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# Chemical Effects

## Resolution of NRC Review Issues

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# Chemical Effects - Review Issues

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1. Issue - The model developed in the WCAP is based on small-scale, short-term testing. Is this model applicable in large-scale post-LOCA containment environments over the mission time required for ECCS recirculation operation  
Response - The model addresses long-term and large-scale sump chemistry behavior. Data from short-term/small scale testing, equilibrium (long-term) thermochemical modeling and larger scale testing (i.e., ICET) were used as inputs to the model.

# Chemical Effects - Review Issues

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2. Issue - Can predominantly separate effects test results be used to account for interactions of multiple materials?

Response – Separate effects testing was performed to elucidate the behavior of individual materials. The data from the tests were combined with literature data and ICET test results to better understand and model the key interactions between materials. The data from these sources were combined using applicable chemistry principles to develop an Integrated Effects model. We recognize that neither integrated nor single-effects testing alone can provide the required information.

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# Chemical Effects - Review Issues

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3a. Issue – Do chemical surrogates adequately represent both the chemical and physical properties of the actual product?

Response – Testing demonstrated that the surrogates created as part of the PWROG program adequately represent the key properties of the precipitates, particularly filterability and settling rate.

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3b. Issue – Can chemical precipitate addition to non-representative test environments simulate plant specific chemical effects?

Response – Yes. Due to the chemical nature of the key precipitates, it is reasonable to expect that the materials will be non-interactive over the range of chemistry conditions that would exist in the post-LOCA environment. That is, the precipitates would be expected to behave as inert materials.

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4. Issue - How will plant specific conditions such as debris materials (e.g., insulations, paints), pool pH, and temperatures that were not tested be evaluated?

Response – The model covers the complete range of expected chemistry and temperature conditions, as well as all classes of materials present in the containments at all participant plants. Thus, the model may be used to evaluate any actual or postulated set of conditions at any plant.

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5. Issue - Individual strainer vendors' chemical effects evaluation plans are needed for staff review.

Response – Plans for addressing chemical effects are included as part of written strainer qualification test plans developed for individual licensees. An overview of these plans will be discussed as part of planned NRC-Vendor meetings.

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6. Issue - Given low approach velocities and small openings, can chemical products by themselves cause head loss in the absence of a continuous fiber bed?

Response – The types of precipitates generated tend to agglomerate to particulates of 10 to 100 $\mu$ m in size, comprising submicron particles. The larger particulates readily break up under shear. Thus, the chemical products would not cause head loss on bare screen.

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7. Issue – Debris bed arrival sequence (e.g., arrival of chemical products relative to other plant debris) can affect bed saturation and head loss.

Response – All debris beds (included tested beds) exhibit a degree of non-homogeneity due to arrival time, agglomeration and flow redistribution. Conservative evaluations assume all precipitate formation over the 30 day mission time is available at the onset of recirculation with no degeneration of the debris bed and typically compared with lowest available NPSH margin. The chemical precipitate is treated like all other particulates (coatings, dirt/dust) during testing.

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8. Issue – Downstream conditions (e.g., temperature cycle, boron concentration, flow) can affect chemical product formation/properties.

Response – Inputs to the chemical model may be adjusted to reflect changes in chemistry downstream.

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- Issue - Current alternate buffer tests, though informative, appear to be more screening tests than a comprehensive study to support a licensee's change to alternate buffer.
- Response – As an initial step in the Alternative Buffer Program, selection criteria were established to define the technical basis for buffer replacement. Testing is one part of a comprehensive program to demonstrate the criteria are satisfied. Test results, information from literature and past tests (ICET/PWROG), and application of the chemical model will be used to document the technical basis for buffer replacement.

# WCAP 16530-NP Review

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- RAIs to be received by July 2006
  - Meeting to discuss and develop common understanding of RAIs should be scheduled shortly after receipt
- Licensee strainer testing, including chemical effects, is being conducted on a schedule to support current GSI-191 resolution schedule