T. PRESTON GILLESPIE, Jr.
Vice President
Oconee Nuclear Station

Duke Energy
ON01VP / 7800 Rochester Hwy.
Seneca, SC 29672

864-873-4478
864-873-4208 fax
T.Gillespie@duke-energy.com

March 23, 2011

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station, Units 1, 2, and 3
Docket Numbers 50-269, 50-270, and 50-287,
Renewed Operating Licenses DPR-38, DPR-47, and DPR-55
"Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," Responses to Request for Additional Information.

Reference:

Letter from John Stang, Senior Project Manager, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, to Preston Gillespie, Site Vice President, Oconee Nuclear Station, Duke Energy Carolinas, LLC (Duke Energy), "Oconee Nuclear Station, Units 1, 2, and 3, Generic Letter 2008-01 Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray System, Request for Additional Information (RAI) (TAC NOS MD7852, MD7853, and MD7854)," dated February 23, 2011.

On January 11, 2008, the Nuclear Regulatory Commission (NRC) issued Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal and Containment Spray Systems." Since that time, there have been several Requests for Additional Information (RAI) and response letters associated with the issue. On February 23, 2011, Duke Energy received an additional RAI (Ref.). The attachment to this letter contains Duke Energy's responses to this most recent RAI.

If you have any questions in regard to this letter, please contact Stephen C. Newman, Regulatory Compliance Lead Engineer, Oconee Nuclear Station, at (864) 873-4388.

A134
NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 23, 2011.

Sincerely,

T Pgillespie

T. Preston Gillespie, Jr.,
Site Vice President,
Oconee Nuclear Station

Attachment

cc: (w/attachment)

Mr. J. F. Stang, Project Manager
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop 8 G9A
Washington, D. C. 20555

Mr. Victor McCree, Regional Administrator
U. S. Nuclear Regulatory Commission - Region II
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, GA 30303-1257

Mr. Andy Sabisch
NRC Senior Resident Inspector
Oconee Nuclear Station

S. E. Jenkins, Manager
Infectious and Radioactive Waste Management Section
2600 Bull Street
Columbia, SC 29201

Attachment

GL 08-01 RAI Responses

RAI 1:

Please provide justification for crediting dynamic venting with Froude numbers between 0.55 and 0.8.

Duke Energy Response:

All piping was evaluated using industry-accepted guidance contained within Section 3.3.1 of WCAP-16631-NP, Volume 1 (Ref. 1). Specifically, the following criteria from the referenced document were utilized:

Since most of the available literature correlates air transport out of horizontal pipes on the basis of Froude number (NFR), this is expected to be the primary correlating parameter. Based on the current state of knowledge, the following transport characteristics can be expected:

1. *For NFR < 0.35 no air will be transported downwards towards the pump suction.*
2. *For NFR > 0.55 all of the air can be flushed out of a horizontal pipe into a plenum. The ability to transfer air through a piping system depends on the layout of piping downstream of the horizontal local high point. It is reasonable to expect that NFR=0.55 will not be sufficient to purge all of the air out of the local high point.*
3. *For NFR > 1.0 all of the air will be transported downwards towards the pump suction.*
4. *For 0.35 < NFR < 1.0 at least a portion of the air can be expected to be discharged from the local highpoint.*
5. *The rate of air entrainment is expected to be a function of the Froude number (NFR) in the horizontal pipe.*

These criteria were published prior to the October 2008 response date required by Generic Letter 2008-01 (References 1, 8). Criteria specified within Reference 9 and its original revision were not issued until after the response date and completion of the required evaluations (Ref. 10). System evaluations consisted of determining Froude numbers that were applicable to each unique horizontal span and judging against WCAP-16631-NP criteria. For locations at which the potential for gas formation existed and the Froude number was not sufficient to ensure adequate flushing as defined in the WCAP, a monthly UT monitoring location and/or vent installation was specified to verify that the piping remained sufficiently filled. Surveys were completed to verify that the UT sites and/or vents were at the actual high point of the span. Oconee system evaluations did not credit dynamic venting in any horizontal span with Froude numbers between 0.55 and 0.8 unless a plume existed in the piping that allowed entrained gas to be transported upward to another section of piping. As part of the initial licensee activities related to GL 2008-01 evaluations, confirmatory UT inspections were performed at numerous locations (~100) to evaluate the effectiveness of dynamic venting. (Ref. 2)

As ongoing validation, post-dynamic flush UTs and/or program monitoring UTs are conducted at numerous points within the GL-addressed systems to verify dynamically flushed piping remains sufficiently filled (Ref. 5).

RAI 2:

Please verify the statement that UT is used to verify that dynamically flushed piping remains sufficiently full with respect to such areas as vertical U-tube heat exchangers and valve internal configurations where UT cannot be used if dynamic flushing involves these locations. If dynamic flushing is not used for these areas, then describe how they are determined to be sufficiently full.

Duke Energy Response:

Programmatic UT sites were uniquely specified based upon results from the system evaluations to verify that dynamically vented piping remains sufficiently filled and to ensure all potential vulnerabilities related to gas accumulation are properly monitored. As part of the evaluation performed for each specific piping span, consideration was inherently given to all components within the span that could possibly trap gas such as valves, heat exchangers, expanders, and orifices. Since valves far outnumbered all other types of installed components and since numerous valve types required consideration, they were specifically addressed in the site GL 2008-01 calculation as follows (Ref. 2):

- *Unventable volumes within valve bonnets are above the flow stream. Only a portion of the gas within tall bonnets such as those on gate valves can be displaced due to the lack of a direct flow path through the upper portion of the bonnet.*
- *For gate valves, discs in the open position reduce the available volume for gas to collect in the bonnet. Many of the gates valves in the systems subject to the GL 2008-01 evaluations are open during the fill and vent of the systems. This minimizes the amount of gas that is present in the valves. In check valves, a large portion of the exposed volume is blocked by the disc.*
- *For valves on the discharge of pumps, the gas volume will likely be compressed up into the bonnet, especially with the taller bonnets on gate valves.*
- *Globe valves within the subject systems have negligible internal volumes subject to gas accumulation*
- *Gate valves oriented horizontally will tend to self vent with minimal gas accumulation in the bonnet.*

As such, the presence of residual gas pockets within valve bodies was not considered to be a significant contributor to overall system vulnerability. This position appears to be consistent with guidance documented in NRC Inspection Manual Temporary Instruction 2515/177 (Ref. 7). Nevertheless, in certain instances, programmatic UT sites were located immediately upstream or downstream of system valves to ensure that gas formation was not occurring in the local span during the operating cycle. Additionally, since no Oconee systems within the scope of GL 2008-01 were determined to have vertical U-tube heat exchanger designs, the industry issue related to U-tube gas formation was not applicable (Ref. 3, 4).

References:

1. WCAP-16631-NP, Volume 1, Testing and Evaluation of Gas Transport to the Suction of ECCS Pumps, Rev. 0, October 2006
2. Duke Calculation OSC-9610, Evaluation of LPI, CF, RBS, and HPI Systems for Generic Letter 2008-01, Revision 0
3. OM-201-0286, Unit 1 and Unit 2 Decay Heat Coolers, Revision D14
4. OM-2201-0277, Unit 3 Decay Heat Coolers, Revision D04
5. PT/*/A/0203/012, HPI/LPI/RBS Piping Venting
6. (not used)
7. NRC Inspection Manual Temporary Instruction 2515/177, Section 04.02 (Design), Revision 1
8. Harrall, T., "Duke Energy Carolinas, LLC (Duke); Oconee Nuclear Station, Units 1,2 & 3, Docket Nos. 50-269, 50-270, 50-287; McGuire Nuclear Station, Units 1 & 2, Docket Nos. 50-369,50-370; Catawba Nuclear Station, Units 1 & 2, Docket Nos. 50-413, 50-414; Generic Letter 2008-01, 9-Month Response," Letter to Document Control Desk, NRC, from Vice President, Plant Support, Duke Energy Carolinas, LLC, October 13, 2008
9. "Guidance To NRC/NRR/DSS/SRXB Reviewers for Writing TI Suggestions for the Region Inspections," December 6, 2010
10. "Inspection Guidance 5 - To NRC/NRR/DSS/SRXB Reviewers for Writing TI Suggestions for the Region Inspections, " February 4, 2010