Duke Energy®

JAMES R. MORRIS
Vice President

Duke Energy Corporation
Catawba Nuclear Station
4800 Concord Road
York, SC 29745

803-701-4251
803-701-3221 fax

March 4, 2010

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

Subject: Duke Energy Carolinas, LLC (Duke)
Catawba Nuclear Station, Unit 1 and 2
Docket Nos. 50-413 and 50-414

Response to Request for Additional Information Regarding Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"

On July 15, 2009 Duke submitted a Supplemental Response to NRC Generic Letter 2008-01 for Catawba Nuclear Station. On December 4, 2009, Catawba received five Request for Additional Information (RAI) questions via e-mail. Catawba's response to these questions is contained in attachment 1 to this letter.

This letter contains no regulatory commitments. Questions regarding this update should be directed to P.W. Barrett at (803) 701-4138.

Very truly yours,

James R. Morris

Attachment

A134
NRR

James R. Morris affirms that he is the person who subscribed his name to the foregoing statement, and that all matters and facts set forth herein are true and correct to the best of his knowledge.

James R. Morris, Vice President

Subscribed and sworn to me: 3-4-10
Date

Notary Public

My commission expires: 7-10-2012
Date

SEAL

xc:

Luis A. Reyes
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
61 Forsyth Street, S.W. Suite 23T85
Atlanta, Georgia 30303-8931

J.H. Thompson, Project Manager (CNS & MNS)
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mail Stop 8G9A
Rockville, MD 20852-2738

A. Hutto
NRC Senior Resident Inspector
Catawba Nuclear Station

bxc:

J.R. Morris (CN01VP)
K.W. Phillips (CN01SA)
R.D. Hart (CN01RC)
R.L. Gill (EC05P)
S.B. Putnam (CN03SE)
R.L. Herring (CN03SE)
C.B. Hood (CN03SE)
A.M. Donato (CN03SE)
Catawba Document Control File: 801.01 – CN04DM
Catawba RGC Date File
ELL-EC05O
NCMPA-1
NCEMC
PMPA

REQUEST FOR ADDITIONAL INFORMATION (RAI)

Guidance on Nuclear Regulatory Commission (NRC) staff expectations is provided by Reference 1 which is generally consistent with Nuclear Energy Institute (NEI) guidance provided to industry in Reference 2 as clarified in later NEI communications. The NRC staff recommends that the licensee consult Reference 1 when responding to the following RAIs:

1. Provide a discussion of the methods used to determine the volume of voids; for both venting and ultrasonic testing (UT). Discuss follow up actions such as trending the volume of voids.

Currently, venting is used to satisfy the monthly surveillance required by Technical Specifications 3.5.2 and 3.5.3 for ECCS. As stated in the Generic Letter response (reference 4), the Containment spray system is vented quarterly.

If gas is found on the Chemical and Volume Control (NV) system piping, the change in Volume Control Tank level has been shown to be a good indicator of the volume vented as the level must decrease to fill the void that is vented.

Gas volumes have been estimated in the past based on the elapsed time for gas to purge to a solid stream of water. If there is a known pocket of gas, UT would be used to trend and monitor the gas volume if possible/accessible.

A gas volume estimate of the Residual Heat Removal (ND) system is normally obtained following recirculation operation of the ND pumps. The estimate of gas volume provides indication of gas volume at un-ventable locations such as the top of the ND heat exchanger U-tubes or inaccessible locations. The gas estimate may be obtained when each ND pump is operated in recirculation at least once per quarter in accordance with the in-service test program. Following recirculation operation a residual pressure of typically greater than 75 psig is trapped downstream of the ND pump suction check valve and the pump discharge check valve. The fluid volume to reduce the ND pump discharge pressure to 55 psig is measured by timing the vent flow rate. Ideal gas relationships are used to estimate a gas volume. This estimate is trended to determine if gas accumulation is occurring. Gas estimate trending is a specific system parameter trended by the system engineer per the ND System Engineering Support Document (ESD). The ND gas volume estimate augments continuous Operator Aid Computer monitoring of ND discharge header pressure for pressurization. ND header pressurization would be detected prior to observing significant change in the ND gas volume estimate.

As for follow up actions, typically when gas has been found, UT is employed to monitor the piping for presence of voids and void size on an increased frequency. As the results/trending indicated that the gas volume was stable or decreasing, the frequency is relaxed. Once it is confirmed that the gas source is isolated, the regular surveillance using venting is resumed and supplemental UTs are no longer required.

Catawba is in the process of changing procedures and training personnel to use ultrasonic testing (UT) to satisfy the monthly surveillance. Once this is done, better determination of any void volumes will be possible by characterizing the depth and length of any voids.

2. In Reference 4 the licensee states that "Surveillance procedures have a low threshold for as found gas" and "The Corrective Action Program is entered if the vented volume

exceeds a predetermined threshold". Clarify what the threshold volume is; and if it takes into account both water hammers and gas injection limits for pumps.

The current threshold when performing the monthly surveillance on ECCS systems or the quarterly surveillance on Containment Spray is zero gas except for allowing ≤2 secs venting duration at one location on each unit. This location is on the normally isolated suction piping to the charging pumps from the Residual Heat Removal system and is located above the Volume Control Tank (VCT) where a small amount of degassing can and does occur. Since this volume is on the suction side of the charging pumps, gas ingestion is the primary concern. Following gas accumulation issues on the Unit 1 Chemical and Volume Control system in early 2004, UTs continued to be conducted for a period of time after the source of the gas was isolated. The UTs indicated that in the month between the normal venting surveillances, gas volumes constituting ~0.5% void fraction would build up at the point where the UT was done at valve 1NV860. Due to slope in the pipe, the cross sectional void fraction may reach a maximum of slightly over 2% at the high point. Total volume for this void fraction would be less than 0.1 cubic feet. Gas transport analysis done by Numerical Applications Inc. ,using GOTHIC computer code, shows that it is well below any limits that would challenge operability of the charging pumps or safety injection pumps as larger void volumes were evaluated for gas accumulation that occurred at this location in 2004. This high point is located upstream of an approximately 15 ft. downcomer which ensures that the two phase mixture transmitted to the pumps is bubbly flow. As this location is on the suction piping, gas ingestion at the pumps and potential injection of gas into the reactor coolant system are considered.

For all vent locations except the one discussed in the above paragraph, gas found on the suction side of the ECCS and Containment Spray pumps would be entered into the corrective action program. Evaluation would include gas ingestion at the downstream pumps and potential injection of gas into the Reactor Coolant System for ECCS. Gas found on the discharge side of the ECCS and Containment Spray pumps would be entered into the corrective action program. Evaluation would include water hammer and potential injection of gas into the reactor coolant system.

As further gas transport analysis is conducted to determine the effects of volumes of gas at different locations in the systems that are subject to the Generic Letter, the current threshold may change.

3. In Reference 4 the licensee states that "Effective transport velocities when dynamic venting is credited (Froude number of > 0.55 for horizontal piping runs and > 1.0 for vertical piping runs)." Justify that dynamic venting under these conditions is able to remove voids.

The criteria used was derived from WCAP-16631-NP. As part of the licensee activities related to the Generic Letter, UT was conducted at numerous points on the subject systems including local high points due to slope in the piping. All of the UTs conducted showed the piping to be full except for one point on the discharge of the Safety Injection pumps. This finding was entered into the Corrective Action Program (CAP). It was determined that the small pocket of air was introduced when maintenance was conducted on valve 1NI-162A after the test that dynamically fills the piping. Since there was no practical means of introducing sufficient flow to sweep the piping of this pocket of gas at the time of discovery, the Operability Determination Process was entered. Evaluations concluded that there would be no adverse effects from water hammer or introduction of the air into the Reactor Coolant system. After the piping was filled in the

most recent outage, 1EOC18, UT showed that this piping was full indicating that the dynamic venting is able to remove the voids.

The Froude numbers referenced were used to determine if sufficient flow was available to sweep the piping during "dynamic venting" of the piping. It is acknowledged that gas may be removed from piping at lower Froude numbers. In the end, UT was conducted at numerous points on the subject systems and the piping was found to be full with the one exception mentioned above.

4. Describe the monitoring of appropriate plant parameters during normal and shutdown operation, including reduced inventory and mid-loop operation. Such as monitoring level indicators; including the level of the volume control tank, and accumulator and piping pressures. Clarify how often the accumulator water make-ups and water makeup rates are monitored and trended as part of the Engineering Support Program. For reduced inventory and mid-loop operations justify that the water level is sufficient to prevent vortexing due to suction from the RHR.

Normal System operation:

- *During normal System operation the ND system discharge pressure is continuously monitored by Operator Aid Computer (OAC) point C1(2)P0079. This OAC point alarms if ND discharge header pressure increases from a normal static pressure of ~48 psig to 60 psig. The ND discharge pressure is also verified once per shift per PT/1(2)/A/4600/002A, Mode 1 Periodic Surveillance Items, PT/1(2)/A/4600/002B, Mode 2 Periodic Surveillance Items and PT/1(2)/A/4600/002C, Mode 3 Periodic Surveillance Items, in modes 1-3. ND pressurization can be symptomatic of Cold Leg Accumulator (CLA) leakage to the ND discharge header as gas comes out of solution.*

- *NI Pump discharge header pressure is monitored once per shift per PT/1(2)/A/4600/002A, Mode 1 Periodic Surveillance Items, PT/1(2)/A/4600/002B, Mode 2 Periodic Surveillance Items and PT/1(2)/A/4600/002C, Mode 3 Periodic Surveillance Items, modes 1-3 to ensure Safety Injection (NI) discharge header pressure remains less than 100 psig. NI pressurization can be symptomatic of CLA leakage to the NI pump discharge header as gas comes out of solution.*

- *The NI System Engineering Support Document (ESD) specifies weekly monitoring of CLA level trends by the system engineer. Based on the NI System ESD, NI CLA make-up or level reductions in excess of once per month are considered excessive. The CLA level monitoring augments the more frequent ND and NI header pressurization surveillances.*

- *VCT level instrumentation*
    1. *As a result of SOER 97-01, the VCT level instrumentation was reviewed.*
        - *Monthly channel checks per PT/1(2)/A/4600/003A (Monthly Surveillance Items) between the control room and Auxiliary Shutdown Panel (ASP) indications are performed and corrective action taken if not within 5%.*
        - *In the event of loss of charging, guidance was added to AP/1(2)/A/5500/012 (Loss of Charging or Letdown) to ensure a suction source and that the pump and suction piping is vented prior to starting an available charging pump if the operating pump tripped due to loss of suction.*
    2. *The suction of the charging pumps will swap to the FWST on receipt of a low-low VCT level signal. A calculation, CNC-1223.04-00-0107, (VCT NPSH and Low-Low Level Auto-swap Setpoint) demonstrates the acceptability of the setpoint for the swap-over to the Refueling Water Storage Tank (FWST). This calculation shows that for the highest expected flows that vortexing will not occur prior to swap-over to the*

FWST. This was done as flows may increase on decreasing pressurizer pressure prior to receipt of the Safety Injection signal that will swap charging pump suction to the FWST.

Residual Heat Removal System operation during shutdown:

- *OP/1(2)/A/6150/006, Draining the Reactor Coolant System contains guidance to preclude loss of residual heat removal during reactor coolant draining operations. Procedures require maintaining a RHR train with an operable DG in a standby condition in the event of a loss of the operating RHR train. The procedure requires two independent level indications in agreement prior to reducing Reactor Coolant (NC) system inventory to mid-loop conditions. The procedure also requires backup indication with the NC System sightglass or tygon level indication.*
- *Calculation CNC 1223.03-00-0007, NC System Draindown to Preclude Gas Entrainment with ND Suction Taken at Hot Legs B and C, evaluates ND System Flow required to prevent gas entrainment in the ND pump suction during mid loop operation. The analysis uses empirical equations to determine the vortex height at various flow rates. The calculation employs the Harleman Equation to determine vortex height. The Harleman equation predictions have been evaluated in WCAP-11916 and bound the ND suction piping configuration at CNS. The calculation has sufficient margin to account for instrument error.*

5. Training was not identified in the GL (Reference 3) but is considered to be a necessary part of applying procedures and other activities when addressing the issues identified in the GL. Provide a brief description of training.

GL 2008-01 did not require discussion of training to satisfy the 10 CFR 50.54(f) request and therefore none was provided in the GL response. However, when any station procedure is modified, an assessment for training needs is required in accordance with Nuclear System Directive (NSD) 704. The determination is typically a function of the nature of the change and the perceived impact on the organization. If training is required, it is generally accomplished prior to, or in parallel with the issuance of the procedure. For fill and vent procedure revisions, the changes have generally been minor, and have been considered enhancements.

Duke Energy classroom training addressing gas accumulation issues identified in NRC and industry documentation such as GL 2008-01, INPO SOER 97-01, and INPO SER 2-05 Rev. 1 was given to Engineering personnel in 2009, Maintenance personnel in 2008, Chemistry personnel in 2008, and is scheduled for Operations in 2010.

Duke Energy is an active participant in the NEI Gas Accumulation Team, which is currently coordinating with the Institute of Nuclear Power Operations (INPO) in the development of generic training modules for gas accumulation and management. These training modules target the Engineering, Operations and Maintenance disciplines. When these training modules are completed and become available to the industry, Catawba Nuclear Station will evaluate them for applicability and may implement a version tailored to meet station needs.

References:

1) Ruland, William H., "Preliminary Assessment of Responses to Generic Letter 2008-01 , 'Managing Gas Accumulation in emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems,' and Future NRC Staff Review Plans," NRC letter to James H. Riley, Nuclear Energy Institute, ML091390637, May 28,2009.

2) Riley, James H" "Generic Letter (GL) 2008-01, 'Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems' Evaluation and 3 Month Response Template," Letter to Administrative Points of Contact from Director, Engineering, Nuclear Generation Division, Nuclear Energy Institute, Enclosure 2, "Generic Letter 2008-01 Response Guidance," ML093070575, March 20, 2008.
3) Case, Michael J., "NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," Letter from Director, Division of Policy and Rulemaking, Office of Nuclear Regulation, NRC, ML072910759, January 11, 2008.
4) 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