

Calvert Cliffs GSI-191 Program

Chemical Effects Testing Update
Option 2b Closure Approach

August 2015



Exelon Generation®

Agenda

- Introductions
- Objectives for Meeting
- Discussion of Chemical Effects Test Plans
- Discussion of Option 2b Simplified Risk-Informed Closure Plan
 - Refined Debris Generation Topics
 - Strainer Head Loss Testing
 - Strainer Head Loss Correlation
- Staff Questions & Concerns
- Schedule for Future Periodic Meetings

CCNPP Attendees

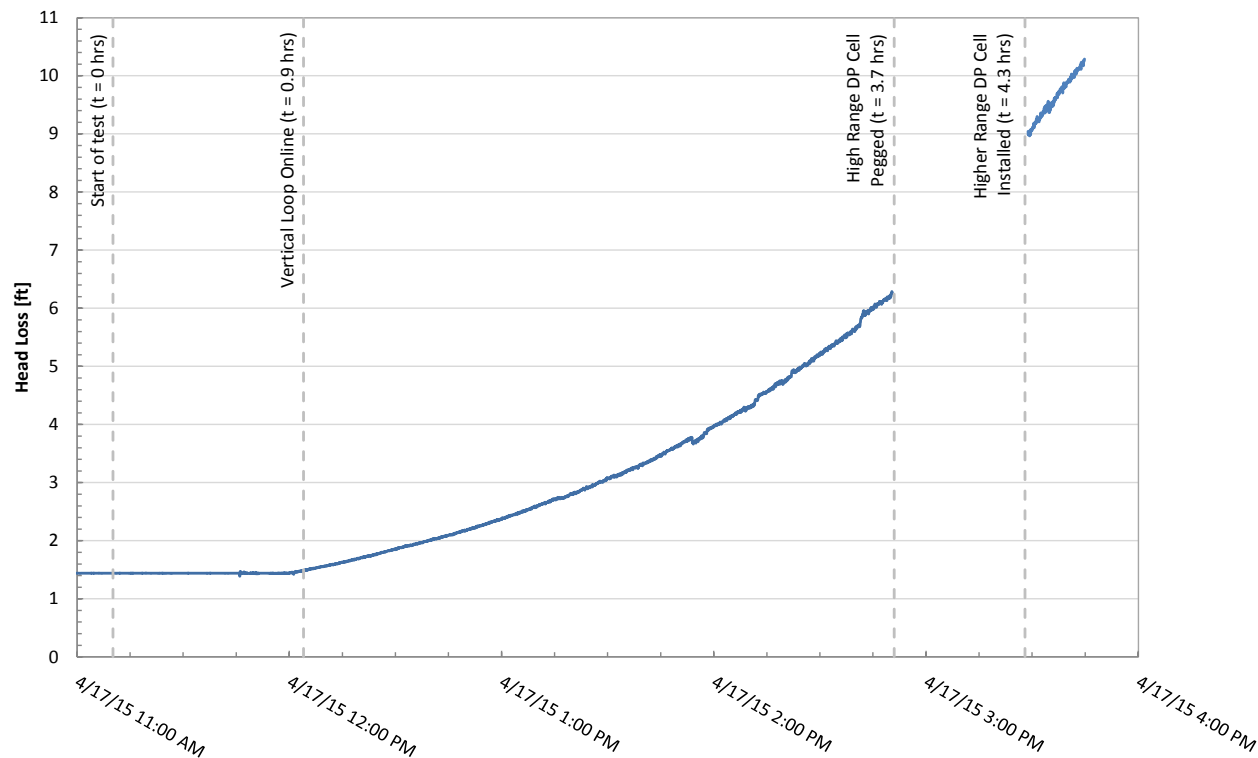
- Andre Drake – Lead Responsible Engineer GSI-191
- Anne Elliott – Mechanical Design Engineer
- Ken Greene – Licensing Engineer
- Craig Sellers – Project Manager GSI-191
- Steve Kinsey – Chemical Effects Testing
- Eric Federline – Project Support & Testing

Objectives of this Meeting

- Status of CHLE Testing
- Status of Risk-Informed Approach
 - Refined Debris Generation Topics
 - Strainer Head Loss Testing
 - Strainer Head Loss Correlation
- Capture Staff Issues and Concerns
- Discuss Next Steps

Status of CHLE Testing

- First Integrated Test Initiated April 17, 2015
- Detector Bed Head Loss Immediately Started Increasing
- Head loss increased until the test was terminated
 - Started at 1.44 ft
 - Test terminated at 10.25 ft, and rising
- Test lasted approximately 4.6 hrs



Status of CHLE Testing (continued)

- Performed Multiple Investigatory Tests
 - Investigatory Head Loss Testing of Materials
 - Baked Nukon Binder Water – **Notable Head Loss Impact**
 - Unbaked Nukon Water – **No Notable Head Loss Impact**
 - Marinite Board – **Notable Head Loss Impact**
 - Dimetcote 9 IOZ Powder – **Notable Head Loss Impact**
 - Mineral Wool – **No Notable Head Loss Impact**
 - Chemical Analysis of Filtered Material
 - Mineral wool particles - Observed
 - Lead particles – Analyzing
 - Aluminosilicate Clay – Analyzing
 - Organic Material – Analyzing, Believed to be Binder from Fiberglass
- **Head Loss Increase Due to Particulate Migration to Debris Bed**
- Detector Debris Bed Significantly Smaller than Equivalent Installed Strainer
 - 2% of full strainer surface area
 - 12% of circumscribed strainer surface area
 - Much more susceptible to particulate head loss increase

Simplified Risk-Informed Approach

- Identify Applicable Strainer Chemical Effects Head Loss Test
 - WCAP-16530 Chemical Surrogates
- Identify Smallest Double-Ended Guillotine Break(s) that Generate Equivalent Quantity of Fine Fibrous Debris as used in Applicable and Acceptable Head Loss Test
- Smaller Breaks Acceptable Through Deterministic Analysis
- Larger Breaks Addressed Probabilistically (Risk-Informed)
- Two Independent Parallel Analysis Produced Same Positive Results
 - ETRANCO Influence Matrix Approach
 - ENERCON NARWHAL Analysis

Refined Debris Generation Topics

- Debris Size Distribution for Mineral Wool and Generic Fiberglass
 - CCNPP Has Assumed Mineral Wool and Generic Fiberglass Debris was 100% Fines
 - CCNPP Desires to Use a 4-Size Debris Distribution for these insulation types
 - Fines, Small Pieces, Large Pieces, and Intact Pieces
 - NRC Accepted 4-Size Debris Distribution for these insulation types at Indian Point [ML082050433, ML093290316, and ML101170237]
 - Mineral wool and generic fiberglass have higher density than NUKON and Thermal Wrap
 - Less Mineral wool and generic fiberglass debris than NUKON and Thermal Wrap
 - CCNPP Insulation Densities
 - NUKON & Thermal Wrap: 2.4 lbm/ft³
 - Mineral Wool: 8 lbm/ft³
 - Generic Fiberglass: 3.5 lbm/ft³ to 5.5 lbm/ft³
 - **Mineral Wool and Generic Fiberglass Higher Densities than NUKON and Thermal Wrap**
 - CCNPP Debris Quantities
 - NUKON & Thermal Wrap: 1,902 ft³ - 4,565 lbm
 - Generic Fiberglass: 248 ft³ - 1,363 lbm (based on 5.5 lbm/ft³ maximum density)
 - Mineral Wool: 61.5 ft³ - 492 lbm
 - **Mineral Wool and Generic Fiberglass Smaller Quantities than NUKON and Thermal Wrap**

Strainer Head Loss Testing

- CCNPP Conducted 7 Strainer Head Loss Tests in 2010
 - Tests included WCAP-16530 Chemical Precipitate Surrogate
- Test #1 Included Fine and Small Fibrous Debris
 - Maximum Head Loss 1.75 inches of water
 - Non-Uniform Debris Deposition
 - Conclusion: Testing with Small Pieces is Non-Conservative



Strainer Head Loss Testing (continued)

- Remaining Tests Used Only Fine Fibrous Debris
 - Full load of particulates and precipitates
 - Test for Success Campaign
 - Break-throughs experienced during each test



Picture 27: Debris layer without precipitate



Picture 28: Debris layer at approximate 75 mbar head loss



Picture 30: Underwater picture of breakthrough

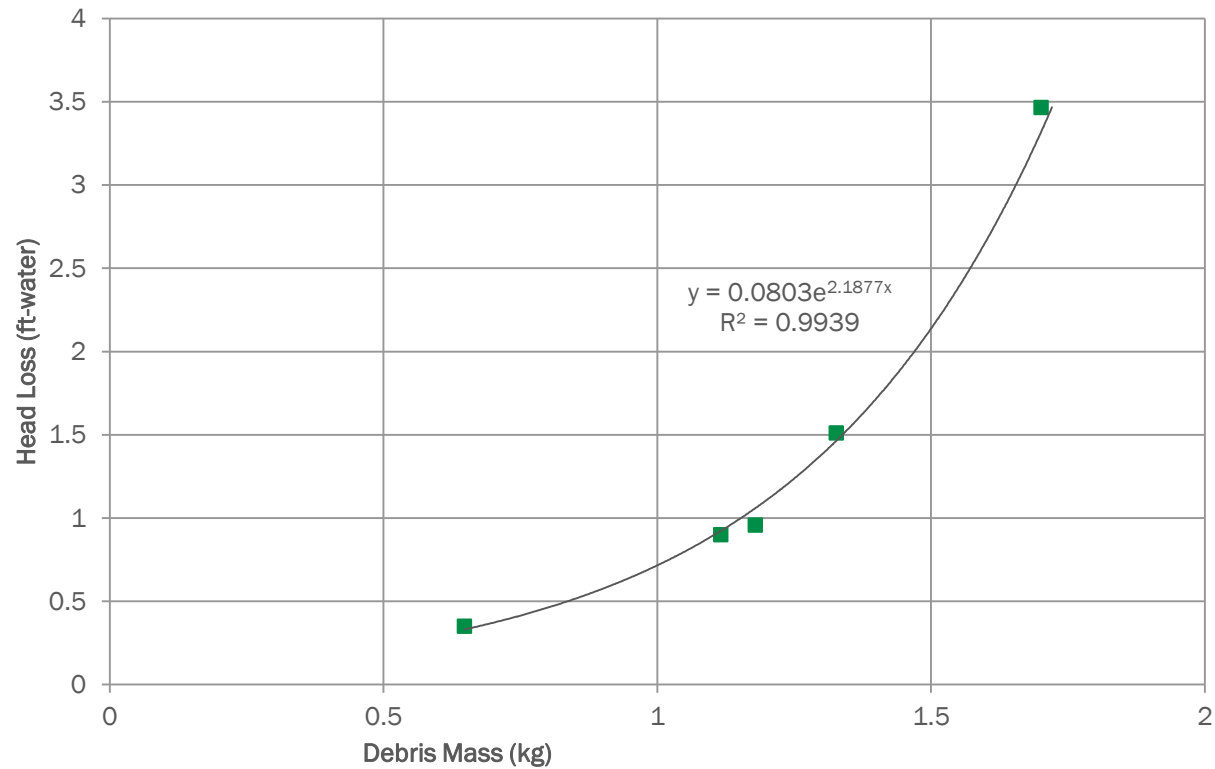
Strainer Head Loss Testing (continued)

- Tests included same insulation types as installed in plant
 - EXCEPT no mineral wool was included in tests
 - Test for success campaign based on multiple insulation replacement schemes all of which included 100% replacement of mineral wool
- Significantly larger particulate load used in test.
 - CCNPP particulate source term reduced since 2010
- Mineral wool <10% of fiber debris source term
- CHLE investigatory tests showed no notable head loss impact from mineral wool

Strainer Head Loss Correlation

- Plot of Head Loss –vs- Fiber Mass produces well correlated curve fit
- Plot includes clean strainer head loss

Head Loss Data - Test Data + Clean Screen



Questions/Concerns

- Jointly Review Issues, Questions, and Concerns for Future Communication

Next Steps

- Update Debris Generation Calculations
- Present Risk-Informed GSI-191 Analysis Results
- Desire Next Meeting – October 2015