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U.S.A. **R-414**

A MODEL FOR CORROSION PRODUCT TRANSPORT IN BWRS

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Objectives: A major radiation source in BWR reactors for personnel exposures has been identified as the activated corrosion products (mainly Co-60) that deposit on the primary system piping walls. A mathematical model of corrosion product transport is being developed to determine the distribution of radioactivity around the primary coolant circuit. The main objectives of the model calculation are:

-To define the most effective approaches to control and reduce radiation field buildup.

-To predict the consequences of water chemistry changes and material replacement in the primary system.

-To assist in cost/benefit evaluations for plant specific actions.

Comments: Description of the model:

General description:

- It is a semi-empirical phenomenological model.
- Corrosion product transport is described mathematically by differential equations.
- The transport coefficients and empirical constants were verified with experimental data.

Corrosion product transport on Zircaloy fuel surfaces:

- Deposition rate is assumed proportional to heat flux.
- Deposition assumed to be in double layer formation.
- Co/Co-60 deposition and release influenced by the amount and characteristics of fuel deposits.

Corrosion product transport on out-of-core material surfaces:

- Assumed a double layer formation in the corrosion film.
- Co/Co-60 deposition assumed dependent on corrosion rate and soluble species concentration in reactor water.
-Water borne insoluble species deposit only in outer layer.
-Iron crud concentration determines soluble/insoluble distribution of Co/Co-60 species in the reactor water.

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Remarks:

* The model is capable of taking into account the effects of zinc injection and hydrogen water chemistry.

* Model is capable of reproducing the observed data in many reactors with a variety of operational histories and a wide range of radiation levels.

* Modeling objectives can be easily achieved:

- Can define effective approaches to reduce radiation fields.
- Can predict radiation buildup trends.
- Can assist in cost/benefit evaluations for plant specific actions.

* The model predicts that contact dose rates on recirculation piping can easily be reduced to below 1 mSv/hr with optimized water chemistry.

References: Lin, C.C., and S.E. Garcia "Modeling of Corrosion Product Transport in BWRs," Proceedings, EPRI Radiation Field Control and Chemical Decontamination Seminar, Tampa, Florida, November 1995, EPRI Distribution Center, P.O. Box 23205, Pleasant Hill, CA 94523.

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