BLIND PHASE RESULTS FOR TRANSIENT SIMULATIONS OF LOFWOS TEST #13

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FFTF AND THE IAEA CRP
FAST FLUX TEST FACILITY

- Fast Flux Test Facility
  - 400 MWt
  - Oxide-fueled
  - Sodium-cooled
  - Built at Hanford site in Washington
  - Built for testing & development of advanced fuels and materials

- Passive Safety Testing program
  - Goals included:
    - Confirming safety margins
    - Data for code validation
    - Demonstrating inherent and passive safety benefits of design features
  - Included 13 Loss of Flow Without Scram (LOFWOS) tests
  - Other tests include static tests to measure feedbacks
IAEA CRP ON FFTF

- Four year Coordinated Research Project (CRP)
  - LOFWOS Test #13:
    - Demonstrated effectiveness of GEMs as shutdown device
    - Limited free bow core restraint system
  - Benchmark specification developed by Argonne and PNNL
  - 25 participants
    - 20 submitted blind phase transient results
- CRP led by Argonne and PNNL

Participants:

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<tr>
<th>CIAE (China)</th>
<th>IBRAE (Russia)</th>
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<td>INEST (China)</td>
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<td>KAERI (Korea)</td>
<td>Zachry Eng. (USA)</td>
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<td>NRG (Netherlands)</td>
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LOFWOS TEST #13

- Performed on July 18, 1986
- Initiated at 50% power & 100% flow
- Transient Initiators:
  - Primary pumps simultaneously tripped
    • Secondary pumps not tripped
  - DHX fan speed reduced ~1 minute earlier
- PPS modified to prevent premature control rod insertion
- Transient Benchmark Boundary Conditions:
  - Primary flow rates
  - Secondary pump speeds
  - DHX sodium outlet temperatures
BENCHMARK PARAMETERS TO CALCULATE

- Measured Test Data
  - Fission power
  - Row 2 PIOTA & Row 6 PIOTA outlet temperatures
  - Primary loop mass flow rates
  - Primary loop hot leg temperatures
  - Primary loop cold leg temperatures
  - Secondary loop hot leg temperatures
  - Secondary loop cold leg temperatures
  - Primary pump discharge pressures for all loops

- Calculated Test Data
  - Total power
  - Decay heat
  - Net reactivity

- For Code-to-Code Comparison
  - Reactivity feedbacks
  - Row 2 PIOTA & Row 6 PIOTA mass flow rates
  - Peak fuel, cladding, & coolant temps
  - IHX primary-side inlet & outlet temperatures
  - IHX secondary-side inlet & outlet temperatures
  - Average reactor vessel inlet & outlet temperatures

- Steady-State Parameters
  - Average fuel temperature
  - Row 2 axial fuel temperature distribution
  - Row 2 axial cladding temperature distribution
  - Row 2 axial coolant temperature distribution
  - Row 6 axial fuel temperature distribution
  - Row 6 axial cladding temperature distribution
  - Row 6 axial coolant temperature distribution
RESULTS
TOTAL POWER

![Graph 1: Power vs. Time for various institutions, showing rapid initial decrease followed by a slower rate.]

![Graph 2: Power vs. Time for various institutions, showing a more gradual decrease over time.]

- **Exp**
- **ANL**
- **CIAE**
- **INET**
- **NCEPU**
- **CEA**
- **KIT**
- **IGCAR**
- **Rome**
- **JAEA**
- **KAERI**
- **NRG**
- **IPPE**
- **EPFL**
- **PSI**
- **TAMU**
- **Zachry**

**Note:** The graphs illustrate the power output over time for different institutions, with varying initial and final power levels.
DECAY HEAT
NET REACTIVITY
PEAK FUEL TEMPERATURES
PRIMARY LOOP #1 MASS FLOW RATE
COOLANT OUTLET TEMPERATURES

Row 2 PIOTA

Row 6 PIOTA
PRIMARY LOOP #1 HOT LEG TEMPERATURE
SUMMARY

- IAEA CRP for benchmark analysis of FFTF LOFWOS Test #13
- Unprotected loss of flow test initiated at half power and full flow
- Blind phase of the CRP concluded in October 2020
- Blind phase transient simulation predictions evaluated for agreement with:
  - Measured test data
  - Other participant predictions
- Blind phase results:
  - Provide confidence that many participants captured the transient progression of the test well
  - Provide key information for improving transient predictions
  - Modeling improvements during open phase focused on reducing discrepancies between measured and predicted results
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THANK YOU FOR YOUR ATTENTION