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April 29, 2005

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC

SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING RESPONSE TO BULLETIN 2003-01 - OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 (TAC NOS. MC6288, MC6289, AND MC6290)

By letter dated August 7, 2003, Duke Energy Corporation (Duke) provided the 60-day response to Nuclear Regulatory Commission (NRC) Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," dated June 9, 2003, for Oconee Nuclear Station, Units 1, 2, and 3 (ONS). The NRC staff reviewed and closed the response in a closure letter dated March 30, 2004 (ADAMS ML040830077). The review concluded that Duke's response to the bulletin adequately addressed each of the compensatory measures recommended in the bulletin. As such, the NRC staff did not request additional information and closed the Bulletin 2003-01 for ONS based on the information provided in the response.

Since the time that the NRC staff closed Bulletin 2003-01 for ONS, concerns regarding degraded containment coatings, adequate remediation efforts and adequacy of Bulletin 2003-01 interim compensatory measures have been raised by NRC staff. Based on this information, the NRC staff re-opened its review of ONS Bulletin 2003-01 response and is now requesting additional information.

Attachment 1 of this response contains an executive summary and documents the answers to the Bulletin 2003-01 request for additional information (RAI).

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ONS actions to date have provided reasonable assurance that degrading coatings will not adversely affect RBES performance. In addition, ONS is involved with ongoing industry and NRC initiatives to better understand these phenomena. Should new insights be gained, ONS will take appropriate actions necessary to ensure adequate RBES performance.

There are no new commitments being made as a result of this response.

If you have questions or need additional information, please contact Reene' Gambrell at (864)885-3364.

Very truly yours,

for R.A. Jones

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NRIA File/ELL
Oconee Master File - ON03DM (File OS 801.01)

ATTACHMENT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING RESPONSE TO BULLETIN 2003-01 - OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 (TAC NOS. MC6288, MC6289, AND MC6290)

ATTACHMENT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING RESPONSE TO BULLETIN 2003-01 - OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 (TAC NOS. MC6288, MC6289, AND MC6290)

Executive Summary

Oconee Nuclear Station (ONS) performed a detailed analysis of sump blockage potential in 1997 to confirm that known post-accident debris sources, including degraded Duke-applied containment coatings and original vendor coatings (unqualified), were not a significant safety concern at the site. Containment coatings transport was evaluated at that time using the best available industry methodology. The analysis concluded that transport of paint chips of 1/4" size (or larger) was not credible given the density of the chip and the expected post-accident Emergency Core Cooling System/Containment Spray System (ECCS/CSS) flow rates and resultant transport velocities in the containment recirculation pool. Current paint chip transport test data available and documented in NUREG/CR-6808 further support the conclusions of that analysis.

In addition to the technical justification, ONS has documented the following items within Operability Assessments, position statements, and responses to GL 98-04:

- Current licensing basis requires that ECCS and CSS components continue to function with up to 50% of the Reactor Building Emergency Sump (RBES) screen blocked. Current analyses support operability using this guidance.

- The 50% blockage requirement, originating in RG 1.82 and incorporated into the ONS design specifications as early as 1969, does not require mechanistic evaluation of the blockage (ie, debris generation, transport, and accumulation modeling).

- The Nuclear Regulatory Commission (NRC) currently holds a Justification for Continued Operation (JCO) for all Pressurized Water Reactors (PWRs) related to the issue of sump screen blockage. ONS agrees with the considerations stated in the NRC's JCO. We further believe that ONS has been aggressive in implementation of compensatory measures addressed in NRC Bulletin 2003-01. Those compensatory measures included procedural enhancements, operator training, ECCS and CSS system modifications, identification of additional water sources for Borated Water Storage Tank (BWST) refill, and inspection of drain passages. NRC further indicated their concurrence by acceptance of that Bulletin response by closure letter of March 30, 2004.

- ONS has virtually fiber free Reactor Building (RB) cavities which minimizes the possibility of a fiber bed forming on the ECCS sump screens.

- The majority of ONS degraded coatings, which is a minimal percentage of the total containment coatings, are located in inaccessible areas which are not in the LOCA zone of influence (ZOI).

- ONS also continues to meet the coating program requirements of minimizing degraded coatings in containment as defined in the ONS response to NRC Generic Letter 98-04. The completion of coating assessments at each refueling outage (RFO) that identify, document and evaluate for repair the degraded coatings areas will continue to minimize the amount of degraded coatings in containment. ONS is further minimizing degraded coatings in containment by developing access capability for difficult to access areas. Work is also ongoing to remove unqualified coatings and replace them with Loss Of Coolant Accident (LOCA) qualified coatings on large components which will also minimize any degraded or unqualified coatings at ONS.

ONS actions to date have provided reasonable assurance that degrading coatings will not adversely affect RBES performance. In addition, ONS is involved with ongoing industry and NRC initiatives to better understand these phenomena. Should new insights be gained, ONS will take appropriate actions necessary to ensure adequate RBES performance.

By completing the above actions, ONS continues to meet commitments contained in GL 98-04 and Bulletin 2003-01.

Response to Request For Additional Information

1) **Bulletin 2003-01 requested that licensees either confirm compliance with 10 CFR 50.46 or implement interim compensatory measures to reduce the risks associated with sump blockage until analyses to verify compliance could be completed. Remediation of degraded coatings would serve to reduce the risks associated with sump blockage. Please provide a detailed discussion of the periodic coating assessment that is performed to assure that any coatings that may be susceptible to detachment are minimized. The response should address:**

   a) **The specific methods, standards and associated criteria used to identify, evaluate and schedule the repair or replacement of localized areas of degraded coatings. Include a discussion of how the extent of degraded coating is determined.**

   Response to Question 1a:

   The purpose of the ONS Service Level I coating program is to assure that coatings in containment are properly applied and maintained so the coatings can perform their intended function. Oconee conducts periodic condition assessment of Service Level I coatings used inside containment. These assessments are used for evaluating the condition of in-service coating systems and are performed during each refueling outage. As areas of degraded coatings are identified, those areas are evaluated and scheduled for repair or replacement as necessary.

   ONS has a standing outage activity for each Unit to perform a walkdown inspection of the containment building at the beginning of each refueling outage as required in the Nuclear Coating Maintenance Manual (NCMM). Surveillance personnel include ANSI N45.2.6 certified Level II coating inspectors or other personnel with demonstrated overall technical knowledge of coatings as defined in the EPRI Guideline on Nuclear-Safety Related Coatings TR-109937. This may be accomplished through experience achieved during implementation of the Duke Power coatings program or training and/or experience gained in other recognized coating programs.

The basis for this inspection is the requirements of ASTM D5163 (coating assessment), ASTM D610 (rusting), ASTM D714 (blistering), ASTM D772 (flaking) and SSPC-VIS2 (rusting). The actual work performed as part of the standing outage activity includes tasks for the inspection and an evaluation for the repair/replacement of the deficiencies identified during the inspection. A visual inspection is conducted on all accessible and difficult to access (defined in answer to question 4a) coated surface areas including areas near sumps or screens associated with the ECCS. Deficiencies identified during the walkdown are documented in the inspection procedure. The coating inspection includes visual examination for defects such as blistering, cracking, flaking, peeling, rusting, pitting, and physical damage due to external force. The coating assessment includes documentation of the deficiencies discovered, location, and the final disposition of each deficiency.

Similar to accessible areas, estimates to quantify amounts of degraded coatings in the difficult to access areas (dome, spray header frame, and polar crane) are made using visual techniques. A conservative estimate is made which envelopes the amount of degradation visible. ONS increased the rigor with which it performs these estimates starting in 2EOC20 (Spring, 2004). The evaluation of the interior dome is performed in quadrants and a conservative estimate of degraded surface area is made using known structural dimensions of the containment. Similarly, known structural dimensions of the polar crane, ring girder, and spray header frame also allow for making reasonably accurate estimates of any degraded coatings in these areas. The previous inspection results are referenced to determine if a variance has occurred.

If the surface area of the coating degradation identified during the coating assessment is within expectations (based on as-left conditions from previous outage), repairs are scheduled during the current outage with available outage resources. If during the coating assessment, ONS finds areas of coating degradation not meeting expectations, as in 2EOC20 and 1EOC22, additional resources are requested to make any necessary repairs during that outage.

Localized areas not repaired/replaced due to inaccessibility or other factors, are documented in the coating assessment report with the surface area of any degraded coatings not removed. In 2004, the coating assessment process started documenting the estimated surface area not removed during the refueling outage in the ONS corrective action program.

b) The technical basis for the methods, standards and criteria and a discussion of how the basis correlates to the coating's performance following the design basis loss-of-coolant accident (LOCA). For example, if adhesion testing is performed, what method or standard is used, what are the acceptable values and how does the basis for these values correlate to the coating system performance during a LOCA event?

Response to Question 1b:

The ONS original containment coatings are considered an "Acceptable" coating system. The definition of an "Acceptable" coating system is provided in EPRI Guideline on Nuclear-Safety Related Coatings TR-109937. ONS Updated Final Safety Analysis Report (UFSAR) Table 3-12 describes the original manufacturer LOCA testing of the "Acceptable" coating systems used in ONS containment.

As stated in response 1a, a visual inspection of containment coatings is conducted each refueling outage to ensure coatings remain acceptable per EPRI Guideline on Nuclear-Safety Related Coatings TR-109937. The technical basis for the acceptance criteria in this inspection is based on the requirements of ASTM D5163 (coating assessment), ASTM D610 (rusting), ASTM D714 (blistering), ASTM D772 (flaking) and SSPC-VIS2 (rusting). Deficiencies identified during the inspection are documented and evaluated for repair/replacement.

The visual assessment and any needed repairs ensure that the coating remains an acceptable coating system per the EPRI Guideline on Nuclear-Safety Related Coatings TR-109937.

c) The definition of "localized area," and the actions and technical basis for addressing degraded areas that are in excess of a "localized area."

Response to Question 1c:

"Localized Area" is a location where the coating system has degraded. It is typically used to describe areas where the removal of less than the entire coating system is needed. There is no numerical definition or limit to a localized area. It may be 1 ft^2 or 100 ft^2. Regardless of whether degradation is classified as local or global, the same repair approach is used to address the degraded areas as defined in response to question 1f.

d) The process and technical basis used for estimating the amount of degraded coating.

Response to Question 1d:

Once a localized area has been identified, visual estimation techniques are used to quantify the surface area as discussed in the response to 1a. Conservative estimates are made using known structural dimensions. Visual estimation is not precise, but is reasonably accurate, and sufficient for the purposes of quantifying the total amount of degraded coatings inside containment and for trending. ONS has increased the rigor and thoroughness of its visual estimation practices. These improvements began in 2EOC20 (Spring, 2004). Visual estimation practices provide an acceptable level of accuracy to quantify the amount of coating degradation inside containment, and to determine needed actions to meet GL 98-04 commitments.

e) The trending of identified areas with continuing degradation. If trending is not performed, provide the technical basis for not trending. What is the apparent rate of degradation? How is the trend and rate incorporated into the periodic coating assessment and the determination of the total amount of degraded coating?

Response to Question 1e:

Containment coatings are inspected per the Reactor Building Coating Inspection Procedure at the beginning of each RFO and inspection results are documented on an enclosure of this procedure. Any coating repairs completed during the outage are also documented. The degraded coatings that remain unrepaired are maintained on the coating inspection report and prioritized for repair during future outages. The previous inspection report is used during the new inspection walkdown, as a cross check, to verify areas that were previously identified and not repaired. The total amount of coating degradation from the previous outage is compared to the as-found amount. Significant changes are documented in the corrective action program, as in 2EOC20 and 1EOC22.

ONS began performing coating assessments in 1997. Beginning with the 2EOC20 outage, the rigor and thoroughness in which the visual estimations were performed was increased. Although a comparison is made between as-left and as-found coating degradation levels per unit, a true degradation rate cannot be predicted due to this change in estimation practices. Beginning with 2EOC21 (Fall, 2005), better data will be available for improved trending.

f) The definition and methods of coating "repair" and coating "replacement," including the criteria and technical basis used to ensure that the intended function of the repaired/replaced coating is met.

Response to Question 1f:

Coating "repair" and/or "replacement" is the action completed in areas where coating degradation has been identified requiring follow up actions. Previous repairs have been completed using any of the following three methods:

1. Removal of the degraded coatings by scraping until the sound adjacent coating is tightly adhered and can not be removed with a dull putty knife.

2. Removal of the degraded coating by scraping until the adjacent sound coating is tightly adhered and recoating over the existing zinc primer and feathering the new coating into the adjacent sound topcoat.

3. Complete removal of the degraded coating system to bare metal and reconstitution of the coating system. The new coating system is feathered into the adjacent sound coating.

The partial recoating system or reconstitution of the coating system will be a design basis accident (DBA) qualified coating system as documented in ONS Calculations and defined in the EPRI guideline on Nuclear-Safety Related Coatings TR-109937. A DBA qualified coating system is a coating system used inside primary containment that can be attested to having passed the required laboratory testing, including irradiation and simulated DBA and has adequate quality documentation to support its use as DBA qualified. The new DBA qualified coating system is applied in accordance with the requirements of the Oconee Nuclear Maintenance Coating Schedule (NMCS) and the NCMM.

g) The NRC staff is concerned with the adequacy of high-pressure spray washing (or alternate method of remediating) the containment only at elevations below the 4th floor. Coatings at ONS are degrading and detaching at elevations above the 4th floor elevation. Please provide a detailed discussion of the technical justification for not remediating at elevations above the 4th floor, where the coating degradation/delamination is occurring.

Response to Question 1g:

ONS has repaired degraded coatings above the 4th floor elevation. For example, during 2EOC20, approximately 2600 ft^2 of degraded coatings were repaired in this area. Other degraded coatings in this area are evaluated per the ONS coatings program. Even though inaccessible areas are not in the ZOI, they are evaluated for possible repair per ONS GL 98-04 response.

Further, in 1997 ONS performed a detailed analysis of sump blockage potential to confirm that known post-accident debris sources, including degraded Duke-applied containment coatings and original vendor coatings (unqualified), were not a significant safety concern at the site. Containment coatings transport was evaluated at that time using the best available industry methodology. The evaluation considered the potential for transport of paint chips of 1/4" characteristic size and known density. Paint chips smaller than 1/8" were assumed to pass through the screen openings and pose no threat to sump performance. No suitable data or model was available to address chips between 1/8" and 1/4". This was judged to be a very small percentage of the total size distribution of chips, and was deemed insignificant. The analysis concluded that transport of paint chips of 1/4" size (or larger) was not credible given the density of the chip and the expected post-accident ECCS/CSS flow rates and resultant transport velocities in the containment recirculation pool. Current paint chip transport test data available and documented in NUREG/CR-6808 further support the conclusions of that analysis.

In addition to the technical justification, ONS has documented the following items within Operability Assessments, position statements, and responses to GL 98-04:

- Current licensing basis requires that ECCS and CSS components continue to function with up to 50% of the RBES screen blocked. Current analyses support operability using this guidance.

- The 50% blockage requirement, originating in RG 1.82 and incorporated into the ONS design specifications as early as 1969, does not require mechanistic evaluation of the blockage (ie, debris generation, transport, and accumulation modeling).

- The NRC currently holds a Justification for Continued Operation (JCO) for all PWRs related to the issue of sump screen blockage. The following excerpts are taken from that JCO:

    1. "In addition, PWRs typically do not need to switchover to recirculation from the sump during a LOCA until 20-30 minutes after the accident initiation allowing time for much of the debris to settle in other places within the containment. Coating debris, in particular, would have plenty of time to settle."

    2. "In addition to these design considerations, the staff considers continued operation of PWRs to be justified because the probability of the initiating event (ie, large break LOCA) is extremely low. More probable (although still low probability) LOCAs (small, intermediate) will require less ECCS flow, take more time to use up the water inventory in the refueling water storage tank (RWST), and in some

cases may not even require the use of recirculation from the ECCS sump because the flow through the break would be small enough that the operator will have sufficient time to safely shut the plant down."

3. "In addition, all PWRs have received approval by the staff for leak-before-break (LBB) credit on their largest RCS primary coolant piping. While LBB is not acceptable for demonstrating compliance with 10CFR50.46, it does demonstrate that LBB-qualified piping is of sufficient toughness that it will most likely leak (even under safe shutdown earthquake conditions) rather than rupture. This, in turn, would allow operators adequate opportunity to shut the plant down safely (although debris generation and transport for an LBB size through-wall flow will still be investigated)."

4. "Another example of margin would be that it has been shown, in many cases, that ECCS pumps would be able to continue operating for some period of time under cavitation conditions. Some licencees have vendor data demonstrating this. Design margins such as these examples may prevent complete loss of ECCS recirculation flow or increase the time available for operator action (eg, refilling the RWST) prior to loss of flow."

- ONS agrees with the considerations stated in the NRC's JCO. We further believe that ONS has been aggressive in implementation of compensatory measures addressed in NRC Bulletin 2003-01. Those compensatory measures included procedural enhancements, operator training, ECCS and CSS system modifications, identification of additional water sources for BWST refill, and inspection of drain passages. NRC further indicated their concurrence by acceptance of that Bulletin response by closure letter of March 30, 2004.

2) By letter dated November 11, 1998, you responded to Generic Letter (GL) 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," dated

July 14, 1998. Your response indicated that the amount of degraded coating inside containment will be minimized, as necessary. Minimizing the amount of degraded coatings inside containment is certainly consistent with the intent of Bulletin 2003-01. In light of the results of past assessments and operating experience with large areas of degraded coating, explain the technical basis for permitting large areas of degraded coating to exist and other areas to continue to degrade. Also, address the technical basis for determining that the remaining coating system can meet its intended design function. Your GL 98-04 response did not take exception to the minimization of delaminated coatings for the dome area in Unit 1. Since you have not been repairing/removing the delaminated paint in the Unit 1 dome area, discuss how you are meeting your commitment to repair/remove delaminated areas as necessary.

a) Explain the technical basis for permitting large areas of degraded coating to exist and other areas to continue to degrade.

Response to Question 2a:

When areas of degradation are discovered, action is taken to remediate these areas as appropriate. The recorded amount of degraded coatings that currently exist is a minimal percentage of the total Service Level 1 coating area in containment. Furthermore, identified areas of degradation are typically not in the ZOI. Consistent with ONS GL 98-04 response, these areas continue to be evaluated for possible repair.

As stated in response to question 1g, the ONS licensing basis (CLB) requires that the RBES support operability of the ECCS and CSS systems with up to 50% of its screen surface area blocked. There is no requirement in the current licensing basis to evaluate post-LOCA debris generation, transport, or resultant head loss. Even so, ONS did perform its own analysis of the potential for debris blockage in 1997. This analysis evaluated both unqualified vendor coatings and Duke-applied containment liner plate coatings. The analysis concluded that coatings were not a safety concern, based largely upon the low potential for transport. Ongoing industry and NRC activities pursuant to GSI-191 have suggested that failure potential and transport potential for containment coatings are significantly greater than previously understood. However, these concerns have not been supported by testing performed by the NRC and/or the industry.

In addition, it is important to note that ONS has minimal fiber content in the RB cavities.

b) Also, address the technical basis for determining that the remaining coating system can meet its intended design function.

Response to Question 2b:

The visual containment coating assessment performed during each refueling outage will identify the areas where coating degradation has occurred. These degraded areas will be evaluated for repair/replacement as necessary to minimize the amount of degraded coatings in containment. The surface area of degraded coatings not repaired during the current outage will be documented. These areas will be visually inspected during the next coating assessment and any significant variance will be addressed.

The repair/replacement of degrading coatings and the continued monitoring for any variance of the degraded coatings not removed provides assurance that the remaining coating system will continue to meet its design function as an acceptable coating system defined in EPRI Guideline on Nuclear-Safety Related Coatings TR-109937.

c) Your GL 98-04 response did not take exception to the minimization of delaminated coatings for the dome area in Unit 1. Since you have not been repairing/removing the delaminated paint in the Unit 1 dome area, discuss how you are meeting your commitment to repair/remove delaminated areas as necessary.

Response to Question 2c:

ONS response to GL 98-04, question 1(c), stated:

"**Unit #1** - The last assessment was performed during the 1EOC17 (September 1997) RFO and the results of this inspection were documented. Except for the sprinkler grid system and the polar crane, the overall condition of the coatings was satisfactory with any degraded coatings evaluated and prioritized for repair during the outage or future repair as necessary. The degraded coatings on the sprinkler grid system and on localized areas of the polar crane have been documented and will continue to be evaluated for possible removal. The next scheduled coating assessment is during 1EOC18 (June 1999)."

The coating assessment performed during 1EOC17 did not specifically quantify any dome liner plate coating degradation in square footage, but recorded its condition as "satisfactory, good condition." During the following Unit 1 outage, 1EOC18, the maintenance procedure enclosure and corrective action program documents less than 50 ft^2 of delaminated coating on the Dome liner plate. Overall condition of the Dome liner plate coatings remained satisfactory and in good condition with this minor amount of coating delamination. The amount of coating delamination in this area has continued to be monitored each outage. The levels of degradation in the Dome area have changed a negligible amount over the past 6 years. During 1EOC22, delaminated coatings observed remained relatively unchanged. Therefore, repair/replacement of the Dome area is not necessary at this time. Continued monitoring every outage is currently the only activity needed to meet ONS commitment to GL 98-04.

3) Explain the technical basis for remediating the coating system by limiting the scraping to only areas that are visibly delaminating. Include the criteria used to determine when a degraded area has been sufficiently remediated by scraping. Also, address the continued use and technical basis of this technique when reports indicate that some coatings contiguous to the scraped areas subsequently begin to delaminate.

Response to Question 3:

These areas are remediated by not only removing the loose degradation, but continuing to scrape until a sound, tightly adhered coating remains. The sound adjacent coating would continue to be considered an "Acceptable" coating system as defined in EPRI Guideline on Nuclear-Safety Related Coatings TR-109937 and meets the ONS licensing basis. ONS recognizes that, in some cases, a minimal amount of the sound topcoat may loosen around the perimeter of the repair area prior to the next refueling outage. These areas would be identified during the next coating assessment and scheduled for repair as necessary. This method of scraping to sound material meets the intent of the ONS response to GL 98-04 to minimize coatings that could detach during a LOCA.

Determining when a degraded area has been sufficiently remediated is based on skill of the craft. The craft is instructed in a pre-job brief on how to remediate the coatings. Hand tools are used to scrape delaminated areas until sound material is reached. This method of remediation is consistent with practices used in the industry.

During 1EOC22, a QC inspection will be added to the remediation work being performed in the inaccessible areas. This will provide additional assurance that the degraded coatings are completely removed and the adjacent sound coating is tightly adhered.

4) Your response to GL 98-04 indicates that inaccessible areas exist within the containment.

a) Provide the definition of an inaccessible area related to the coating assessment.

Response to Question 4a:

The following definition is given for inaccessible areas, as it relates to ONS response to GL 98-04.

"Inaccessible" or "Difficult to Access" - Areas considered difficult to access using standard maintenance means during normal RFO evolutions for completing coating repair activities. These areas include the dome, ring girder, RB spray structural steel and the polar crane. Special lift rigs or significant scaffolding are needed to access these areas.

Throughout this RAI response, the terms "inaccessible areas" and "difficult to access areas" are used interchangeably.

It is important to note that areas classified as inaccessible are still visually inspected from available vantage points during the coating assessment.

b) Provide a list of all areas considered inaccessible and an approximate area associated with each.

Response to Question 4b:

Inaccessible area - approximate surface areas

1) Dome surface area - 16,320 ft^2

2) Building Spray Header Steel (includes vertical support rods) - 8320 ft^2

3) Polar Crane (includes girders, aux hoist support steel, trolley/cab, crane rail and ring girder) - 13,000 ft^2

c) If periodic assessment cannot be performed in these areas, provide the technical basis for determining that the coating remains "acceptable" in meeting its original design criteria. Include a discussion of why, given the plant operating history and extensive coating degradation, all of the coating in the "inaccessible" areas is not considered unqualified or unacceptable since its condition cannot be adequately evaluated.

Response to Question 4c:

Assessments are performed every outage in both the accessible and inaccessible areas as part of the coating program. Visual coating assessments are being performed on inaccessible areas as listed in response to question 4b. These assessments are performed for each unit during each refueling outage. The inaccessible areas can be visually inspected from the 4th floor grating, from the top of the elevator structure, from the polar crane access platform, using binoculars, and with the camera located inside the containment. An estimate of the degraded coatings is made and an evaluation is performed to determine if repair is necessary. This is done in accordance with our coating assessment program; thereby, ensuring the coatings remain acceptable per EPRI Guideline on Nuclear-Safety Related Coatings TR-109937.

d) Degradation and inadequate remediation of this "inaccessible" coating is not consistent with the intent of Bulletin 2003-01, which is to reduce the risks associated with sump blockage. The NRC staff understands that you now have a device that can access these "inaccessible" areas. If so, provide justification for not minimizing the loose paint in these areas during the earliest possible outages.

Response to Question 4d:

ONS has developed the capability to access these "inaccessible" areas. ONS utilization of this new capability is a first-time evolution for the site. Care will be taken in planning and decision making to protect the health and safety of ONS personnel during this high risk activity. This capability is being used during the current Unit 1 outage to scrape and remove degraded coatings in some of the inaccessible areas. ONS plans to use this capability as necessary to repair or replace degraded coatings during future outages. The current level of coating degradation in the inaccessible areas is minimal compared to the total quantity of Service Level 1 coating inside containment. The Liner Plate itself has over 77,000 ft^2 of Service Level 1 coating, and the entire Reactor Building is approximately 250,000 ft^2 of Service Level 1 coating. The recorded amount of degraded coating currently existing in the inaccessible areas is a minimal percentage of the total Service Level 1 coating area in containment. Coatings in the inaccessible areas will continue to be monitored every outage.

ONS is taking other aggressive actions to reduce risk associated with emergency sump blockage. These actions include installation of a larger emergency sump screen (current schedule is 2EOC21 (fall 2005), 3EOC22 (spring 2006), and 1EOC23 (fall 2006)), and reduction of the amount of unqualified coatings in Containment by replacing them with qualified coatings. Specific examples are the Core Flood Tanks and refurbished Reactor Coolant Pump Motors.

The actions ONS has taken and additional actions planned meet the intent of Bulletin 2003-01 to minimize the risk of emergency sump blockage, and meet GL 98-04 commitments to minimize coatings that could detach during a LOCA.

5) Has a root cause analysis ever been performed to identify causal factors and recommend corrective action associated with the observed coating degradation? If so, provide a detailed description of the cause and recommended corrective action. Identify any corrective action taken and include a discussion of how the corrective action taken to date ensures that coatings will not adversely impact performance of the containment sump. Also, discuss any plans that constitute a final resolution to the observed coating degradation.

Response to Question 5:

A formal root cause evaluation has not been completed for the ONS coating system; however, a formal root cause investigation is currently underway on Unit 1. In addition, a third party is performing an independent failure analysis. Results of this investigation will be factored in to the ONS coatings program.

While a root cause has not been completed, earlier coatings degradation have been evaluated and corrective actions have been taken.

6) Provide the technical basis for considering exposed inorganic zinc resulting from the remediation process, or from degradation of the epoxy topcoat, to be an acceptable coating. Include the following:

a) The criteria and technical basis used to evaluate acceptability of exposed residual inorganic zinc. Also, address the testing performed and technical justification for concluding that the inorganic zinc is acceptable based on its method of application (being exposed after having been originally topcoated).

Response to Question 6a:

The visual containment coating assessment, including the exposed zinc primer, is based on the requirements of ASTM D5163(coating assessment), ASTM D610 (rusting), ASTM D714 (blistering), ASTM D772 (flaking) and SSPC-VIS2 (rusting). LOCA testing of the untopcoated zinc primer is documented in Carboline Testing Project #02182 dated 10/27/83. The zinc primer continues to provide corrosion protection as designed and is an acceptable untopcoated system based on the detailed definition of "acceptable" as defined in the response to question 1b. This supporting data and the visual coating assessment meets the requirements of the ONS plant licensing requirements.

Delamination of the zinc primer is not considered a credible failure. There are no known causes or examples of delamination or flaking of the zinc primer. This is further discussed in the response to question 6e.

b) The standards, criteria and technical basis used to evaluate exposed inorganic zinc during subsequent periodic assessment.

Response to Question 6b:

The zinc primer is visually inspected during each coating assessment in accordance with ONS procedures. The visual coating assessment is based on the ASTM standards noted in response to question 6a. Degradation of the exposed zinc primer or rusting of base metal identified during the coating assessments would be evaluated for repair/replacement as necessary. Surveillance personnel shall include ANSI N45.2.6 certified Level II coating inspectors or personnel that have demonstrated overall technical knowledge of coatings as defined in the ONS coating program.

c) The technical basis for acceptability in light of the inorganic zinc being a remnant of a failed coating system. The inorganic zinc may be a contributor to failure of the coating system and as such may not remain adhered during a LOCA event. Include a discussion addressing ONS reports that indicate that the remaining inorganic zinc is loose and powdery.

Response to Question 6c:

The zinc primer remains tightly adhered to the liner plate and support steel surface when the degraded topcoat is removed by scraping. The visual coating assessment is based on the ASTM standards noted in response to question 6a. During the visual coating assessment or during the scraping process, there have been no indications of the zinc primer losing adhesion to the base metal. LOCA testing of untopcoated zinc primer is documented in Carboline Testing Project #02182 dated 10/27/83.

The zinc primer is compatible with topcoating materials and any future topcoating failures would be for reasons not related to the use of zinc primer. The zinc primer (Carbo Zinc 11) used with Carboline Phenoline 305 topcoat is an "Acceptable" coating system per EPRI Guideline on Nuclear-Safety Related Coatings TR-109937.

It has been documented in the ONS corrective action program that in some areas where degraded coatings were identified at ONS, the zinc primer had a slight powdery residue remaining on the surface. The slight powdery residue was minimal leaving only a stain when hand swiped.

d) The technical basis and criteria used to support applying an epoxy topcoat over the existing inorganic zinc primer that was a component of a failed coating system and subsequently considering the entire coating system acceptable.

Response to Question 6d:

The technical basis for the application of the epoxy topcoat applied to the residual zinc primer after removal of the degraded topcoat is documented in Carboline Testing Project #02578 dated 07/24/89. This cleaning and repainting would be in accordance with the requirements of the ONS NMCS and the NCMM and would be a DBA qualified coating system as defined in EPRI Guideline on Nuclear-Safety Related Coatings TR-109937.

e) Describe how failure of the exposed inorganic zinc would impact the performance of the containment emergency sump and how this is incorporated into the total amount of degraded coating.

Response to Question 6e:

Delamination of the inorganic zinc (IOZ) primer on the containment liner plate and other steel structures is not postulated or expected and has not been observed in the industry. Also, the inorganic zinc primer applied to the containment liner plate is an "acceptable" coating system as defined in EPRI Guideline on Nuclear-Safety Related Coatings TR-109937. Since this coating system is "Acceptable", there is no postulated impact to the performance of the containment emergency sump.

If the IOZ is postulated to fail as "talcum powder", transport could be possible. However, in light of the low fiber content of the ONS containments (within postulated ZOI), and the high probability of Leak-Before-Break (which would lead to very low fiber debris generation), such a powder would be expected to pass through the RBES screen freely and pose no threat to sump performance.

Since the IOZ primer on the ONS containment liner plate is an "Acceptable" system as defined in the EPRI Guideline on Nuclear-Safety Related Coatings TR-109937 and no significant failures of the zinc primer have been identified, areas of the liner plate coated with this primer are not considered "degraded". Therefore, they have not been incorporated into the total amount of degraded coating.

7) In your response to GL 98-04, you stated, "As localized areas of degraded coatings are identified, those areas are evaluated and scheduled for repair and replacement as necessary." In your August 7, 2003, response to Bulletin 2003-01, you stated that the ONS containments are not compartmentalized. The NRC staff agrees with your response that such a configuration is beneficial with respect to free flow of inventory to the sump. However, this physical configuration can also lead to more direct and easier transport of debris to the sump. Knowing that coatings are degrading and are most likely scattered around the containment floor, the NRC staff is concerned with the adequacy of your interim compensatory measures. Please discuss the technical basis for concluding that the degraded coatings will not transport and adversely impact the emergency core cooling system sump performance.

Response to Question 7:

See response to questions 1g and 2 above. ONS analysis of coatings transport concluded that coatings would not transport on the following basis:

- Coatings were assumed to fail as chips.

- Density of coatings supports settling prior to initiation of sump recirculation.

- Chip size and density were evaluated for transport.

- Chips 0.25″ in characteristic dimension or larger were conservatively assumed to transport at the same velocity. (Larger chips are known to be less susceptible to transport.)

- The required transport velocity determined by the analysis was greater than the available velocity in the region between the steam generator cavities and the sump.

- Chips smaller than 1/8″ were assumed to pass through the screen unimpeded. Chips in the size range of 1/8″ to 1/4″ were not evaluated, as the available data did not support extrapolation to chips of this size. These were not considered, however, as the quantity was judged to be negligible.

Additional considerations supporting low paint chip transport position:

- Results of testing performed by LANL (sponsored by the NRC) and documented in NUREG/CR-6808 show that paint chips require higher flow velocities for transport than predicted by ONS analysis (by a factor of about two). Incipient transport velocity for paint chips (as reported in NUREG/CR-6808 Table 5.1) is 0.4 ft/sec as compared to our calculated available transport velocity of about 0.2 ft/sec.

- Substantial physical barriers to transport are present at the basement floor level. For example, a 14″ tall barrier stands between the Alpha steam generator cavity and the RBES in all units. Also, all sumps have a curb of approximately 2-4″ in height enclosing the entire perimeter of the sumps. Substantial increases in transport velocity are required to lift coatings over physical barriers. NUREG/CR-6808 Table 5.1 shows that a velocity of about 0.5 ft/sec is required to lift a paint chip over a 2″ barrier. It is estimated that the available transport velocity at ONS is less than half of that (about 0.2 ft/sec for the bounding case).

- System modifications have reduced the expected maximum ECCS flow rates by about 20%, further reducing the transport potential.

- Leak-Before-Break (LBB) considerations support the position that the probability of large breaks is extremely small. GDC-4 now excludes any consideration of local dynamic effects from pipe breaks in piping that has been analyzed for LBB and approved by NRC. ONS primary loop piping LBB analysis has been approved by NRC. Generation of debris by a pipe jet is a local dynamic effect. Thus, debris generation from an RCS pipe break is highly unlikely. Any breaks having significant probability of occurrence will require significantly less ECCS flow than the classic large break. Thus, the more probable scenarios will have less potential for debris generation and transport.