



AECL Approach to Chemical Effects Testing



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Head Loss due to Chemical Effects

- **Purpose** – *to determine the increase in debris bed head loss due to chemical reactions that form precipitates*
- **Testing** in reduced-scale facility with appropriate boron concentration and pH
- **Methodology** under development with Dominion Energy and Sargent & Lundy using WCAP-16530-NP as guidance



AECL Proposed Methodology

- **Start with a bench-top program:**
 - Show that appropriate precipitates can be produced and handled
- **Reduced-scale testing methodology:**
 - Form thin-bed on test section in tank
 - Produce precipitate in smaller tank
 - Add precipitate to test tank
 - Observe increase in head loss



Bench-top Program

Estimate quantities of dissolved Ca, Si, Al expected to be present in containment sump pool



Consider only 2 precipitates:

AlOOH or $\text{Ca}_3(\text{PO}_4)_3$



Determine concentrations of precipitate suspensions to be produced



Bench-top tests to determine optimum method to produce and handle precipitates



Bench-Top Tests

- **Small-scale bench tests (1-2 L)**
- **Precipitates characterized and compared with *WCAP-16530-NP***
- **Consistency between bench-top tests and reduced-scale tests:**
 - **Same chemicals (supplier, grade)**
 - **Concentrations will be the same**



Precipitate Generation

- **Prepared in borated, deionised water**
 - Boron concentration and pH will be plant-specific (pH monitored and adjusted as required)
 - Effect of boron species on precipitate properties unclear - conservative to produce precipitates in the presence of boron.
 - Deionised water to minimize interferences
- *No effort will be made to exclude carbon dioxide from tests.*



Bench-top Testing – Precipitate Characterization

- The following properties of precipitates will be measured and compared with those reported in WCAP-16530-NP:
 - **Precipitate Stability**
 - **Precipitate Settling Rate**
 - **Precipitate Particle Size Characterization**
 - **Precipitate Filterability**



In Addition...

- **Determine if precipitate properties will change when added to test loop containing service water**
 - Portion of bench-top solution will be added to borated service water and pH adjusted.
- **Precipitate Characterization:**
 - Filtered to determine particulate concentration
 - Elemental composition of precipitate and filtrate determined by ICP-AES
 - Chemical phase determined using XRD and/or FTIR



Tentative Testing Schedule

- **Bench-top tests:**
 - **Scheduled late fall/early winter**
- **Reduced-scale chemical effects testing:**
 - **Early 2007**



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