Davis-Besse Nuclear Power Station

New Containment Emergency Sump Design

Opening Remarks . . . .Gary Leidich

New Containment Emergency Sump ……….. Jim Powers

Closing Comments………………………….. Gary Leidich

Opening Remarks

Gary Leidich,
Executive Vice President - FENOC

Desired Outcome

- Present the new Containment Sump Design/Modification at Davis-Besse

- Obtain NRC comments on Davis-Besse approach

CEO of FirstEnergy has set the standard of returning Davis-Besse back to service in a safe and reliable manner

We must do the job right the first time and regain the confidence of our customers, regulators, and investors in our nuclear program

We are committed to meeting this challenge

Return to Service Plan

Restart Overview Panel

Restart Action Plan
Lew Myers

Reactor Head Resolution Plan
Bob Schrauder

Program Compliance Plan
Jim Powers

Containment Health Assurance Plan
Randy Fast

System Health Assurance Plan
Jim Powers

Restart Test Plan
Randy Fast

Management and Human Performance Excellence Plan
Lew Myers

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Return to Service Plan

- New Containment Emergency Sump Design is part of the Containment Health Assurance Building Block from the Davis-Besse Return to Service Plan

- Restore operability as well as add margin to Containment Emergency Sump

- Containment Emergency Sump Intake Screen is on the Davis-Besse IMC 0350 Restart List

Containment Emergency Sump Background

Jim Powers

Director - Nuclear Engineering

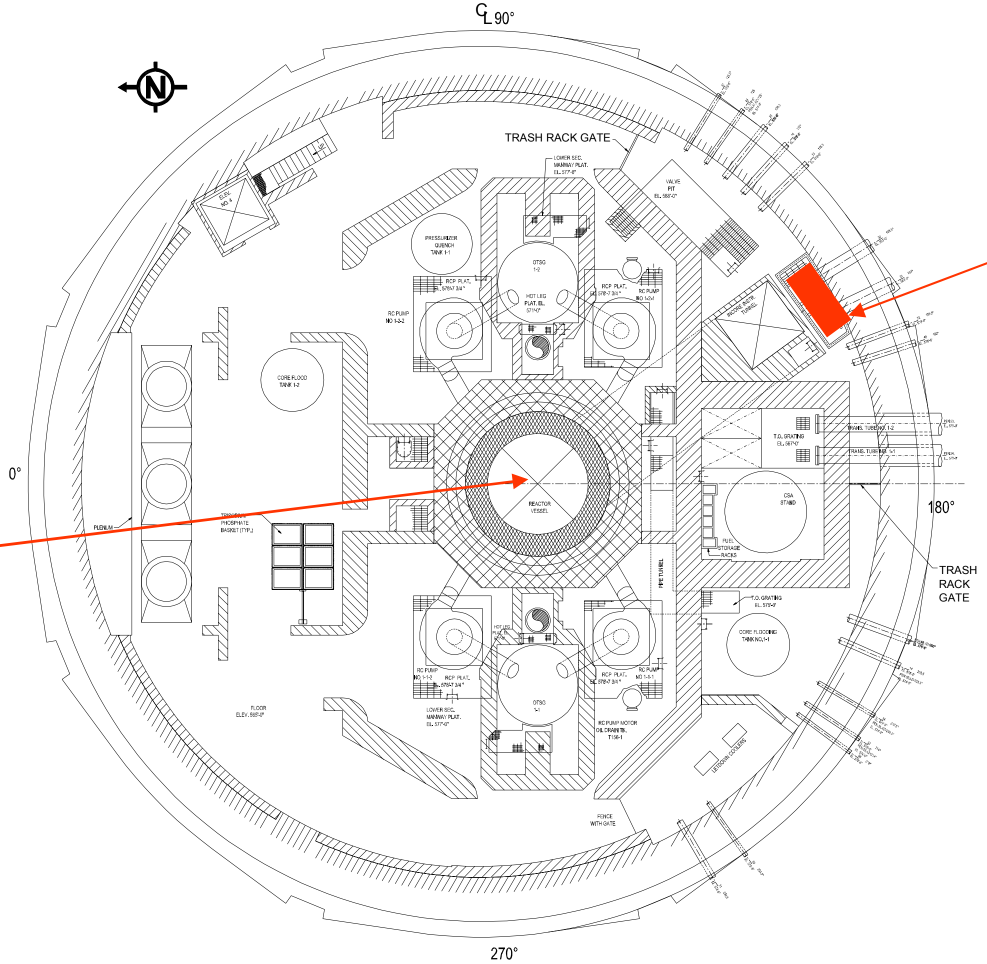
Strainer Function

- 10CFR50.46 (b)(5) and Appendix A to 10CFR50, Criterion 35 require long term emergency cooling
- Strainer protects Low Pressure Injection (LPI), High Pressure Injection (HPI) and Containment Spray(CS) systems from debris intrusion during a LOCA event

Original Containment Emergency Sump Configuration

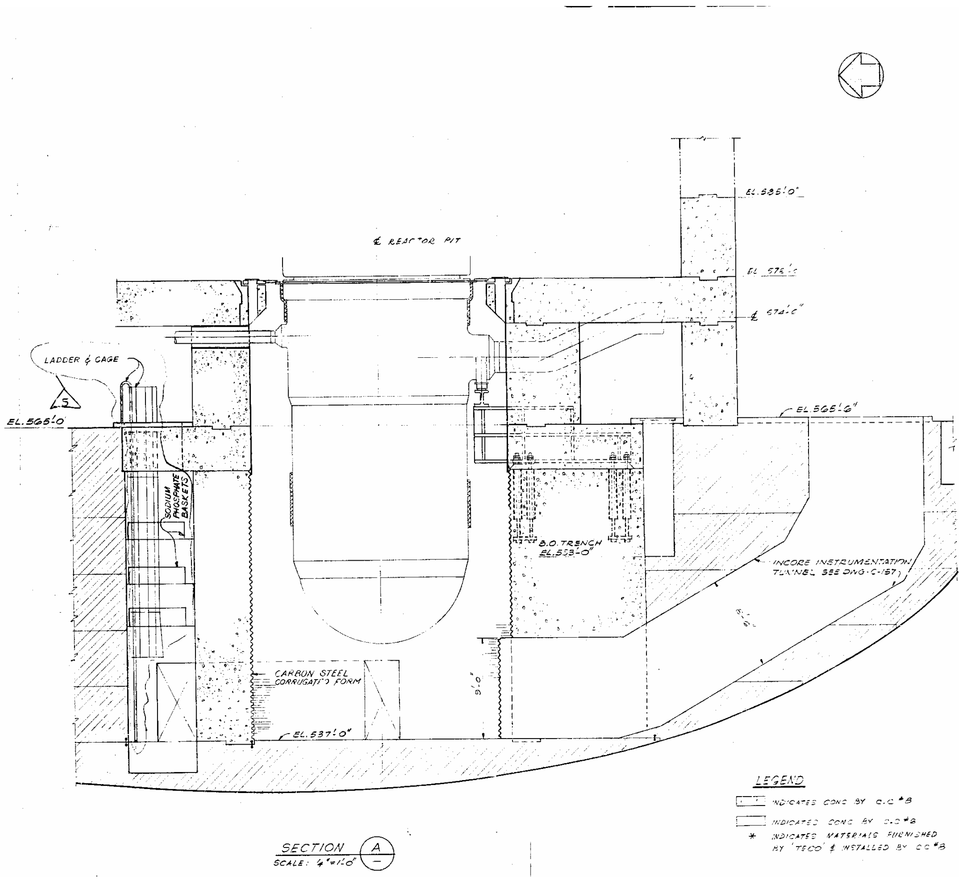
- Nominally 14 ft. X 5 ft. X 2 ft. (L x W x H)
- Approximately 50 sq. ft. available (vertical) surface area
- 1/4” square screen openings, galvanized wire - 53.4% open area
- Vortex Suppression with existing grating qualified by testing

Containment Building Drawing



ELEV. 565

Incore Tunnel



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Original Containment Emergency Sump

Original Containment Emergency Sump Strainer

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Original Containment Emergency Sump Strainer

Containment Emergency Sump Modification

Increase Net Positive Suction Head (NPSH) margin for Emergency Core Cooling System under design basis accident conditions

Containment Emergency Sump Discovery Action Plan

- Conduct reviews of the design basis of the sump
- Identify debris sources (NEI 02-01 guidance):
  - Containment walkdowns,
  - Coating evaluations, and,
  - Foreign material evaluations
- Evaluate the transport of debris to the sump screen
- Develop corrective actions to reduce debris sources
- Develop plan to significantly increase sump intake surface area

Preliminary Design Parameters for New Strainer

- Flow Rates
  - Low Pressure Injection (LPI) — 4000 gpm per train
  - Containment Spray (CS) — 1500 gpm per train
  - Total Strainer Design Flow — 11,000 gpm
- Minimum Water Level
  - Small Break LOCA — Elevation 566.76 ft. (1.76 ft. above floor)
  - Limiting Large Break LOCA — Elevation 566.83 ft. (1.83 ft. above floor)

Preliminary Design Parameters for New Strainer

- Net Positive Suction Head (NPSH) Margin

  (NPSH Margin = NPSH Available - NPSH Required)
  - Approximately 3 feet for LPI (before adding strainer/debris head loss)
  - Approximately 5 feet for CS (before adding strainer/debris head loss)

Note: No credit taken for containment over pressure above vapor pressure of water (Licensing Basis)

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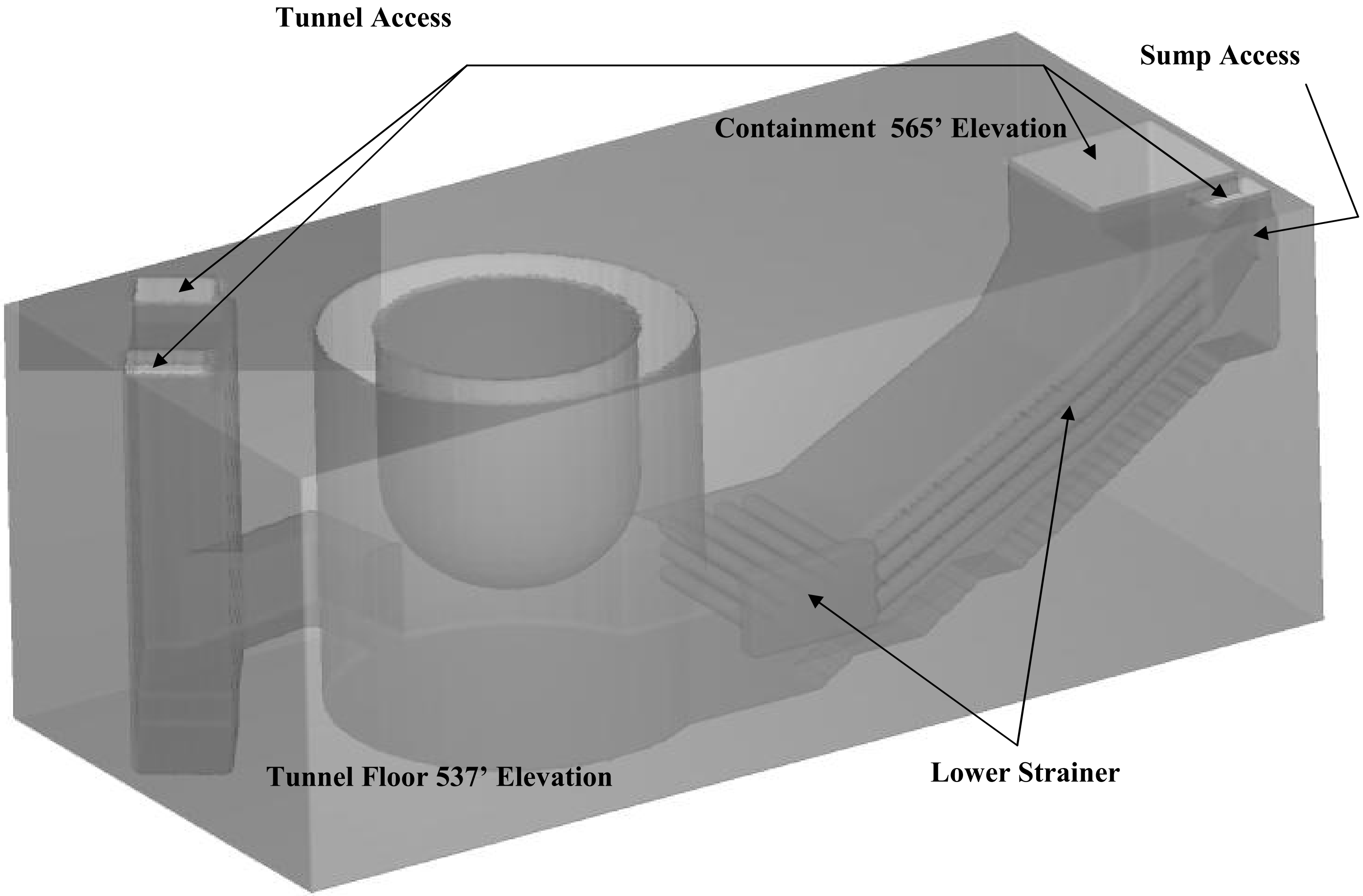
Design Goal

- Increase NPSH available
- Increase strainer surface area
  - Lower approach velocity
  - Lower head loss
- Increase margin
- Design based on conservative approach for debris generation, transport and head loss

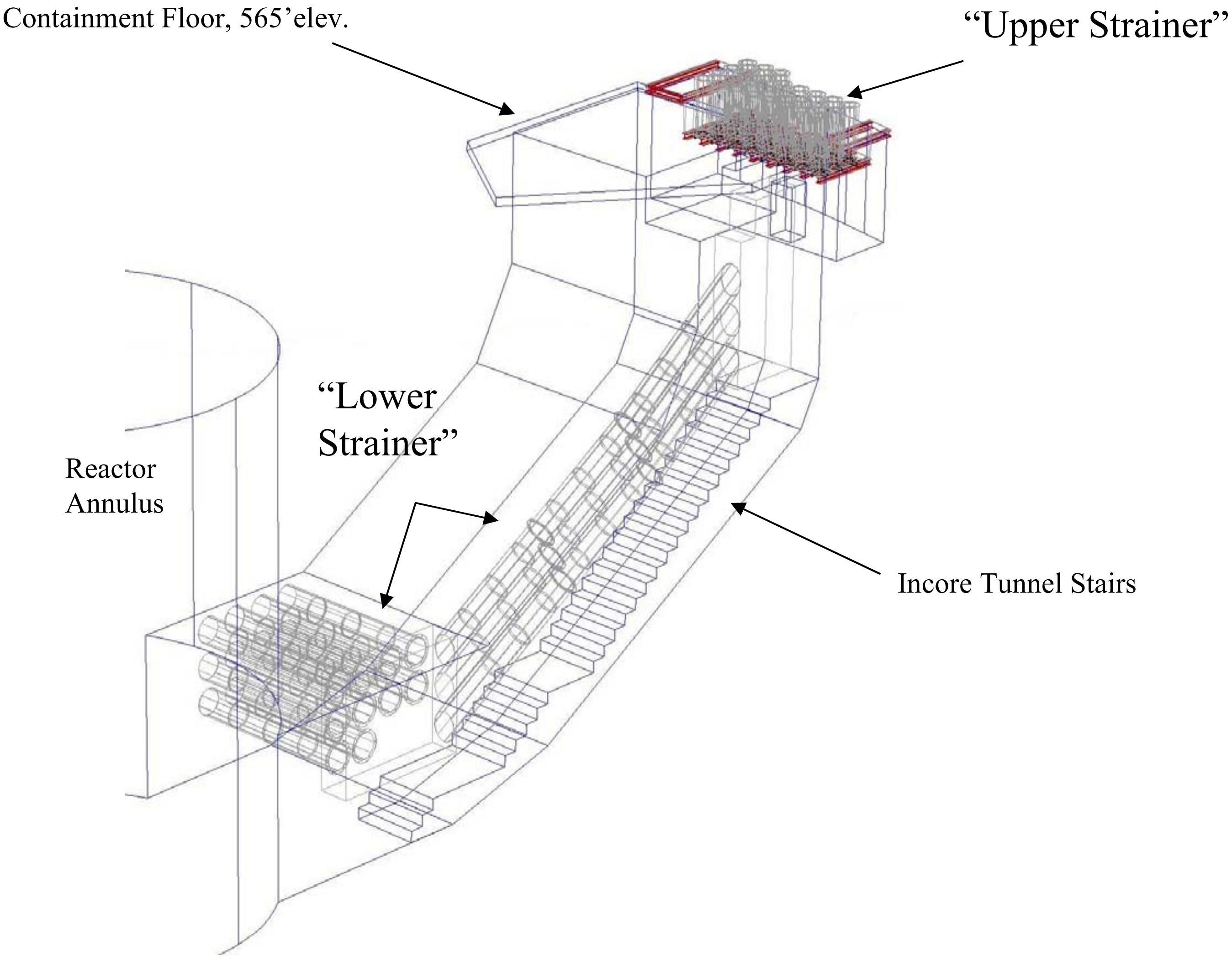
New Strainer Design

- Available surface area ~ 1200 sq. ft.
  - Upper strainer ~ 400 sq. ft.
  - Lower Strainer ~ 800 sq. ft.
- Strainer and supporting structure made from stainless steel
- Strainer made from 10 gauge perforated plate with 3/16" diameter holes with 41% open area
- Strainer designed to ASME Section III, Subsection NF Code to withstand 5 psi differential pressure
- Vortex suppression designed to the guidance of RG 1.82, Rev.2

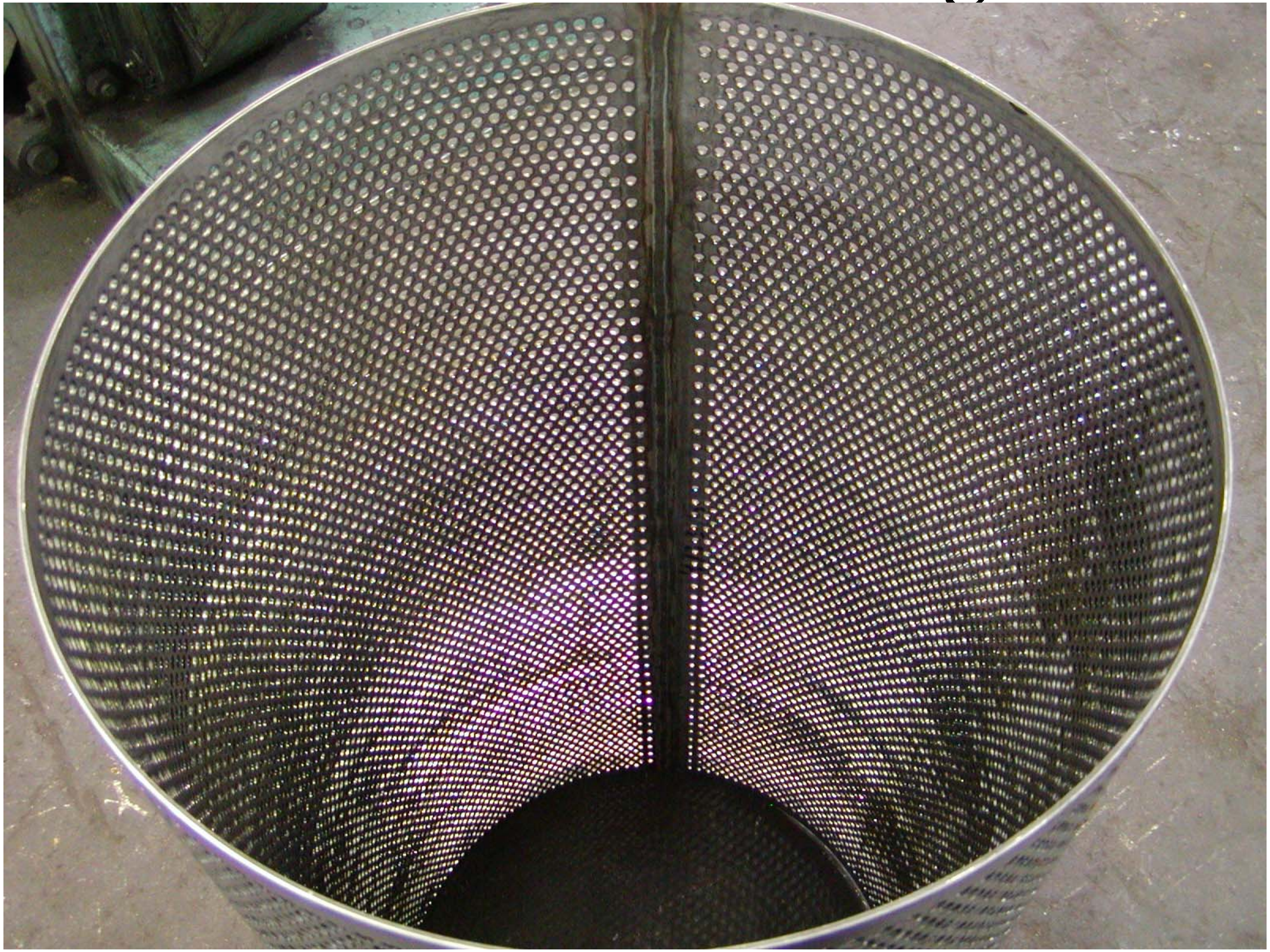
New Strainer Design



New Strainer Design



New Strainer Design



New Strainer Design

- New design facilitates two controlling pipe break scenarios
  - Hot Leg break at top of OTSG (Case I)
  - Hot Leg break at RPV (Case II)
- Case I generates largest volume of debris
  - Both upper and lower strainer sections available
- Case II generates smaller volume of debris
  - Upper strainer section available
  - No credit taken for lower strainer due to potential damage from pipe break blowdown

Debris Source Term

- NEI 02-01, "Condition Assessment Guideline: Debris Sources Inside Containment"
  - Conducted field walkdowns to collect plant specific data
- Methodology used:
  - BWROG Utility Resolution Guidance methodology (plus NRC comments)
  - Conservative Zone of Influence (ZOI)
  - 100% destruction of fibrous insulation in ZOI
  - 42% destruction of Reflective Metal Insulation (RMI) in ZOI
- Unqualified Coatings
  - Assumed 100% failure under Design Basis Accident

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Debris Source Term

- Pipe Breaks
  - Loss-of-Coolant-Accident (LOCA) locations per NRC's Standard Review Plan (MEB 3-1)
  - Pipe breaks on Reactor Coolant System included
  - Critical pipe breaks
    - Hot Leg break at top of OSTG (Case I)
    - Hot Leg break at RPV (Case II)

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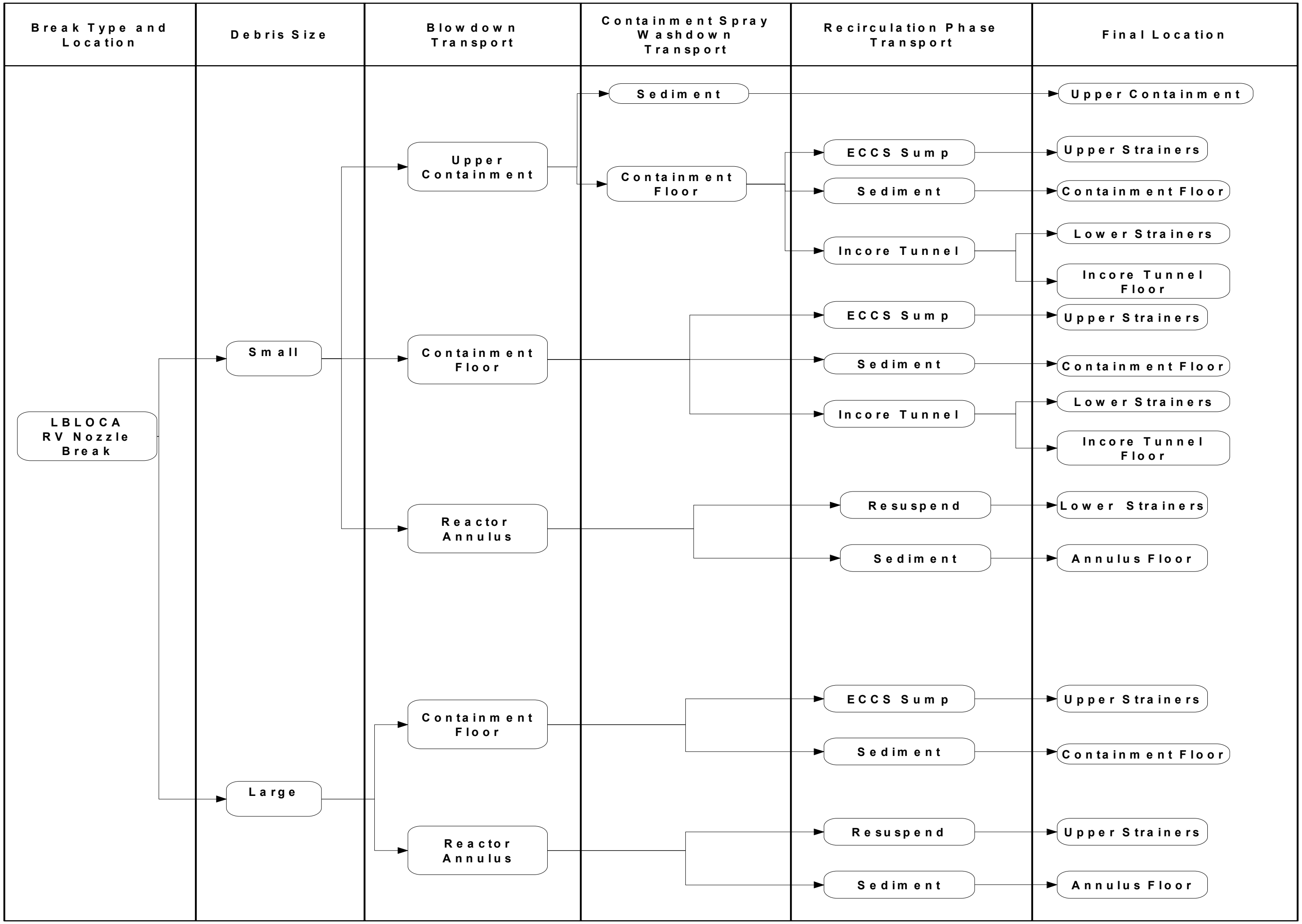
Debris Source Term

(Preliminary Results)

Debris Type	Case I	Case II
Fiber	42 ft^3	3ft^3
RMI Foils	67,700 ft^2	11,900 ft^2
Dust, Dirt, Concrete	475 lbs.	
Rust		159 lbs.
Coatings		
Inorganic Zinc		9620 ft^2 (577 lbs.)
Epoxy	9620 ft^2 (481 lbs.)	
Alkyds	3500 ft^2 (105 lbs.)	

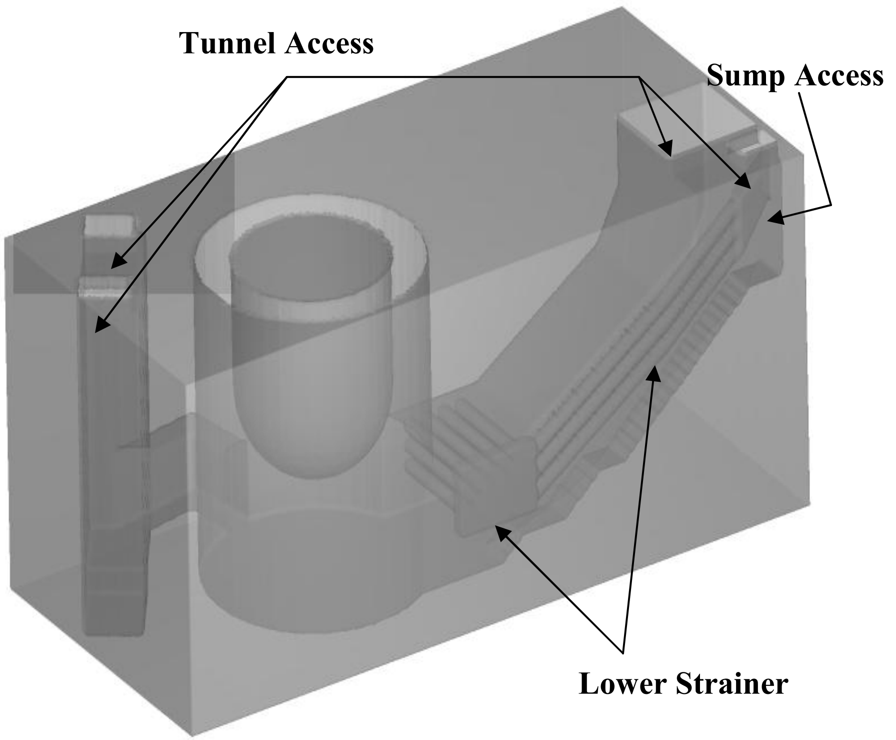
Sample Davis-Besse Debris Transport Logic Tree (Per NUREG/CR-6369) (RMI Transport)



Debris Transport

CFD Modeling of Davis-Besse Incore Tunnel

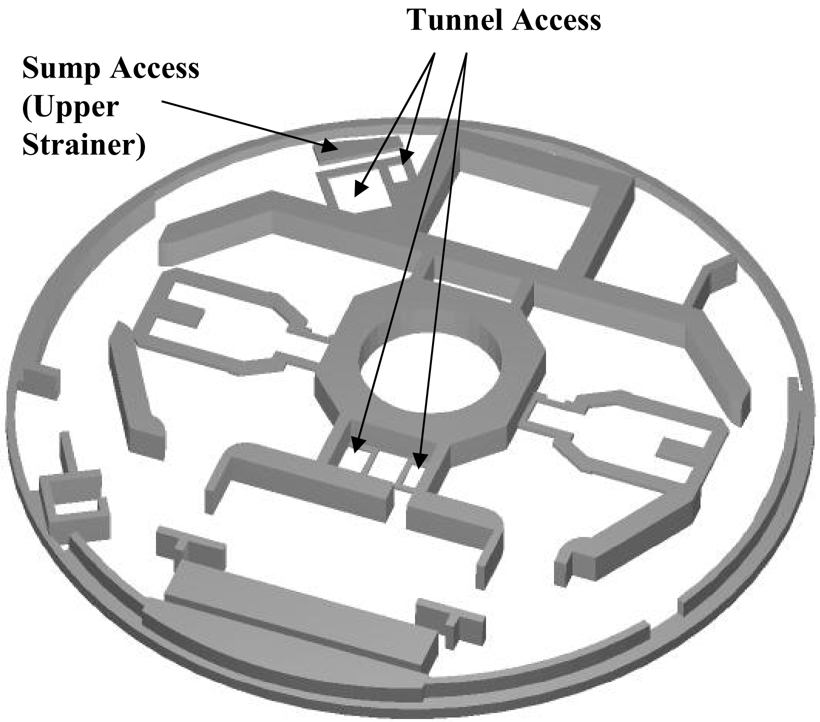
- All Significant flow paths modeled
- Interactions between access tunnels and containment floor
- Strainers incorporated
- Models movement and settling of debris
- Computational cells ~ 2,000,000



Debris Transport

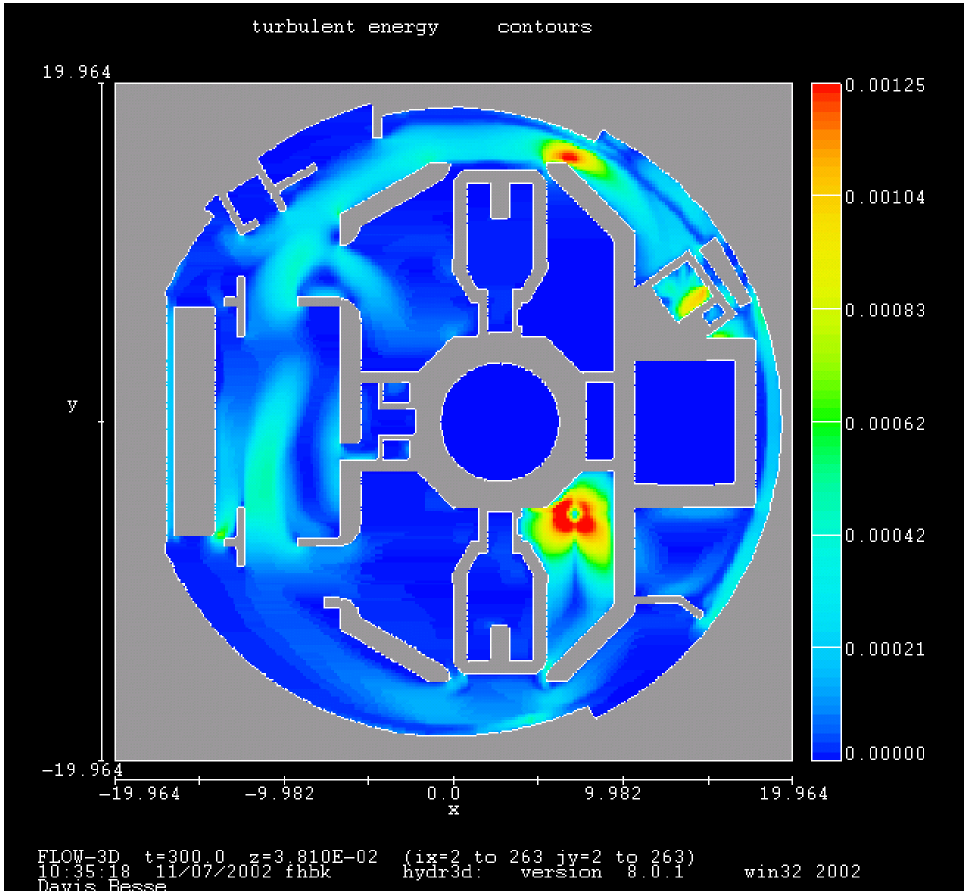
CFD Modeling of Davis-Besse Containment Floor

- All significant flow obstructions modeled
- Interactions between containment floor and incore tunnel
- Emergency sump and strainers incorporated
- Movement and settling of debris is modeled
- Computational cells ~ 500,000



Example
RMI Transport Model - Turbulence
CFD Analysis of Davis-Besse Containment Floor

- Red: Turbulence > RMI debris suspended
- Break on lower right
- Flow: 11,000 gpm
- Pool height: 2 feet
- Elevation: +1.5 inches above floor level



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Design Summary

- New strainer features greatly increased surface area
- Preliminary calculations indicate that Emergency Core Cooling System pumps will have NPSH margin under Design Basis Accident debris loading

Closing Remarks

Gary Leidich,
Executive Vice President - FENOC