

# BNL ALARA Center Data Base

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## OPTIMUM WATER CHEMISTRY IN RADIATION FIELD BUILDUP CONTROL

**Keywords:** OPERATIONAL AND MAINTENANCE TECHNIQUES; WATER CHEMISTRY; ZINC ADDITION; HWC; COBALT REDUCTION; BWR

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**Project Manager:**

**Objectives:** Provide a summary of the latest water chemistry techniques in reducing radiation fields in a BWR.

**Comments:**

Countermeasures for Radiation Field Buildup:

- Cobalt source reduction
- Feedwater Fe reduction/control: controlling Co-60 transport
- Ionic impurity reduction: reducing material corrosion
- Depleted zinc oxide (DZO) addition: reducing Co-60 in water
- Decontamination: removing radioactivities on piping
- Prefilming: reducing initial activity buildup
- HWC: reducing material corrosion

Effects of Zn Addition in Radiation Buildup Control:

- Zn (depleted in Zn-64) is recommended to avoid Zn-65 production
- Lab data confirm that Zn at 5-10 ppb in water slows down the corrosion rate and reduces Co-60 deposition on steel surface
- Reactor data show Zn also reduces the Co-60 release rate from fuel deposit, resulting in lower Co-60 concentration in water

Effects of HWC on Radiation Field Buildup:

- Shutdown dose rate increase due to increased Co-60 deposition
- Magnitude of effect different among HWC plants
- Soluble and filterable Co-60 concentrations vary among plants
- Dose rate buildup varies among plants, from none to substantial
- At some plants with both HWC and GEZIP, shutdown dose rate increase was dominated by Zn-65

**Remarks/Potential for dose limitation:**

Background:

- Shutdown radiation fields in BWRs have been reduced significantly in recent years, and average personnel exposure continues to decrease slowly
- Personnel exposure goals continue to be lowered

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- Further reduction in radiation field by water chemistry control is a formidable challenge
- Plant specific strategies aimed at controlling radiation field buildup and minimizing personnel exposure have to be developed and implemented

**Summary and Conclusion:**

- The concept of optimum water chemistry can be realized in radiation field reduction
- Co/Co-60 model calculation is helpful to define effective approaches to control and reduce radiation field buildup
- Effects of HWC on radiation field buildup have been clearly observed, but the magnitude may be minimized with source term reduction and proper operation procedure

**References:** Lin, C.C., "Optimum Water Chemistry in Radiation Field Buildup Control," *Radiation Field Control Seminar*, Electric Power Research Institute, Seattle, Washington, 1993.

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