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# **TENNESSEE VALLEY AUTHORITY BROWNS FERRY NUCLEAR PLANT**

## **POWER UPRATE ACRS**

### ***CONTAINMENT OVERPRESSURE (COP)***

**Rockville, Maryland**

**July 10, 2008**

# Introduction

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- COP Part of BFN Current Licensing Basis for Appendix R and LOCA
- EPU Results in Additional COP need in Licensing Basis Analysis
- ACRS Concerns from Unit 1 105% Review
  - Magnitude and duration of Appendix R event
  - Feasibility of protecting second RHR pump
  - Consider external initiators when using risk-informed arguments for the Appendix R COP credit
  - Realistic long-term LOCA analysis needs to be supported by more defensible sensitivity analyses

# Introduction

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- Actions Taken to Address ACRS Concerns on Appendix R COP
  - July 2007 meeting with NRC Staff
  - Fire area analysis undertaken to compare COP needs for realistic fire versus Appendix R analysis
  - Deterministic analysis to provide risk insight
    - Submitted November 15, 2007
  - Followed-up with NPSH analysis for limiting cases
    - Submitted June 12, 2008

# Alternate Fire Shutdown Analysis

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- Appendix R Rule Based Fire
  - Prescribed Appendix R fire damage
    - Loss of all equipment not meeting generic separation criteria
    - Fire damage not based on analysis
  - Fire damage overly conservative for many areas of the plant

# Alternate Fire Shutdown Analysis

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- Fire Hazards Analysis
  - Supplement to Appendix R
  - Fire damage by analysis versus prescribed fire damage
  - Screen based on fire protection parameters
    - Combustible loading
    - Volume of fire area
    - Detection/Suppression
    - Ignition sources
  - 22/39 fire areas screened out
    - Fire limited to ignition source
    - No wide spread fire damage
  - 17 fire areas screen in
    - Evaluated for equipment availability

# Alternate Fire Shutdown Analysis

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- Equipment Availability Analysis
  - All equipment in fire area assumed lost in 17 fire areas
  - Unaffected equipment used per EOLs
  - Offsite power credited where unaffected
    - BOP systems available in many areas
  - 15/17 areas do not need COP
    - Sufficient equipment available to limit pool temperature
  - Only 2 fire areas need some COP
    - Electrical Board Rooms

# Alternate Fire Shutdown Analysis

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- NPSH Analysis – Limiting Fire Areas
  - Minimum equipment
    - Emergency depressurization
    - Reactor water level maintained with BOP
    - One RHR pump for containment cooling
  - Pool water volume increased during event
    - Peak pool temperature lower
    - Pool level/elevation head increase
  - Relaxed NPSHr based on revised vendor report
    - Based on shorter operating time consideration
  - Termination of drywell coolers not required

# Alternate Fire Shutdown Analysis

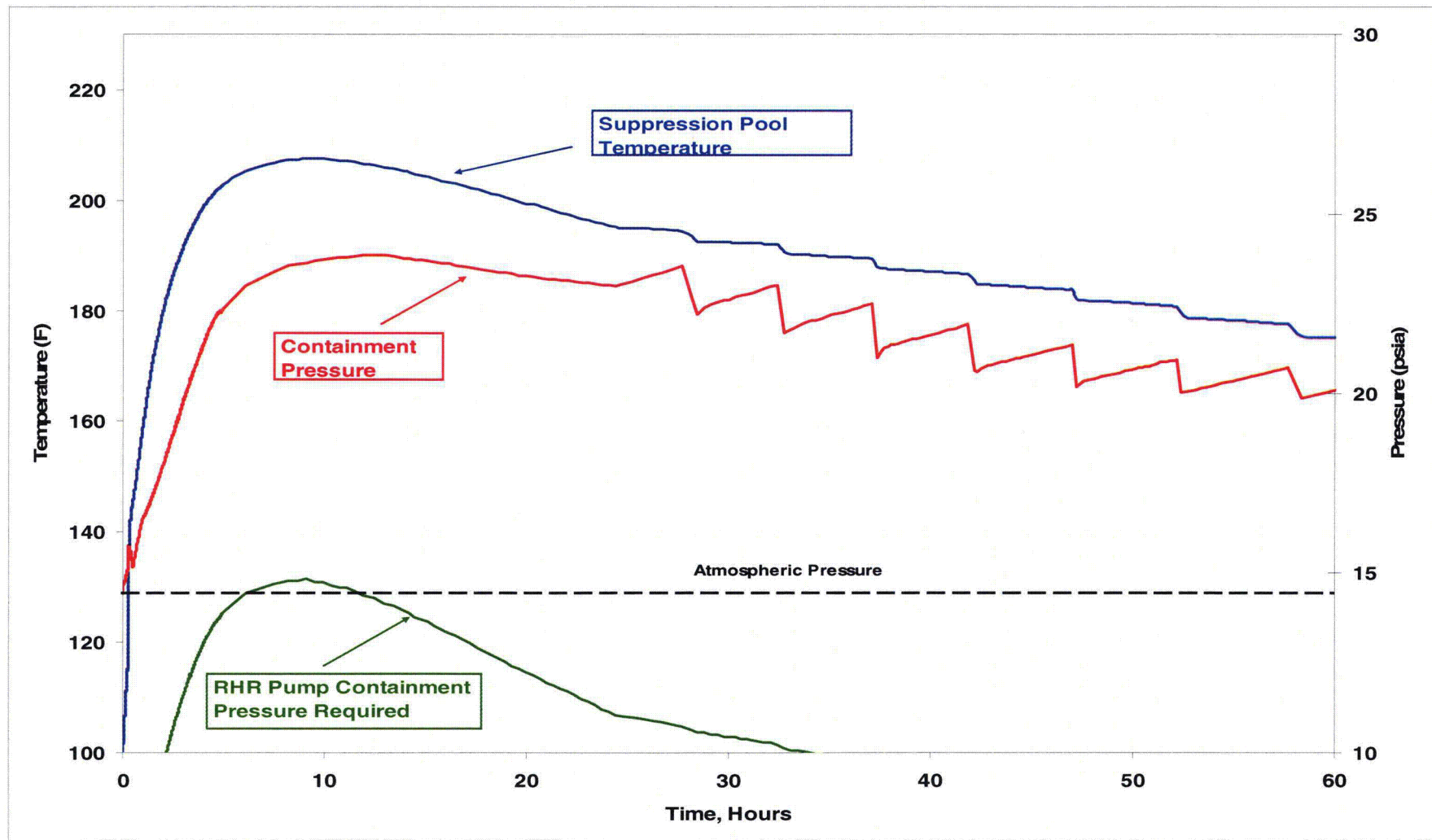
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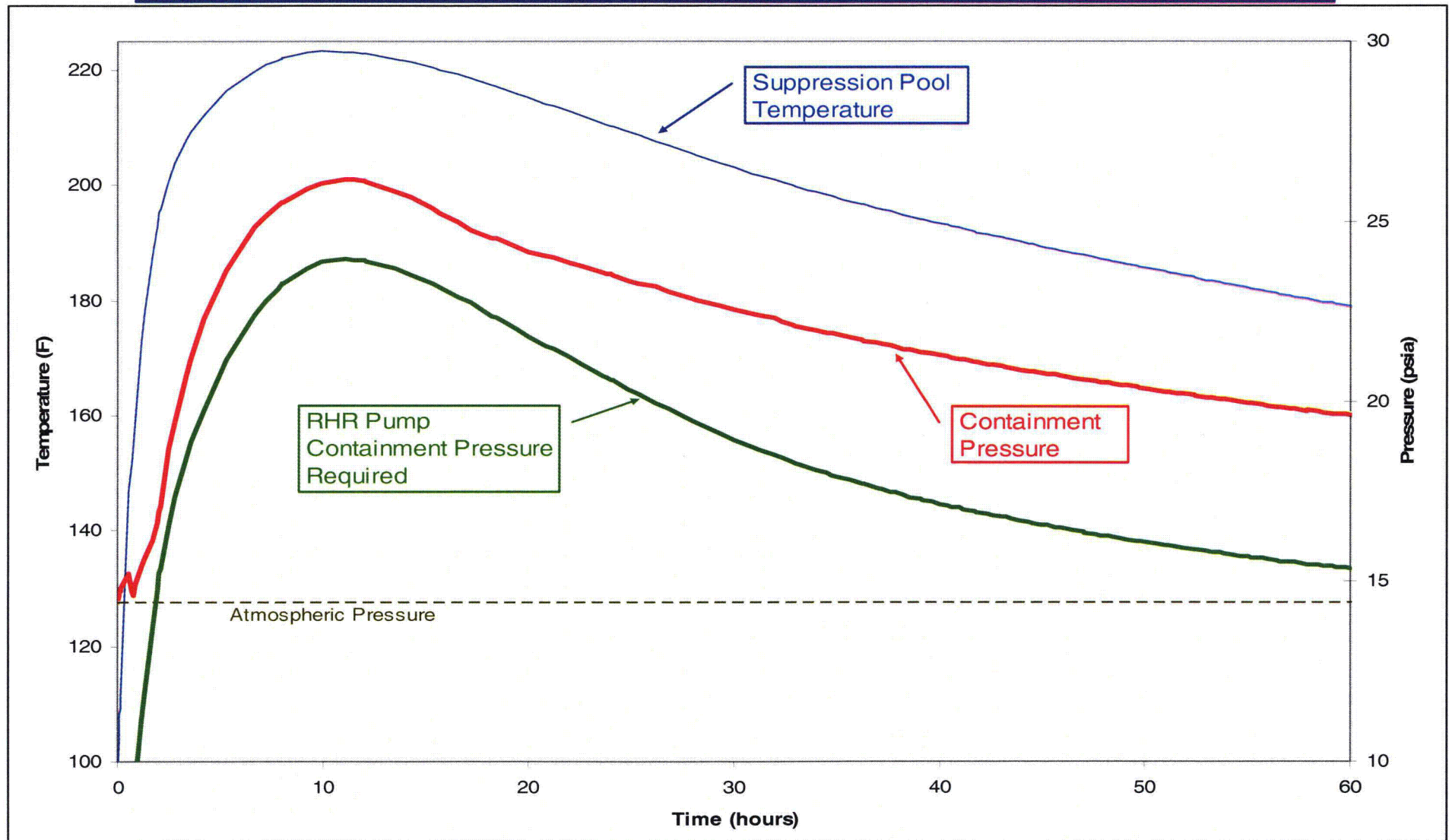
- NPSH RESULTS
  - Significant reduction in COP required
    - 1/2 psi COP
    - 6 hour duration
  - Significant COP margin
    - Minimum 8 psi
  - Core cooling not dependent on COP
    - Core cooling by BOP Systems
    - Defense-In-Depth consideration



# COP Available and COP Required Alternate Fire Hazards Analysis



# COP Available and COP Required Licensing Basis Appendix R



# Specific ACRS Recommendations

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- Feasibility of Second RHR Pump for Appendix R
  - Extensive resources
    - Physical location of switchgear
    - Shared electrical system
    - Support equipment
      - Valves/controls
      - Diesel generator/controls
      - RHRSW pump/valves
    - Significant modifications
    - Significant program and licensing changes
  - Minimal safety benefit
    - Demonstrated by fire hazards analysis

# Specific ACRS Recommendations

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- Consideration of External Events in Fire Risk Evaluations
  - Fire risk insights from deterministic fire hazards analysis
    - Not a PRA analysis
    - Bounding fire is assumed

# Appendix R Conclusions

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- Licensing Basis Analysis Complies With Appendix R and Demonstrates a Success Path
- COP Magnitude and Duration for Appendix R Driven by Rule Based Assumptions
- Fire Hazards Analysis Shows Reduced or No Dependency on COP

# Additional ACRS Issue

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- Bias and Uncertainty in Realistic LOCA
  - Realistic LOCA used to build PRA model for COP
  - Use of 95% non-exceedance values
  - Use of probability distributions
  - Use of conservative licensing basis methods
  - Realistic NPSH analyses biased conservatively

# Closing

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- Concluding Remarks