January 14, 2008

MEMORANDUM TO: Michael L. Scott, Chief
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Office of Nuclear Reactor Regulation

FROM: Joseph A. Golla, Project Manager ***/RA/***
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SUBJECT: PHONE CALL SUMMARY WITH CONTROL COMPONENTS, INCORPORATED (CCI) ON AUGUST 15 & 16, 2007, TO DISCUSS SUMP STRAINER HEAD LOSS TEST SPECIFICATION

On August 15 & 16, 2007, a phone call was held with representatives of CCI to discuss the CCI test procedures for determining debris head loss across a sump screen. The discussion encompassed the following documents:

1. CCI Presentation to NRC July 10, 2007, "CCI Chemical Testing Strategy and Methodology" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML071920506).

2. CCI Test Specification Q.003.84.780, "Chemical Laboratory Bench Top Test" (ADAMS Accession No. ML071930365).

3. CCI Test Specification Q.003.84.781, "Chemical effect Head Loss Test Specification" (ADAMS Accession No. ML071930316).

The phone conference was convened, and CCI gave a general briefing on the CCI chemical testing strategy and methodology, referring to Powerpoint briefing slides that were sent to the NRC for this purpose prior to the phone call (Document No. 1 above).

The staff had several technical questions regarding the steps outlined in the presentation. These questions were all answered by CCI.

The precipitate surrogates used by CCI were different than that of Westinghouse. The results for the CCI tests indicate that the settling rates are significantly different. For example, the CCI surrogate settled much more slowly after aging for approximately 13 weeks while the WCAP surrogate (WCAP-16530, "Evaluation of Post-Accident Chemical Effects in Containment Sump

Fluids to Support GSI-191") settles more rapidly with time. CCI responded that their precipitate settlement tests and the Westinghouse precipitate settlement tests may not be comparable.

It appears that the Multi-Functional Test Loop (MFTL) precipitate settles much faster than aluminum hydroxide. The NRC staff asked if the amount that reaches the screen versus what is settled out upstream of the screen is quantified. CCI responded that it is difficult to distinguish between debris and chemical precipitate.

Staff inquired if CCI attempts to match the low, high, or best estimate plant-specific pH value when performing tests in the MFTL. A CCI representative stated that as long as the pH is anywhere in the range required by the plant, the test is acceptable.

The staff inquired whether the Palo Verde strainer installation was in a pit because of the depiction of the strainer on Slide 25 of the presentation material. The licensee responded that the installation was not in a pit and that most of the beams around the strainer had been removed.

The staff asked for additional detail on the baffle plate that can be installed in the MFTL upstream of the strainer (ref. Slide 28). CCI indicated that the plate can be installed at either joint in the test loop and can be moved vertically to increase or decrease the flow area in the flume. CCI also indicated that the purpose of the plate is to increase the velocity of the flow to prevent debris from settling on the floor of the flume and that the plate is solid and does not have any holes in it.

A staff consultant stated there was a significant difference in the theoretical and measured boron concentrations of the solutions and asked why no analysis was performed for the precipitates for boron. CCI responded that additional work needs to be done in this area.

The staff consultant asked why the boron concentration in the solid was measured using titrimetric methods but the boron in the solution was measured by Inductively Coupled Plasma (ICP) analysis. CCI responded that the boron was measured in the test loop by ICP because of the precipitate in the loop.

The staff consultant stated that ICP analysis for boron, calcium, magnesium, aluminum and silica can have significant matrix effects and asked if any matrix matching was performed. CCI stated that matrix matching was not performed.

The staff consultant asked how the filtration tests were performed. CCI indicated that precipitates were introduced into a funnel and filtered using a vacuum apparatus. The time to filter a specific volume of liquid (usually 30 ml) was measured as the filtration rate.

After the above discussion on the presentation material, the two CCI test specifications listed above were discussed. The first was the "Chemical Laboratory Bench Top Test," specification no. Q.003.84.780. The second test specification discussed was "Chemical Effect Head Loss Test Specification," specification no. Q.003.84.781. Both of these specifications apply to Palo Verde Units 1, 2, and 3.

The NRC staff consultant asked what the differences between MFTL tests, 3, 4, 5 are but did not get clarification on this.

The staff consultant asked how high CCI allowed the pH to get before adjusting it down. CCI responded that the maximum adjustment using nitric acid was 0.1-0.2 pH units.

The staff consultant asked how many test runs were done for each plant. CCI's response to this was unclear. It may have been three corresponding to the MFTL runs 3, 4 and 5.

The staff consultant asked why calcium was added to the test if Palo Verde has no calcium silicate insulation (CalSil). CCI responded that calcium was added to account for the dissolution of concrete. Amounts of calcium added were greater than that which would come from the stone flour alone.

The staff had several questions relative to debris preparation and debris settlement during testing. The staff noted that the flow field in the flume should be similar or conservative with respect to the strainer installation being tested (i.e., with respect to velocity and turbulence), or that the debris should be agitated such that it remains in suspension until it is drawn onto the strainer. CCI indicated that the test was designed to minimize settlement and that the intent was to get all debris onto the strainer. CCI uses a steel baffle plate inserted between the plexiglass modules to increase the local fluid velocity and lift the debris onto the strainer.

The staff further questioned to what extent CCI's intent of minimizing debris settlement was realized in past testing. CCI indicated that the quantity of settled debris is recorded for each test. Following the test, the debris accumulated on the strainer is placed into a box and compared to the volume of debris on the floor of the flume. However, CCI indicated that there was no criterion to judge whether the quantity of settled debris was excessive. The staff considered CCI's quantification of settled debris to be a good practice for roughly estimating the impact of debris settling during a head loss test, but noted that quantifying the effect of the settled debris on head loss would be challenging because of the difficulty in differentiating between different types of debris and in further understanding the marginal increase in head loss potentially associated with the settled debris. Therefore, the staff stated that CCI should ensure that essentially all debris reaches the strainer or should provide a technical basis to justify debris settlement during head loss testing.

The staff questioned the initial water level of 1 cm above the strainer and the control of water level as debris is added. The staff further emphasized that, to avoid flashing of the water flowing through the debris bed, the submergence of the strainer should be greater than the head loss across the debris bed. CCI was aware of the criterion and indicated that the 1-cm submergence was not intended to be representative of a plant condition. Rather, the test was begun with 1 cm of submergence at a minimum to allow for the addition of debris (mixed with water) to the test flume. CCI stated that ideally, no water would be drained from the flume during the test. However, if the water level gets too high, the level is reduced with the intention of minimizing the quantity of debris lost from the flume. CCI can drain from the sample line downstream of the strainer, or if the water is clear CCI can drain directly from the tank. CCI estimated the amount of debris lost as being very small, but quantification was not provided during the call. The staff considered it important for CCI to limit the debris and chemical species drained from the flume to a negligible amount.

The staff asked about the blocking of the lower row of pockets during the Palo Verde test (to simulate a curb in the plant). The specific questions regarded the sealing of the pockets and whether the scaling accounted for the blocked pockets. CCI responded that the pockets were sealed so that no flow could pass through them and that the scaling accounted for the blocked row of pockets.

The staff inquired as to the sizing of the particulate matter used during testing because the specification was unclear as to what size distribution was used (ref. pg. 10 of specification Q.003.84.781). CCI indicated that they used stone flour for the epoxy coating surrogate and not the chips discussed in the specification. The stone flour is sized conservatively based on GSI-191 Guidance Report/Safety Evaluation guidance. The surrogate mix noted for Test 6 was used, not Test 5. The staff considered the use of particulate for the coatings debris to be reasonable based on the potential for a layer of fibrous debris and/or chemical precipitates to accumulate upon the test strainer that would be capable of filtering out coating particulate. The staff stated that this position had been previously expressed in a slide presentation during a public meeting on June 19, 2007 (ADAMS Accession No. ML071780405).

The staff requested information on how CCI performs thin bed testing. CCI responded that for plants with high fiber loads they perform a separate thin bed test with a 5 mm theoretical bed. For a plant like Palo Verde (very low fiber), all fiber is added and a single test is performed.

The staff inquired as to what the 400 sq. ft. reduction in plant screen area listed on page 11 of spec 781 represented. CCI indicated that it was the sacrificial area subtracted from the strainer area to account for tags, tape, signage, etc.

The staff stated that it was important, especially for a thin bed test and for plants like Palo Verde that have very little fiber (mostly latent), that the fibers be introduced as mostly fines. Fines are defined as single fibers. The CCI specification calls for 10-mm (3/8-inch) maximum fiber shreds. The staff indicated that for a plant like Palo Verde the fibers should be finer to ensure prototypical transport and bed deposition. The staff noted that this comment had previously been provided to CCI during the staff's observation of head loss testing in September 2006. The staff also stated that the test should ensure that debris will not agglomerate between the time that it is destroyed into fines and introduced into the flume. CCI indicated that the fiber is diluted significantly. For example, Palo Verde had 400 grams of fiber mixed into 200 liters of water. The agglomeration of prepared fibrous debris had also been previously raised as an issue during the staff's September 2006 observation (ADAMS Accession No. ML070170235) of CCI's testing. Based upon the information provided during the call, the staff considered the agglomeration issue to have been adequately addressed for Palo Verde.

The staff questioned the test termination criteria, especially the ability of the test engineer to terminate the test if the criteria were not met (ref. pg. 16 of spec 781). CCI responded that the head loss could be erratic with head losses generally stable, but at particular instants not satisfying the criterion of less than a 1 percent change in 30 minutes. In cases such as this, CCI stated that the test coordinator may terminate the test. While recognizing that deviations from the specified termination criterion may be justifiable in some cases, the staff emphasized that the observed behavior and expected trend of the measured head loss should be understood prior to terminating a test.

The staff questioned whether there was a time limit for the analyses performed on the samples taken during the chemical effects testing. CCI stated that the analyses were performed soon

after the samples were taken and would be completed on the same day that the sample was taken. CCI stated that the chemical laboratory was in the same building as the test facility, making the logistics associated with transport of the samples easier.

The staff requested further information on the Thermolag that was being used in the testing. It was verified that the actual material was being used as the test surrogate and that it was being ground into powder prior to introduction into the test loop. The fibers were added along with the rest of the powder.

The staff asked what Alpha cloth (ref. pg. 23 of spec 781) consisted of. The licensee stated that it was the cloth covering over Nukon fibers.

Regarding the CCI chemical laboratory bench top testing (spec 780), the NRC staffs' main questions concerning the test approach were related to: (1) understanding the types and amounts of precipitates that form with chemical injection; (2) demonstrating that the settlement properties of precipitate formed with this method are representative (i.e., how much precipitate settles after 1 and 2 hours); and (3) how much of the aluminum added to the loop during testing remains dissolved during the test duration. CCI indicated they would provide the staff information to address these questions.

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Paul Klein
Steve Smith
John Lehning
Mike Scott
Bob Litman (consultant)
Joe Golla

Industry Participants:
Urs Blumer (CCI)
Martin Spoerri (CCI)
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