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# Fort Calhoun Station GL 2004-02 Closure Strategy

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Water Management Initiative

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# PURPOSE

- Review OPPD's proposal for closure of GL 2004-02 for Fort Calhoun Station

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# Current Status

- Commitments to extend GL 2004-02 compliance to 2008 outage met
  - 1100 ft<sup>2</sup> strainer installed
  - TSP replaced with NaTB
  - Removed auto-start from one CS pump
  - Others
- Additional strainer testing required
  - Resolve issues from August 2005 testing to size strainer
  - No chemical effects testing conducted

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# Principal Unresolved Issues

- Downstream Effects on Fuel
  - Industry plan proceeding towards resolution
- Chemical Effects
  - Blockage of strainer by coating of fibrous bed on the surface of strainer with precipitants formed by chemical reactions
  - Resolution is probably plant specific

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# Interpretation of Completed Chemical Effects Testing

- 1-2 grams of the chemical precipitant can essentially stop flow through one square foot of a fiber covered strainer
- Chemical precipitants will pass through a strainer without a fiber bed

# Sources of Fiber and Chemical Precipitants at Fort Calhoun

## Fiber

- Calcium Silicate
  - Asbestos and Cellulose Fibers
- Fiberglass, Temp-Mat and NUKON
  - Glass Fibers
- Testing in 2005 completely covered strainer

## Chemical Precipitants

- Sodium Aluminum Silicate
- Aluminum Oxyhydroxide
- PWROG model predicts formation of ~600 kg

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# Chemical Effects Resolution Options

- Reduce the amount of precipitant predicted by the PWROG model
  - Testing has shown silicon inhibits the corrosion of aluminum
  - Westinghouse anticipates silicon inhibition could result in a 50-90% reduction in predicted precipitant
    - Maximum reduction could leave FCS with 60 kg of precipitant
    - May be sufficient amount to block strainer

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# Chemical Effects Resolution Options

- Remove aluminum from containment
  - Principle sources are detector well and containment coolers (75%) and aluminum jacket on calcium silicate insulation
- Remove sufficient insulation to maintain a portion of the strainer free of a fiber bed
  - Requires removal of calcium silicate containing asbestos

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# Chemical Effects Resolution Options

- Build sufficiently large strainers to maintain a portion of the strainer free of a fiber bed
  - Insufficient space in containment if CS pumps are used for recirculation
- Add a chemical that prevents formation or intake of the chemical precipitants
  - No chemicals identified for service in a radiation environment

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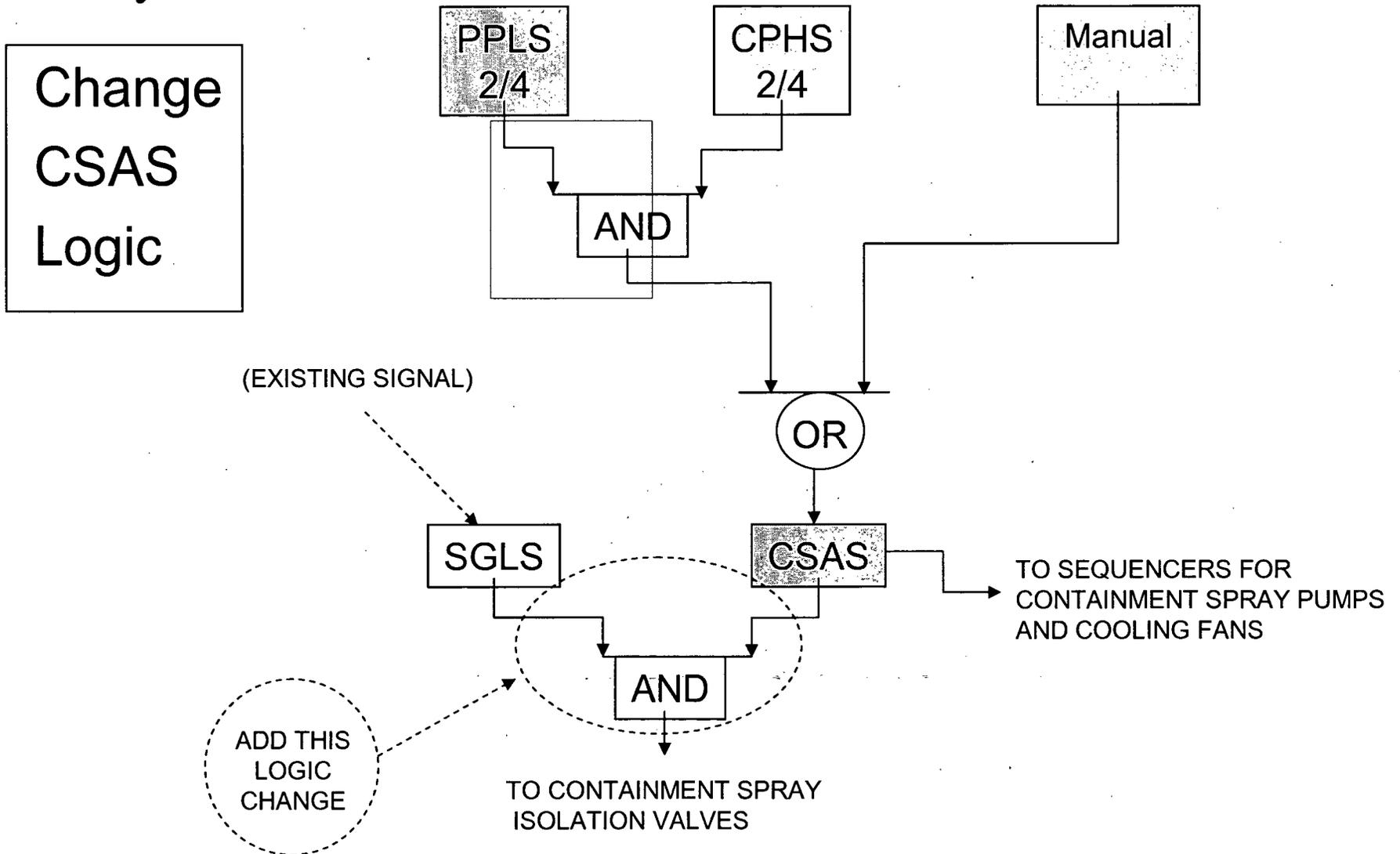
# Chemical Effects Resolution Options

- Build sufficiently large strainers and remove sufficient insulation to maintain a portion of the strainer free of a fiber bed
  - Viable but potentially expensive
  - Uncertainty associated with “debris free” surface
  
- Change ESFAS logic to eliminate CS on LOCA and run only HPSI during recirculation
  - Water Management Initiative

# Fort Calhoun Water Management Initiative

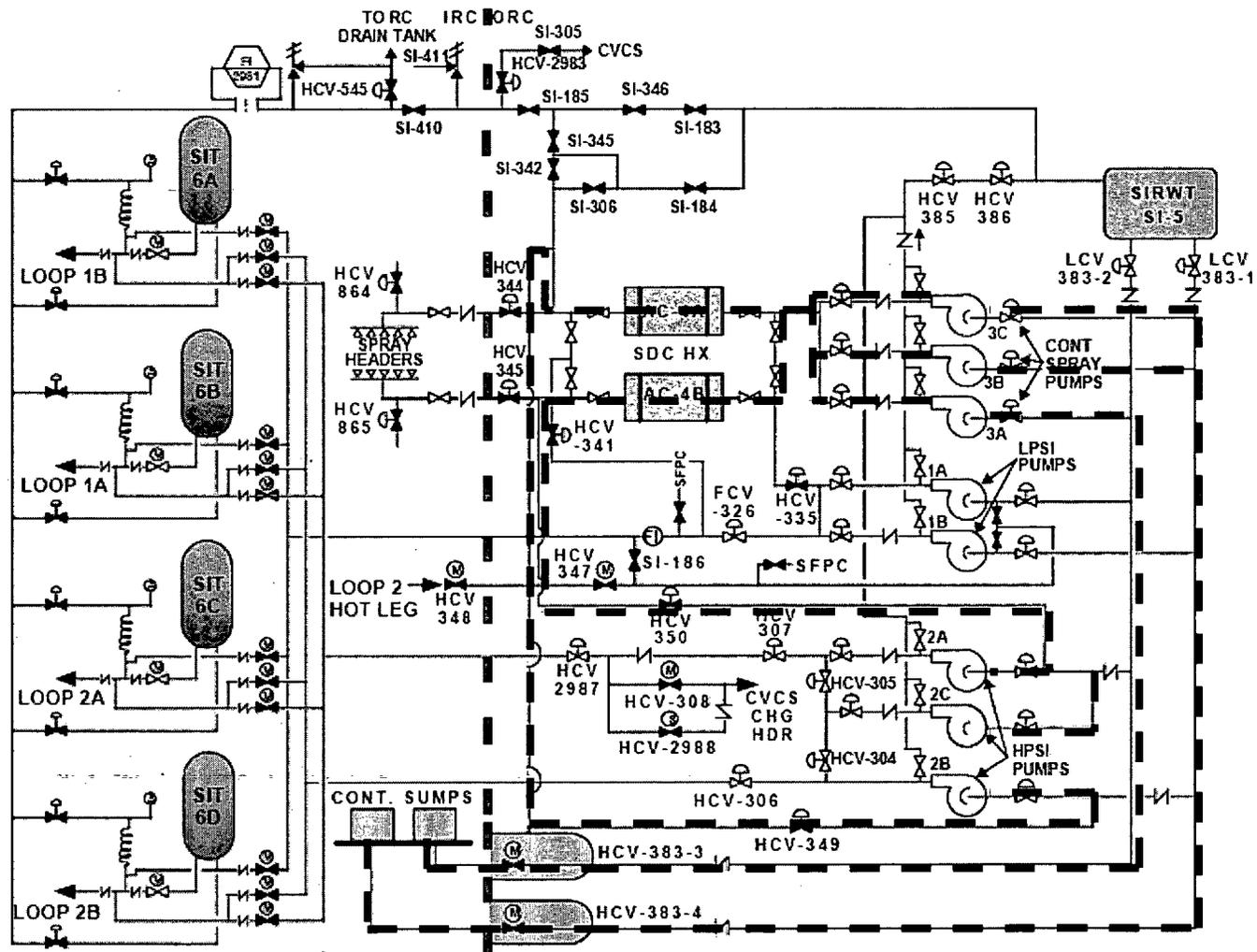
- Change ESFAS Logic and credit existing EOP guidance for cooled HPSI suction
- Licensing Issues
  - Hydrogen generation
    - Resolved with revision to 10 CFR 50.44
  - Post LOCA Containment Pressure and Temperature
  - DBA LOCA Offsite and Control Room Dose
- GL 2004-02 closure
  - Little debris transported to strainers

# Physical Modification



# Cooling of Sump Pool

Credit  
HPSI  
Cooled  
Suction



# Post LOCA Containment Pressure and Temperature

- GOTHIC model shows acceptable pressure response without CS
- Temperatures calculated using GOTHIC long term mass and energy release (M&E) model (AREVA topical BAW-10252) are overly conservative
  - Superheat calculated after transition from RELAP generated M&E
  - Model change required
- Methodology change may be required
- Anticipate staying within existing EQ envelope

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## DBA LOCA Offsite and Control Room

Dose

- Acceptable doses shown by crediting HEPA filter retention of aerosol iodines
  - HEPA filters tested in accordance with ASME N510-1980
  - Filter efficiency not tested since 100% recirculating system
  - Filter efficiency assumed in dose calculations will be justified

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# GL 2004-02 Closure

- Strainers to be designed and tested for HPSI recirculation flow (900 gpm)
  - CFD transport calculations show
    - Pool is essentially stagnant outside of steam generator bays
    - TKE insufficient to transport individual fibers to strainers
      - Less than 100% of individual fibers, dirt, dust, paint and Cal-Sil particulate will be transported
    - Velocities are at borderline of capabilities of model
  - Head loss testing, including chemical effects, is planned

# Flow Velocity – HPSI Only (1350 gpm)

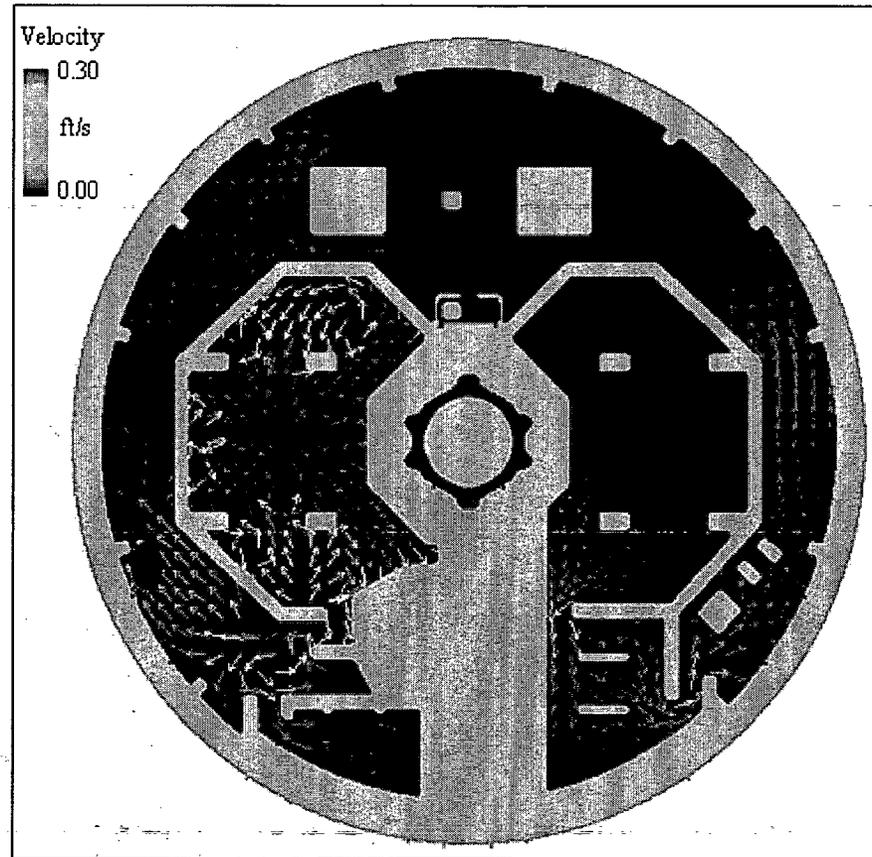
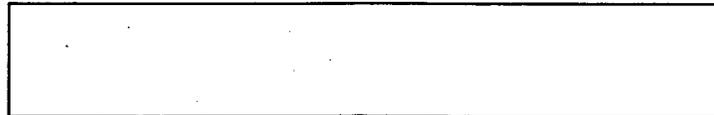
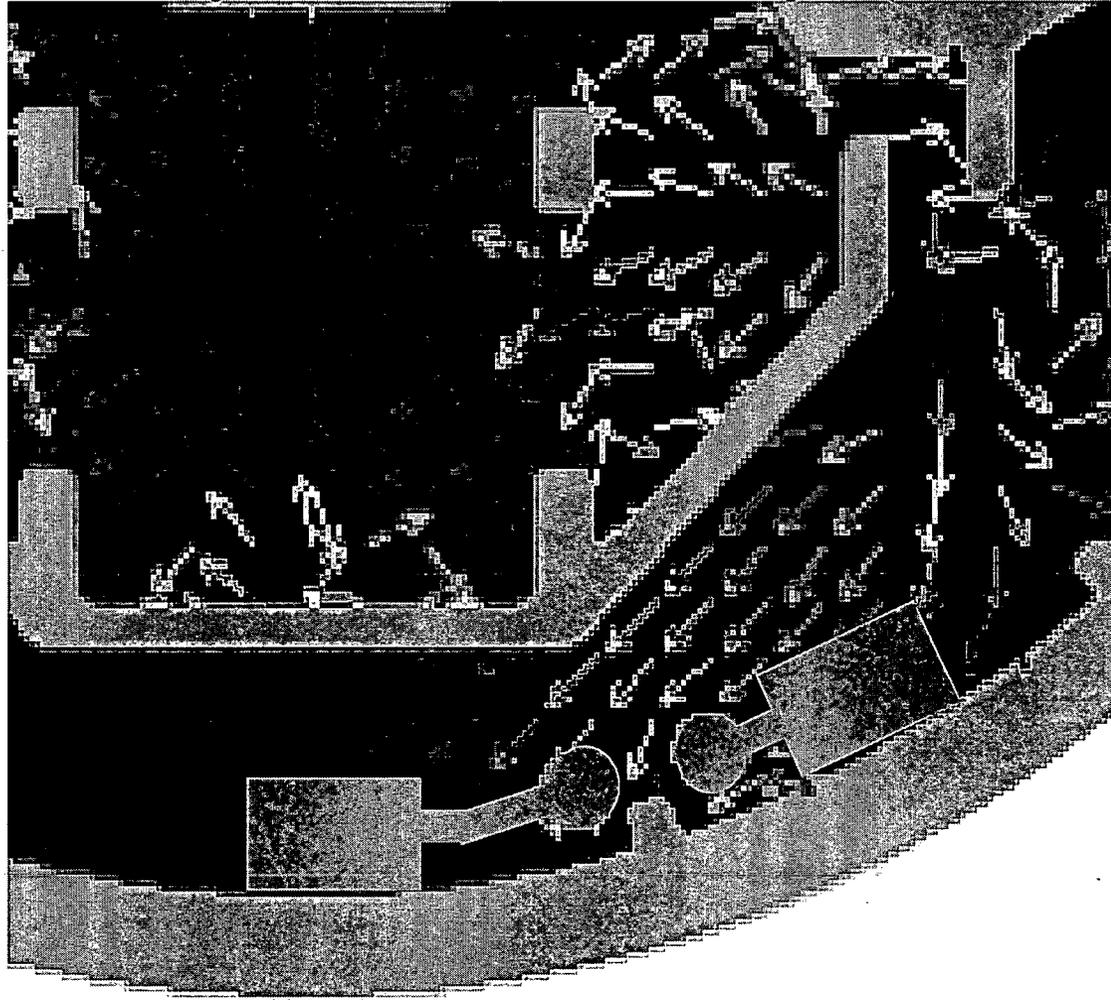
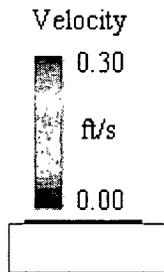


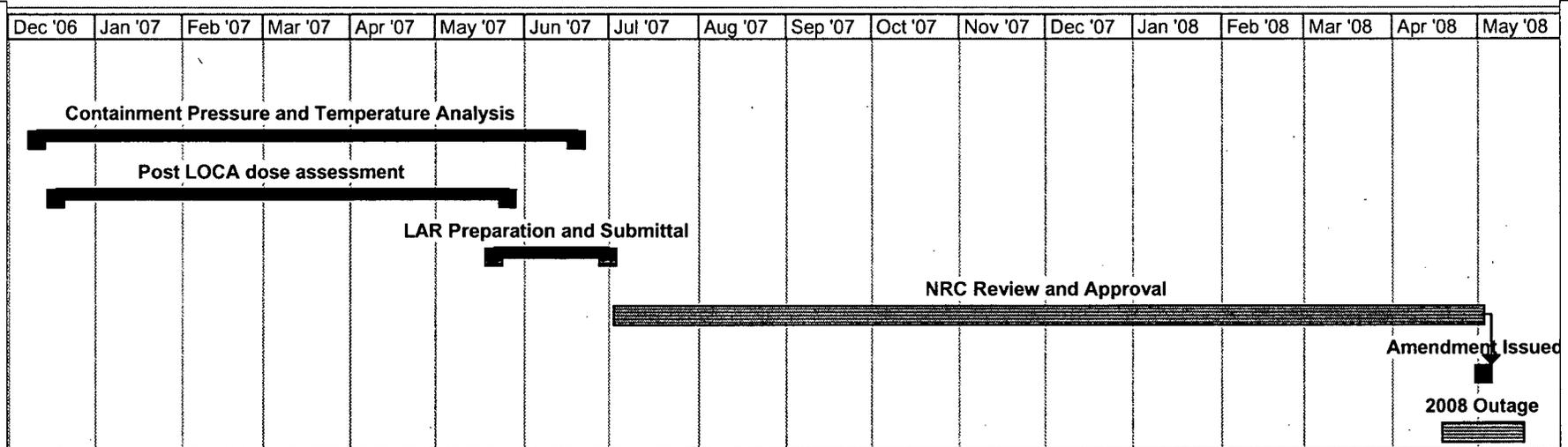
Figure 5-55 – Vector plot with velocity magnitude (Case 6)



# Flow Velocity - HPSI Only (1350 gpm)



# Water Management LAR Schedule



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# Permanent Change to NaTB Buffer

- Temporary change outstanding issue
  - Formation of calcium based precipitants
- Should be resolved as part of WCAP-16530-NP review

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# CONCLUSION

- Implementation of Water Management provides OPPD the best means of closing GL 2004-02