

January 20, 2006

Mr. Bruce H. Hamilton
Vice President, Oconee Site
Duke Energy Corporation
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 - NRC STAFF
EVALUATION OF SUPPLEMENTAL RESPONSE TO NRC BULLETIN 2003-01,
"POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP
RECIRCULATION AT PRESSURIZED-WATER REACTORS"
(TAC NOS. MB6288, MB6289, AND MB6290)

Dear Mr. Hamilton:

By letter dated August 7, 2003, you 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). We reviewed and closed the response in a closure letter dated March 30, 2004. Since the time that we 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, we re-opened our review of the ONS Bulletin 2003-01 response and requested additional information by letter dated March 30, 2005. You submitted a response to this request on April 29, 2005. On August 15, 2005, we sent you another request for additional information via electronic mail, and you responded by letters dated August 16, 2005, and October 13, 2005.

We have reviewed the information that you provided, and we find that the interim compensatory measures that you put in place reduce the interim risk associated with potentially degraded or nonconforming emergency core cooling system recirculation functions until an evaluation to determine compliance is complete. The NRC staff's evaluation of your response to Bulletin 2003-01 is enclosed. As part of this evaluation the NRC staff has identified key areas that require further evaluation in order to successfully resolve Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on Pressurized-Water Reactor (PWR) Sump Performance" at ONS. These areas will be evaluated as part of the NRC staff's audit of your

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response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." The NRC staff's GSI 191 audit of ONS was initiated during a 2-day kickoff meeting at ONS on November 8 and November 9, 2005.

Sincerely,

/RA/

Leonard N. Olshan, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosure: Evaluation of Bulletin
2003-01 Response

cc w/encl: See next page

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Enclosure: Evaluation of Bulletin
2003-01 Response

cc w/encl: See next page

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Oconee Nuclear Station, Units 1, 2, and 3

cc:

Ms. Lisa F. Vaughn
Duke Energy Corporation
526 South Church Street
P. O. Box 1006
Mail Code = EC07H
Charlotte, North Carolina 28201-1006

Manager, LIS
NUS Corporation
2650 McCormick Dr., 3rd Floor
Clearwater, FL 34619-1035

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
7812B Rochester Highway
Seneca, SC 29672

Mr. Henry Porter, Director
Division of Radioactive Waste Management
Bureau of Land and Waste Management
Dept. of Health and Env. Control
2600 Bull St.
Columbia, SC 29201-1708

Mr. Michael A. Schoppman
Framatome ANP
1911 North Ft. Myer Dr.
Suite 705
Rosslyn, VA 22209

Mr. B. G. Davenport
Regulatory Compliance Manager
Oconee Nuclear Site
Duke Energy Corporation
ON03RC
7800 Rochester Highway
Seneca, SC 29672

Ms. Karen E. Long
Assistant Attorney General
NC Department of Justice
P.O. Box 629
Raleigh, NC 27602

Mr. R. L. Gill, Jr.
Manager - Nuclear Regulatory
Issues and Industry Affairs
Duke Energy Corporation
526 S. Church St.
Mail Stop EC05P
Charlotte, NC 28202

Division of Radiation Protection
NC Dept of Environment, Health, & Natural
Resources
3825 Barrett Dr.
Raleigh, NC 27609-7721

Mr. Peter R. Harden, IV
VP-Customer Relations and Sales
Westinghouse Electric Company
6000 Fairview Road
12th Floor
Charlotte, NC 28210

Mr. Henry Barron
Group Vice President, Nuclear Generation
and Chief Nuclear Officer
P.O. Box 1006-EC07H
Charlotte, NC 28201-1006

NUCLEAR REGULATORY COMMISSION (NRC)
REVIEW OF BULLETIN 2003-01 RESPONSE
OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3
DOCKET NOS. 50-269, 50-270, AND 50-287

The NRC staff has reviewed the information provided by Duke Energy Corporation (the licensee) for Oconee Nuclear Station, Units 1, 2 and 3 (ONS), regarding interim compensatory measures put in place to reduce the risk associated with potentially degraded or nonconforming emergency core cooling system (ECCS) recirculation functions. As part of this evaluation the NRC staff has identified key areas that require further evaluation in order to successfully resolve Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on Pressurized-Water Reactor (PWR) Sump Performance" at ONS. These areas will be reviewed as part of the NRC staff's audit of the ONS response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors [PWRs]."

The NRC staff finds that the licensee reasonably addressed transport of degraded coatings to the sump. The licensee responded with respect to the ONS current licensing basis assumption of 50 percent screen blockage. The licensee provided technical justification for its assumption that coatings will not transport by referencing threshold transport velocities as compared to ONS specific pool velocities. The licensee referred to data provided in NUREG/CR-6772 and LA-UR-00-4998 (also in NUREG/CR-6808) in its response to the NRC staff's Request for Additional Information (RAI) dated March 30, 2005. This data is based on testing performed by Los Alamos National Laboratory (LANL) for the NRC. The licensee stated that its calculated available transport velocity is approximately 0.2 feet/sec (ft/s), which is less than the 0.4 ft/s experimental flow velocity required to initiate floor transport (NUREG/CR-6772). The licensee also stated that its containment includes substantial barriers to transport in that all ONS sumps have a curb of approximately 2-4 inches in height enclosing the entire perimeter of the sumps. Based on the NUREG data, a flow velocity of 0.5 ft/s was needed to lift a coating chip over a 2-inch high barrier, in which case the ONS flow velocity (0.2 ft/s) would not be adequate. Additionally, as discussed in the ONS bulletin response, ONS has implemented system modifications that have reduced the expected maximum ECCS flow rates by about 20 percent, further reducing the transport potential.

In the transport area, the licensee relied on existing analyses and NUREG test data for concluding that it meet its current licensing basis of 50 percent sump screen blockage. Although the licensee did not perform a plant-specific evaluation to justify the applicability of the NUREG data for Oconee, the licensee's response to the NRC staff's RAI provided evidence that the coatings will not likely transport. It is the NRC staff's judgement that some of the coatings debris may transport to the sump; however, this is very difficult to quantify because transport potential is dependent on variables such as flow velocity, chip size, chip density, shape and other factors. The NRC staff cannot conclude that there would be no transport of coatings debris to the sump. It is likely that some portion of the coatings debris could float transport and make it to the sump screen. Additionally, the licensee has stated that there are locations within containment where zinc primer has been exposed, thus there is a thin residual

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layer of loose zinc particulate on the surface which could potentially be wetted and float transport to the sump.

Currently there is limited data available on coatings debris characteristics and transport. There is also a large degree of variability in this area. In addition to considering the LANL test data referenced by the licensee, the NRC staff also considered insights gained from previous coatings transport testing in assessing ONS's response regarding the coatings transport potential. It should be noted that these insights are qualitative, as detailed quantitative coatings data (i.e., chip size distribution, density, shape, and type) were not necessarily collected during these tests. Therefore, there are uncertainties in the test parameters that make it difficult to judge the direct application of this information to ONS. These insights were gained from an NRC staff review of tests previously performed by industry (ITS/VY-98-01, EC-059-1006, CDI TM 97-14, and CDI TM 99-01). A full review of coatings-debris transport will be necessary for resolution of GSI 191. However, the current licensing basis for ONS assumes 50 percent sump screen blockage and does not require a full mechanistic evaluation.

ONS stated that they have repaired areas of degraded coatings during past outages, and will continue to do so as necessary. ONS has developed the capability to access areas previously considered "inaccessible," including the Reactor Building (RB) dome, RB spray header steel, and the polar crane. The licensee used this capability during the 2005 Unit 1 outage to remove large amounts of degraded coatings throughout containment and in some areas previously considered inaccessible. ONS plans to use this capability, as necessary, to repair or replace degraded coatings during future outages. The licensee stated that coatings in the difficult to access areas will continue to be monitored each outage. The licensee's actions have significantly reduced a potential debris source and are consistent with actions outlined in Bulletin 2003-01. ONS is in the process of developing a long-term coatings remediation strategy that will support resolution of GSI 191.

ONS provided failure analysis reports for the coatings in Unit 1 containment. These reports indicated that application methods associated with the original coatings may have contributed to degradation. During the fall 2005 Unit 2 outage, ONS attempted to identify the extent of degradation by performing adhesion tests on coatings that were visually sound. An additional amount of coatings above the 4th floor elevation was identified as degraded and was planned for remediation. The formal root cause report has not yet been submitted by ONS. The licensee will need to identify the amount of debris that could result from coatings to support resolution of GSI 191.

As mentioned previously, the licensee has committed to performing physical testing to attempt to bound the amount of degraded coatings in containment. The licensee is using the "Adhesion By Knife Test" (ASTM D6677) for assessment of coatings adhesion. This test provides a quick, qualitative assessment of the material condition of the coatings without quantifying the level of degradation. The NRC staff has indicated that physical testing of coatings should be performed by licensees and should be capable of demonstrating that coatings will remain adhered in the event of a loss-of-coolant accident (LOCA). The NRC "Safety Evaluation of Nuclear Energy Institute Guidance on PWR Sump Performance" (ADAMS Accession No. ML043280007) states that if a licensee cannot demonstrate that its coatings will remain adhered during a LOCA, the licensee must assume failure of all containment coatings and consider the debris in the transport and screen blockage analysis. A correlation between this test (ASTM D6677) and design-basis accident (DBA) performance does not exist. As part of the final GSI 191

resolution, ONS will be required to show that its coatings are capable of withstanding LOCA conditions or assume that all coatings will fail.

During the coatings remediation process, the licensee may scrape off the topcoat and leave the inorganic zinc primer exposed. The licensee indicated that the top layer of some of the zinc primer is loose and powdery. This thin residual layer of loose zinc particulate could easily transport to the sump when washed down under LOCA conditions. The licensee indicates that these zinc particles would readily pass through the strainer screen and not contribute to head loss. Once these particles pass through the screen, they have the potential to cause downstream effects. As part of the final GSI 191 resolution, ONS will be required to address the impact of inorganic zinc on the emergency sump and system performance.

ONS identifies a large portion of the coatings inside containment as "acceptable". An "acceptable" coatings is defined as:

A safety-related coatings or lining system for which a suitability for application review which meets the plant licensing requirements has been completed and there is reasonable assurance that, when properly applied and maintained, the coatings or lining will not detach under normal or accident conditions.

ONS primarily identifies the coatings as acceptable because DBA testing was performed on the same generic coatings system (inorganic zinc primer and epoxy topcoat) and original application was believed to be performed per industry standards. As stated above, ONS is developing a long-term remediation strategy for coatings at the site. Remediation efforts to date have included scraping off the degraded topcoat to remove the most egregious debris and in some cases applying new coatings. When applying new coatings, the NRC staff understands that plant current practice focuses on removal of prior coatings to bare metal followed by application of a self-priming epoxy system. The new self-priming epoxy system is DBA-qualified coatings. The licensee's long-term strategy for remediating coatings has not been formally discussed with NRC staff at this time. Therefore, ONS will be required to show that all the containment coatings are capable of withstanding LOCA conditions or assume that all coatings will fail as part of the final GSI 191 resolution.

The NRC staff finds that the interim compensatory measures put in place by the licensee reduce the interim risk associated with potentially degraded or nonconforming ECCS recirculation functions. However, as part of the overall GSI-191 effort, the NRC staff expects the licensee to address coatings and their impact on sump performance. Licensees will provide to the NRC staff their mechanistic analysis assumptions regarding coatings (debris characteristics and transportability to the sump). The NRC staff also expects that ONS will address how it is demonstrating that acceptable coatings in containment (outside the zone-of-influence) will remain adhered in the event of a LOCA. As stated in the GSI-191 safety evaluation, if licensees cannot demonstrate this, then they must assume that the coatings are degraded and treat them accordingly (i.e., assume that the coatings will fail and consider transport to sump). The GL requests that all licensees complete any necessary sump modifications by December 2007. In the interim, licensees are operating under the generic GSI-191 justification for continued operation and the compensatory measures implemented as part of Bulletin 2003-01.