BORIC ACID BEHAVIOR FOLLOWING A LOSS-OF-COOLANT ACCIDENT
TOPICAL REPORT CENPD-254-P

- OVERALL FRAMEWORK OF TOPICAL REPORT AND GENERAL APPROACH REMAIN VALID FOR FUTURE LICENSING ACTIONS

- CURRENT LICENSING BASIS APPLICATION OF TOPICAL REPORT IS NOT AFFECTED AND CONTINUES TO BE ACCEPTABLE AS THE LICENSING BASIS FOR THE PLANT

- FUTURE LICENSE AMENDMENTS NEED TO ADDRESS FOLLOWING SPECIFIC CONCERNS:

  (1) Justify mixing volume and account for void fraction when computing the boric acid concentration.

  (2) Mixing volume is variable with time, concentration prior to switching to simultaneous injection should reflect the variable size of the mixing region set by the pressure drop in the loop. The fluid static balance between the downcomer and inner vessel region can then be performed taking into account the loop pressure drop at a given steaming rate to compute the mixture volume in the core and eventually the upper plenum regions. The concentration in the resulting mixing volume just prior to expansion into the upper plenum must be shown to remain below the precipitation limit.

  (3) The precipitation limit must be justified, especially if containment pressures greater than 14.7 psia are assumed or additives are contained in the sump water.

  (4) If using a 10 CFR Part 50, Appendix K (App. K) model, the decay heat multiplier as required by App. K, must employ a multiplier of 1.2 for all times. 10 CFR 50.46(b)(5) states that "decay heat shall be removed for an extended period of time required by the long lived radioactivity remaining in the core." Appendix K, I(A)(4) entitled "Fission Product Decay," states, in part, "the heat generation from radioactive decay of fission products shall be assumed to be equal to 1.2 times the values for infinite operating time." If using a non-App. K model, a realistic decay heat multiplier may be used with sufficient justification.

Combustion Engineering PWR Plant Design
Post-LOCA Boric Acid Precipitation Analysis

Waterford 3 EPU Approach

- Mixing volume
  - Liquid in core calculated using CEFLASH-4AS core phase separation model
  - Liquid in outlet plenum based on core exit void fraction calculated using CEFLASH-4AS core phase separation model
  - 50% of lower plenum liquid volume
  - Top elevation of mixing volume accounts for inner vessel-to-break differential pressure due to venting of core boil-off steam flow

Combustion Engineering PWR Plant Design
Post-LOCA Boric Acid Precipitation Analysis

Waterford 3 EPU Approach (continued)

- Solubility limit of boric acid
  - Credit minimum containment pressure calculated using a conservative model
  - Credit boiling point elevation of boric acid solution in mixing volume
  - Credit presence of containment sump chemical additives such as TSP and NaOH
- Credit mixing of BAMT and RWT inventory in cold legs
- Use CENPD-254-P-A decay heat model, which includes a decay heat multiplier of 1.1 after 1000 seconds