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.
BNL ALARA Center Data Base

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.


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