BNL ALARA Center Data Base

U.S.A. R-417

WATER CHEMISTRY AND CORROSION EFFECTS ON ACTIVITY BUILDUP IN BWRS OPERATING WITH HYDROGEN WATER CHEMISTRY

Keywords: COMPONENT RELIABILITY; DOSE; DOSE RATE; HYDROGEN WATER CHEMISTRY; NORMAL WATER CHEMISTRY; IGSCC; CORROSION; ZINC; GEZIP; ZINC ADDITION

Principal Investigator:

Gerard Palino
NWT Corporation
7015 Realm Drive
San Jose, CA 95119
U.S.A.
Phone: (408)281-1100

Project Manager:

Christopher Wood
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94304
U.S.A.
Phone: (415)855-2379

Objectives: To review and comment on laboratory and field experience with hydrogen water chemistry (HWC), to assess hypotheses offered to explain increased shutdown dose rates following HWC implementation, and to perform on-line in-reactor measurements to identify chemistry and operational factors that influence the rate of radiation buildup on piping surfaces.

Comments: Based on a review, the following hypotheses regarding rates of incorporation of Co-60 into corrosion films on BWR system surfaces appears supportable:

1) Rate of incorporation of Co-60 into a growing corrosion film on an unfilmed specimen is proportional to the specimen corrosion rate and the concentration of soluble Co-60 in the liquid phase.
2) The capacity of the film for Co-60 is dependent on the nature of the film, i.e. magnetite, hematite, etc. Also, film characteristics will vary if GEZIP is being employed during Hydrogen Water Chemistry (HWC) or Normal Water Chemistry (NWC).
3) Corrosion film thicknesses on 304 SS are similar at HWC and NWC chemistry conditions after reasonable operating periods.
4) Formation of a protective film occurs more quickly during NWC than HWC. However, as the corrosion process continues, incorporation of Co-60 on the HWC specimen increases and, in many cases, surpasses that occurring on the NWC specimen.
5) For a given film thickness, a greater buildup of activity in HWC films is expected based on the larger fraction of spinel present in the films.
6) Activity buildup on specimens exposed to HWC and NWC is consistent with film thickness, corrosion rate, Co-60 capacity.

Remarks: The credibility of the model was supported by the capability to develop what appear to be rational explanations for piping surface activity variations at several plants where significant questions existed relative to the cause of observed variations.

Decontamination using conventional processes applied to BWRs operating with HWC is not as effective as in plants operating with NWC since the films are high in chromium. A successful

BNL ALARA Center Data Base

U.S.A. **R-417**

decontamination of a HWC BWR will require a pretreatment process to oxidize the chromium in the corrosion film. Decontamination also makes the surface very susceptible to rapid recontamination, particularly if decontamination is very effective. It also appears that the recontamination process is more rapid under HWC. This appears attributable to a greater Co-60 capacity of the newly formed or restructured HWC film compared to NWC film.

Finally, stability of the NWC film formed over an extended period appears significantly greater than that of the HWC film.

References: Sawochka, S.G., G. F. Palino and M. E. Clouse, "Water Chemistry and Corrosion Effects on Activity Buildup in BWRs Operating with HWC," Proceedings, EPRI Radiation Field Control and Chemical Decontamination Seminar, Tampa, Florida, November 1995, EPRI Distribution Center, P.O. Box 23205, Pleasant Hill, CA 94523.

Duration: from: 1993 to: 1996 **Funding:** N/A

Status: In progress **Last Update:** May 7, 1996