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CANADA **R-433**

DEVELOPMENT OF THE CAN-DEREM PLUS REAGENT

Keywords: CONTAMINATION REMOVAL; DECONTAMINATION; DOSE; DOSE RATE; CANDU; STEAM GENERATOR; PICKERING 1

Principal Investigator:
Douglass Miller
AECL
Chalk River Laboratories
Chalk River, ONTARIO K0J 1J0
CANADA
Phone: (613)584-8811

Project Manager:
R. Speranzini
AECL
Chalk River Laboratories
Chalk River, ONTARIO K0J 1J0
CANADA
Phone: (613)584-8811

Objectives: To develop a reagent to carry out the decontamination of the steam generators of the Pickering 1(CANDU) reactor.

In April 1994 it was recognized that the steam generators at Pickering Unit 1 should be decontaminated. The decontamination was scheduled for July 1994, at the front end of the maintenance outage. Given the short lead time to perform the decontamination, the most feasible flow configuration was to transfer the reagent between a pair of steam generators. This was referred to as the fill and drain method. Selection of the appropriate decontamination reagent had to be given careful consideration because of the relatively high magnetite deposit loading in the Pickering Unit 1 steam generators and the large surface area to volume ratio of the system to be decontaminated. Reagents were evaluated on the basis of:
(1) effectiveness
(2) compatibility with system materials
(3) capacity of the reagent
(4) waste handling (regeneration and removal of the reagent using ion-exchange resins).

Comments: The results of tests performed under static, low- and high-flow conditions indicated that a formulation containing citric acid and EDTA was the appropriate reagent for decontamination using the fill/drain method. This formulation, which used higher concentrations of reagents than CAN-DEREM, was referred to as CAN-DEREM PLUS. Its effectiveness was comparable to CAN-DEREM and its capacity for soluble corrosion products was 2.5 times greater than that of CAN-DEREM. A higher capacity was required to ensure that the steam generators could be cleaned in a reasonable amount of time. Loop runs performed with the CAN-DEREM PLUS reagent indicated that the reagent could be regenerated using a cation ion-exchange resin and was removed from the solution using a mixed-bed ion-exchange resin.

Remarks: A qualification program was undertaken to assess the compatibility of CAN-DEREM PLUS with key steam generator materials and welds in the Pickering 1 steam generators. The qualification program included a series of loop runs to optimize the application conditions in terms of pH, temperature and inhibitor concentration. A series of electrochemical tests were performed in parallel to estimate the amount of ferric ion released during the decontamination and to assess the potential for ferric ion corrosion of the carbon steel surfaces in the decontamination flow path.

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The recommended reagent for the decontamination of Pickering 1 steam generators was pH-modified CAN-DEREM PLUS containing a corrosion inhibitor (Rodine 31A) and hydrazine. The general corrosion rate of A106 Gr. B carbon steel was less than 1μm/h and localized corrosion was minimal.

References: Miller, D.G., R.A. Speranzini, M.D. Wright and D.S. Mancey, "Development of the CAN-DEREM PLUS Reagent," Proceedings, EPRI Radiation Field Control and Chemical Decontamination Seminar, Tampa, Florida, November 1995, available from EPRI Distribution Center, P.O. Box 23205, Pleasant Hill, CA 94523, Phone: (501)934-4212.

Duration: from: 1994 to: 1995 **Funding:** N/A

Status: Completed. **Last Update:** May 7, 1996