PWR Owners Group

WCAP-16793-NP, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid"

Project Update
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Mo Dingler
PWROG

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BACKGROUND

- NRC staff asked PWROG to address differences between vendor limits by conducting a cross-test. The results of this test would identify what (if any) influence facility differences had on the results.
- There is different behavior of debris between the test facilities. However, both facilities are constructed in such a way that any minor differences in test facilities are outweighed by the conservatisms inherent in the test process.
- PWROG has proposed program to address outstanding questions posed by the NRC staff. The program is a dual-path:
  - PATH 1: Quantify conservatisms inherent in fuel assembly (FA) testing and demonstrate any small differences in facilities are insignificant in comparison to conservative test process.
  - PATH 2: If questions surrounding test facilities cannot be addressed and/or conservative testing does not provide conclusive results, further cross-testing will be conducted.

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PATH DESCRIPTIONS

- Path 1: Quantification of Conservatisms
  - Testing would occur at facility with vendor FA that provides most conservative fiber limit.
  - This testing would be bounding for all fuel types.
  - The goal is to demonstrate suitability of test facilities due to the magnitude of conservatisms that were not included previously.
  - The goal is that this testing will produce a single fiber limit the entire fleet can adopt.
  - Testing will be at a higher fiber limit than what we currently have.
- Path 2: Cross-Testing
  - In the event the quantification testing does not produce conclusive results and/or additional staff concerns need to be addressed, both vendors will participate in cross-testing.

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Test Conservatisms

Did not credit effects of boron and buffering agents

- Industry data indicates testing with representative water chemistry (including boron and buffering agents) will decrease dP.

Did not credit effects of high temperatures

- All testing conducted with ambient water.
- Higher temperatures will decrease water viscosity and decrease dP.

Did not include boiling

- In event total blockage does occur during a hot-leg break, coolant will begin to boil which will disrupt blockages and allow flow to enter core.

Did not simulate non-uniform flow

- Areas with higher velocities will transport larger percentage of debris. Areas with lower velocities will transport smaller percentage of debris. It is these areas that will not form an impenetrable blockage – ensuring LTCC.

Did not credit debris settling in sump

- Licensees' transport evaluations are conservative.

Did not credit debris bypass through sump screen

- Testing was conducted with a closed loop.
- In actual conditions, the debris that initially bypasses the FA will be caught at the sump screen.

Did not credit alternate flow paths

- To maintain LTCC, only the core boil-off rate needs to be exceeded. Alternate flow paths provide this capability.

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- Conservatism Testing
  - Goal: Quantify the impact of testing more prototypical conditions on dP.
  - Test Conditions:
    - Flow: 44.7 gpm (hot-leg break)
    - P:F Ratio: 1:1 (fiber will be determined after review of current data set)
    - Chemical: 20 gallons of AlOOH (consistent with previous tests)
    - Boron: concentration TBD
    - Buffer: concentration TBD
    - Temperature: ~120°F
  - Test Facility and FA:
    - Facility: CDI
    - FA: AREVA
    - The fiber load defined at CDI with the AREVA FA was lower than that defined at Westinghouse with the Westinghouse FA. Therefore, a favorable result with the CDI facility-AREVA FA will be applicable and bounding to the Westinghouse FA.
- Cross-Testing
  - Goal: Demonstrate the suitability of test facilities.
  - Test parameters will be defined.
- Schedule:
  - Finalization of test parameters by March 2011.
  - Complete conservatism testing by April 15, 2011.
  - Submit report to NRC by May 13, 2011.
  - Complete cross-testing (if required) by June 10, 2011.
  - Submit cross-testing report (if required) by July 29, 2011.