



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 6, 2013

LICENSEE: Calvert Cliffs Nuclear Power Plant, LLC

FACILITY: Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2

SUBJECT: SUMMARY OF AUGUST 28, 2013, MEETING WITH CONSTELLATION ENERGY GROUP, INC., TO CONTINUE DISCUSSIONS ON THE PROPOSED RISK-INFORMED APPROACH TO THE RESOLUTION OF GENERIC LETTER 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS" WITH A FOCUS ON CHEMICAL EFFECTS TESTING AND SUMP STRAINER BYPASS (TAC NO. MC4672 AND MC4673)

On August 28, 2013, a Category 1 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) and representatives of Constellation Energy Group, Inc., the licensee at NRC Headquarters, Three White Flint North, 11601 Landsdown Street, Rockville, Maryland. The purpose of the meeting was to discuss the licensee's proposed risk-informed approach to the resolution of Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors (PWRs)" with a focus on chemical effects testing and sump strainer bypass for Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (Calvert Cliffs). The meeting notice and agenda, dated August 14, 2013, is available in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML13226A090. A list of attendees is provided as Enclosure 1, but may not be all inclusive.

The licensee discussed (1) the coating bench top autoclave experiment test plan; (2) chemical effects phenomena identification and ranking table (PIRT) items; (3) the debris bypass/penetration Test Plan; and (4) future periodic meetings. (See Enclosure 2).

Discussion of Coating Bench Top Autoclave Experiment Test Plan

1. The NRC staff asked the licensee to confirm that any conclusions about plant-specific coatings drawn from tests performed for other licensees are applicable to the coatings in service at Calvert Cliffs.
2. The coatings document stated that aluminum may have been added in flat or "leaf" form to some epoxy coatings used in reactor containment buildings. The NRC staff expressed concern that this could result in a significant source term of aluminum not identified by a licensee. The licensee's contractor stated that the nuclear industry considered these types of coatings early on in the process of reviewing containment materials. The NRC staff's expectation is that licensees would review their plant specific coating systems and account for any aluminum that may be exposed to the environment following an accident.

3. The licensee's representatives stated that the coatings autoclave tests of unqualified coatings will include plant-specific coatings to ensure they are representative.
4. The NRC staff and the licensee discussed whether the types and quantities of species that may leach from a new coating in an autoclave test would be representative of a coating in service for many years at the plant. The licensee thinks the newly applied coating would leach a conservative amount of organic material relative to a coating that has been in service for many years. The NRC staff agreed that freshly applied coatings would likely result in a more conservative test. The licensee stated that they would consider thermal aging of the coatings to reduce the conservatism, but would ensure that any such aging would not result in a non-conservative test.
5. In addition to characterizing materials that may leach from the coatings during autoclave testing, the NRC staff stated that it would be appropriate to evaluate whether unqualified coatings could break down during testing and affect head loss in a similar manner to a precipitate. The NRC staff concern was not that the coatings would be particulate debris, since that is already accounted for, rather that the coatings could become softened or gelatinous in nature. Therefore, the NRC staff and the licensee discussed whether it would be appropriate at some point (e.g., at the test conclusion) to filter a sample of autoclave fluid. The licensee agreed some type of filtering may be appropriate for the test protocol.
6. The licensee stated that they were re-evaluating the use of stainless steel coupons as a substrate for coatings. While this material was originally selected due to excellent corrosion resistance, questions about coating bonding may result in another material being used in the tests.

Discussion of PIRT Considerations

7. Prior to discussing the open items from the chemical effects PIRT, the NRC staff provided some overall context to the NRC staff's March 2011 PIRT disposition document (ADAMS Accession No. ML102280594). The goal of this document was to determine whether the NRC should sponsor additional research for any of the remaining chemical effects expert panel PIRT open items. At that time, all plants were assessing chemical effects in a deterministic manner. For some items, the NRC staff used the conservatism built into existing chemical effects evaluations to balance remaining uncertainties and conclude that no additional research was needed. Uncertainties related to chemical effects evaluations become more significant as conservatisms are removed.
8. NRC Staff clarified that agreement between the NRC staff and a licensee that a PIRT item is being addressed does not mean that the NRC staff will not have additional questions related to that item during the evaluation of a test method or a test facility. For example, the NRC staff and industry agree that pH variability, or a range of plausible post-loss-of-coolant accident (LOCA) pool pH values, needs to be considered. In this example, the NRC staff will be looking for Calvert Cliffs to explain the basis for any test pH values and demonstrate how the entire range of plausible post-LOCA pH values is being evaluated.

9. From the NRC staff's perspective, PIRT questions related to radiological effects can be grouped into two categories:
 - Effects of radiation on the post-LOCA cooling water (examples – lowering of pH by radiolysis, increased oxidizing agents such as hydrogen peroxide).
 - Effects of radiation on physical and chemical properties (examples could include radiation affecting the structure or properties of formed precipitates or potentially causing embrittlement of fibers affecting debris bed properties).
10. The NRC staff stated that the treatment of radiation related PIRT items may depend on the Calvert Cliffs chemical effects evaluation approach. For example, for a deterministic evaluation the NRC staff precedent has been to balance this uncertainty with known conservatism in the chemical effects evaluation. Therefore, NRC staff will need to clearly understand where conservatism has been built into the plant-specific deterministic evaluation. For a risk-informed chemical effects evaluation, effects of radiation are an additional uncertainty that will need to be considered in the risk informed evaluation. It is not clear to the NRC staff at this point how this will be factored into the staff's review. The NRC staff has recently started a review on a risk informed pilot plant and we expect that the pilot will establish a precedent for risk informed evaluations.
11. With respect to the PIRT Item related to coatings dissolution, the NRC staff stated that the Calvert Cliffs autoclave tests of unqualified coatings are expected to address this open item.
12. Based on the planned plant-specific chemical effects testing supporting the Calvert Cliffs evaluation, the NRC staff has no more questions related to PIRT items on Inorganic Agglomeration or Organic Agglomeration.

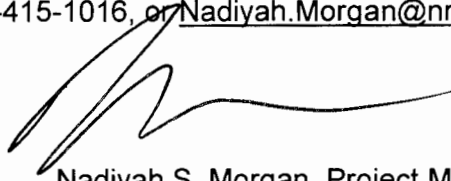
Discussion of Debris Bypass/Penetration Test Plan

13. The NRC staff stated that the test plan considers aspects of testing considered important by the NRC.
14. The NRC staff stated that it has not been adequately shown that water chemistry does not affect bypass measurements. Given a lack of mechanistic understanding concerning how water chemistry affected head loss, the single sensitivity study by South Texas Project does not provide adequate evidence for universal acceptance of non-sensitivity of debris bypass to water quality.
15. The NRC staff stated that the test plan discussion of debris type ignores some properties that may affect bypass. Length, flexibility, and potentially other properties may have a significant effect on fiber bypass. The NRC staff noted that mineral wool has been noted to bypass at higher percentages than Nukon. The NRC staff does not understand why Nukon is conservative compared to Thermal Wrap based on fiber diameter. Nukon has a larger diameter than thermal-wrap, and therefore, may be less likely to bypass if diameter is the controlling characteristic. The NRC staff requested that the licensee provide additional justification as to why Nukon is an acceptable surrogate for all fiber types. The basis for excluding Temp-Mat and mineral wool should be expanded.

16. The NRC staff stated that they had observed fine fiber prepared using the Nuclear Energy Institute (NEI) methodology that appeared to be excessively agglomerated or inadequately fragmented during preparation. The NRC staff stated that to ensure consistency with assumptions in the NEI 04-07 guidance, fine fiber preparation should generate a majority of class 2 fibers.
17. The NRC staff stated that the debris filtering relationship is only valid if the debris is mixed homogeneously in the water at the start time, remains homogeneously mixed, and does not settle. The relationship does not evaluate shedding which may or may not be important depending on how the relationship is applied. Shedding may vary with debris amount on the strainer. Based on the response to the item below, the NRC staff concluded that there would be adequate time between filter changes and fiber additions to ensure accurate test results.
18. The NRC staff questioned when filter changes would be made with respect to the batch introductions. The licensee stated that there are 15 turnovers and three filter changes, after each of the first 3 batches, and prior to the next batch being introduced. Based on that schedule, the NRC staff concluded that there would be adequate time to capture all but insignificant amounts of debris, if settling does not occur during the test. If settling occurs more time may be required to remove most of the debris.
19. The NRC staff stated that the assumptions that two 1/8 inch batches will cover the strainer completely should either be verified during testing or by previous testing, if it is important to the methodology.
20. The NRC staff stated that after initial preparation, the debris should be treated (e.g. stirred adequately) to ensure lack of agglomeration when added to the test.
21. The NRC staff noted that some of the acceptance criteria for parameters controlled or measured during the test may be difficult to attain.
22. The CENG representatives noted that some of the issues discussed during the meeting may be resolved by the industry testing that was performed to evaluate the characteristics of debris that bypasses a strainer.

Members of the public were not in attendance. Public Meeting Feedback forms were not received.

Please direct any inquiries to me at 301-415-1016, or Nadiyah.Morgan@nrc.gov.

A handwritten signature in black ink, appearing to be 'Nadiyah S. Morgan', written over the email address in the line above.

Nadiyah S. Morgan, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosures:

1. List of Attendees
2. Licensee Handout

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LIST OF ATTENDEES

AUGUST 28, 2013, MEETING WITH CONSTELLATION ENERGY GROUP, INC.

CHEMICAL EFFECTS IN RISK-INFORME GL 2004-02 RESOLUTION

CALVERT CLIFFS NUCLAR POWER PLANT, UNIT NOS. 1 AND 2

NAME	ORGANIZATION
Nadiyah Morgan	NRC
Paul Klein	NRC
Matt Yoder	NRC
Stephen Smith	NRC
John Burke	NRC
Emma Wong	NRC
Gloria Kulesa	NRC
John Swailes	CENG
Craig Sellers	Enercon Services, Inc.
Ken Greene	CENG
Josh Wargo	MPR Associates, Inc.
Tom Konerth	CENG
Anne Lederer	CENG
Gilbert Zigler	Enercon Services, Inc.
Jon Cavallo	Underwater Engineering Services, Inc.
Time Sande	Enercon Services, Inc.

CENGSM

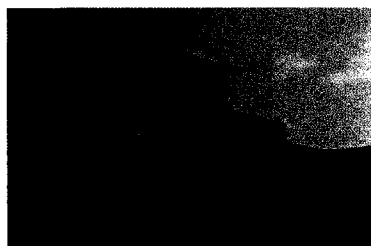
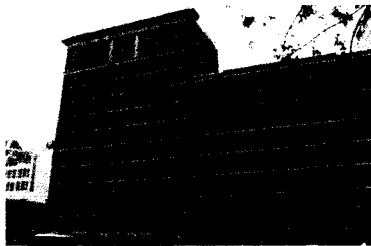
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**Constellation
Energy**



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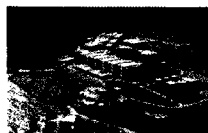
Calvert Cliffs Chemical Effects in Risk- Informed GSI-191 Resolution

Fifth Discussion With NRC Staff
August 28, 2013

Enclosure 2

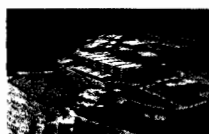
Agenda

- Introductions
- Objectives for Meeting
- Discussion of Chemical Effects PIRT Items
- Discussion of Alkyds Autoclave Test Plan
- Discussion of Debris Bypass/Penetration Test Plan
- Other Items
- Schedule for future periodic meetings



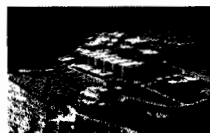
CCNPP Attendees

- Tom Konerth – Supervisor Mechanical Design
- Anne Lederer – Mechanical Design Engineer
- Ken Greene – Licensing Engineer
- John Swailes – Project Manager GSI-191
- Craig Sellers – Project Manager RI GSI-191
- Jon Cavallo – Coatings Consultant
- Gil Zigler – Debris Bypass/Penetration Tests



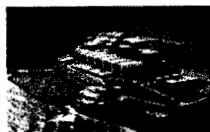
Objectives of Meeting

- Review & Work Towards Agreement on Remaining Chemical Effects PIRT Issues – CCNPP-CHLE-003
- Review & Work Towards Agreement on Alkyd Autoclave Test Plan – CCNPP-CHLE-007
- Review & Work Towards Agreement on Strainer Bypass/ Penetration Test Plan – CCNPP-BPPlan-001
- Address Other Items
- Present Proposed Schedule for Future Meetings
- Capture Staff Issues and Concerns



Remaining Chemical Effects PIRT Issues

- PIRT Item 2.1 Radiolytic Environment
 - Plan to add Strong Acids at Predicted Rate of Production
- PIRT Item 2.5 Addit'l Debris Bed Chemical Reactions
 - Fiberglass & Metals Insensitive
 - Irradiation is not expected to have a chemical effects impact on coatings
- PIRT Item 6.4 Coatings Dissolution and Leaching
 - Zinc and Epoxy Coatings Not Sensitive
 - Alkyd Coatings to be addressed in Autoclave Test
- Others?



Alkyds Autoclave Test Plan – CCNPP-CHLE-007

- Investigate Dissolution/Leaching from Alkyd Coatings
 - Apply Alkyd Coatings to SS Coupons
 - Submerge in Borated Water
 - Dissolve Buffer at 195°F
 - Expose to LOCA Temperature Profile for 48 Hours
 - Chemical Analysis for Potential Precipitants

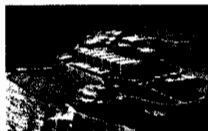
- Section-by Section Review



Bypass Test Plan – CCNPP-BPPlan-001

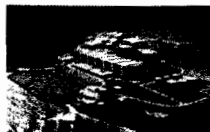
- Prototypical Strainer Module
 - Fabricated from Spare Parts
- LDFG (Nukon) Debris
 - Temp-Mat Quantity < 5%
 - Mineral Wool < 10%
- NEI Pressure-Wash Debris Preparation
- Range of Flow Rates
- Continuous Filtration

- Section-by Section Review



Other Items

- Assumption of 10 μm Sphere Particulate
 - Surface Area of 10 μm Particulate Debris Results in Unusually Large Surface Area of These Materials
 - Working on Resolution Approach
 - Submit for Discussion Soon
- Others?



Schedule for Future Periodic Meeting

- September 2013
 - Interim Bench-Top Test Results
 - Approach to 10 μ m Particulate Debris
- December 2013/January 2014
 - Chemical Effects Bench-Top Test Results
 - Final Chemical Effects Screening Test Protocol
 - Strainer Bypass/Penetration Test Results



Members of the public were not in attendance. Public Meeting Feedback forms were not received.

Please direct any inquiries to me at 301-415-1016, or Nadiyah.Morgan@nrc.gov.

/ra/

Nadiyah S. Morgan, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

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OFFICE	DORL/LPLI-1/PM	DORL/LPLI-1/LA	DE/ESGB/BC	DSS/SSIB/BC	DORL/LPLI-1/BC
NAME	NMorgan	KGoldstein	GKulesa	JStang	BBeasley
DATE	11/13/2013	11/13/2013	11/18/2013	11/25/2013	12/6/2013

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