Hydrogen peroxide is one of the stable products radiolytically produced in BWR coolant. Understanding the chemical properties of hydrogen peroxide in the BWR coolant has become an important factor in dealing with the material corrosion problems in the BWR primary system.

References: Lin, C.C., "Decomposition of Hydrogen Peroxide in BWR Coolant Circuit," *Water Chemistry of Nuclear Reactor Systems 6*, Vol. 1, pp. 85-88, British Nuclear Energy Society, London, 1992.

Duration: from: 1989 to: 1992

Funding: N/A

Status: Completed

Last Update: September 3, 1993