

March 7, 2000

Mr. S. K. Gambhir  
Division Manager - Nuclear Operations  
Omaha Public Power District  
Fort Calhoun Station FC-2-4 Adm.  
Post Office Box 399  
Hwy. 75 - North of Fort Calhoun  
Fort Calhoun, NE 68023-0399

SUBJECT: FORT CALHOON STATION, UNIT NO. 1 - GENERIC LETTER 97-04,  
"ASSURANCE OF SUFFICIENT NET POSITIVE SUCTION HEAD FOR  
EMERGENCY CORE COOLING AND CONTAINMENT HEAT REMOVAL  
PUMPS" (TAC NO. M99992)

Dear Mr. Gambhir:

On October 7, 1997, the US Nuclear Regulatory Commission (NRC) staff issued Generic Letter (GL) 97-04, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps," to all holders of operating licenses or construction permits. By letter dated December 31, 1997, Omaha Public Power District (OPPD) provided their response to GL 97-04 for the Fort Calhoun Station, Unit No. 1. By letter dated October 29, 1998, OPPD submitted a 10 CFR 50.59 evaluation at the staff's request. The 50.59 evaluation evaluated a 1992 Updated Safety Analysis Report (USAR) change regarding credit for subcooling in the calculation of net positive suction head (NPSH) for the containment spray pumps. Ongoing discussions continued between you and the staff regarding assumptions and conclusions in the evaluation. The staff issued a request for additional information (RAI) on December 7, 1998, and an assessment of the RAI on February 23, 1999. You responded to the RAIs on January 5, and April 15, 1999.

The staff has reviewed your letters and supporting documentation. You determined that 8.99 feet of subcooling is required to meet the NPSH requirements of the containment spray pumps. For consistency, you also used 8.99 feet of subcooling in the NPSH analyses of the high-pressure safety injection pumps. Based on the information provided by you, the staff considers GL 97-04 closed for Fort Calhoun Station. The staff has also determined that the

Mr. S. K. Gambhir

- 2 -

March 7, 2000

1992 50.59 evaluation did not consider the potential loss of the containment spray due to inadequate subcooling. As such, the licensing basis change from 0 feet to 8.99 feet of subcooling credit should have received prior staff review. The staff assessment is enclosed. This completes the staff's effort on TAC No. M99992.

Sincerely,

***/RA/***

L. Raynard Wharton, Project Manager, Section 2  
Project Directorate IV & Decommissioning  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure: Staff Assessment

cc w/encl: See next page

1992 50.59 evaluation did not consider the potential loss of the containment spray due to inadequate subcooling. As such, the licensing basis change from 0 feet to 8.99 feet of subcooling credit should have received prior staff review. The staff assessment is enclosed. This completes the staff's effort on TAC No. M99992.

Sincerely,

***/RA/***

L. Raynard Wharton, Project Manager, Section 2  
Project Directorate IV & Decommissioning  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure: Staff Assessment

cc w/encl: See next page

DISTRIBUTION:

- File Center
- PUBLIC
- PDIV-2 Reading
- SRichards (clo)
- OGC
- ACRS
- CMarschall, Region IV
- JHannon
- KKavanagh
- RLobel

To receive a copy of this document, indicate "C" in the box					
OFFICE	PDIV-2/PM	C	PDIV-2/LA	C	PDIV-2/SC
NAME	RWharton:lcc	EPeyton		SDembek	
DATE	03/03/00	03/03/00		03/03/00	

DOCUMENT NAME: C:\GL9704.wpd

OFFICIAL RECORD COPY

Ft. Calhoun Station, Unit 1

cc:

Winston & Strawn  
ATTN: Perry D. Robinson, Esq.  
1400 L Street, N.W.  
Washington, DC 20005-3502

Mr. Jack Jensen, Chairman  
Washington County Board  
of Supervisors  
Blair, NE 68008

Mr. Wayne Walker, Resident Inspector  
U.S. Nuclear Regulatory Commission  
Post Office Box 309  
Fort Calhoun, NE 68023

Regional Administrator, Region IV  
U.S. Nuclear Regulatory Commission  
611 Ryan Plaza Drive, Suite 1000  
Arlington, TX 76011

Ms. Cheryl Rodgers, LLRW Program  
Manager  
Environmental Protection Section  
Nebraska Department of Health  
301 Centennial Mall, South  
P.O. Box 95007  
Lincoln, NE 68509-5007

Mr. J. M. Solymossy  
Manager - Fort Calhoun Station  
Omaha Public Power District  
Fort Calhoun Station FC-1-1 Plant  
Post Office Box 399  
Hwy. 75 - North of Fort Calhoun  
Fort Calhoun, NE 68023

Mr. Mark T. Frans  
Manager - Nuclear Licensing  
Omaha Public Power District  
Fort Calhoun Station FC-2-4 Adm.  
Post Office Box 399  
Hwy. 75 - North of Fort Calhoun  
Fort Calhoun, NE 68023-0399

ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO THE CLOSE OUT OF GENERIC LETTER 97-04,  
"ASSURANCE OF SUFFICIENT NET POSITIVE SUCTION HEAD FOR  
EMERGENCY CORE COOLING AND CONTAINMENT HEAT REMOVAL PUMPS"  
OMAHA PUBLIC POWER DISTRICT  
FORT CALHOUN STATION, UNIT NO. 1  
DOCKET NO. 50-285

## 1.0 BACKGROUND

The NRC staff issued Generic Letter (GL) 97-04, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps," on October 7, 1997. The GL requested that licensees provide information necessary to confirm the adequacy of the net positive suction head (NPSH) available for emergency core cooling and containment heat removal pumps. By letter dated December 31, 1997, Omaha Public Power District (OPPD) submitted its 90-day response to GL 97-04.

By letter dated October 29, 1998, OPPD submitted a 10 CFR 50.59 evaluation at the staff's request. This 50.59 evaluation evaluated the 1992 Updated Safety Analysis Report (USAR) change regarding credit for subcooling in the calculation of NPSH for the containment spray pumps. The change involved increasing the FCS reliance on subcooling from 0 feet to 8.99 feet (approximately 3.9 psi) in order to assure adequate NPSH for the containment spray pumps. OPPD also submitted the calculation associated with the NPSH available for the containment spray pumps in recirculation phase. By letter dated December 7, 1998, the NRC staff requested additional information from OPPD regarding the 1992 USAR change. OPPD responded to the request for additional information by letter dated January 5, 1999. By letter dated February 23, 1999, the staff provided a detailed assessment of the staff's concerns and a request to meet with OPPD. The staff and representatives from OPPD met on March 18, 1999. By letter dated April 15, 1999, OPPD provided additional information that was requested by the staff during the March 18, 1999 meeting.

## 2.0 ASSESSMENT

Fort Calhoun Station has containment spray and high-pressure safety injection (HPSI) pumps which take suction from the containment sump during the recirculation phase following a large-break loss-of-coolant accident (LOCA). The containment spray pumps, in conjunction with heat exchangers, control containment pressure and containment sump temperature. The HPSI pumps provide core cooling by injecting containment sump water into the reactor core.

According to the USAR, Fort Calhoun takes credit for subcooling to assure adequate NPSH to the containment spray and HPSI pumps during the recirculation phase. The measure of subcooling is the difference between containment pressure and the vapor pressure of the sump water.

The staff has reviewed the OPPD letters and supporting documentation related to containment overpressure. The licensee has determined that 8.99 feet of subcooling is required to meet the NPSH requirements of the containment spray pumps. According to the licensee, the amount of subcooling available is 35.95 feet. The available subcooling was calculated by subtracting the vapor pressure at the sump temperature from the containment pressure at the same point in time. The calculated available subcooling is based on a delta pressure of 15.47 psia which occurred at 99,650 seconds following the large-break LOCA with an associated sump temperature of 100.3 degrees Fahrenheit. The licensee then took credit for 25 percent of this calculated subcooling, or 8.99 feet, and accounted for it in the NPSH calculations. For consistency, the licensee also used 8.99 feet of subcooling in the NPSH analyses of the HPSI pumps. Although taking credit for only 25 percent of the subcooling available appears to be conservative, the licensee's minimum containment pressure analysis is not consistent with the methods used by the staff.

The Fort Calhoun minimum containment pressure analysis is not dependant on time or the temperature of the sump water. Minimum containment pressure analyses that include these effects provide information such as the actual amount of subcooling required to meet the NPSH requirements, the amount of time the subcooling credit is required, and the point in time during the accident when the subcooling is required. This information is then used as part of the basis for approving the use of a specified amount of containment overpressure (or subcooling) in the NPSH analyses. Since this type of information was not available, the staff could not make purely analytic conclusions on the acceptability of the amount of subcooling credited.

It has been and continues to be the staff's position that any increase in reliance on containment overpressure (or subcooling) must be reviewed and approved by the staff. An increase in reliance could be an increase in the amount of overpressure, an increase in the time the overpressure is required, or both.

This position is also consistent with previous presentations made to the Advisory Committee of Reactor Safeguards (ACRS), the BWR Owners Group NPSH Subcommittee, and several enforcement conferences. In conjunction with the ACRS presentation, the ACRS provided guidance to the staff on approving the use of containment overpressure (subcooling) for meeting the NPSH requirements for pumps. In its letter dated December 12, 1997 (Reference 1), the ACRS stated that they "now concur with the NRC staff position that selectively granting credit for small amounts of overpressure for a few cases may be justified. We recommend that instead of using qualitative arguments and restricting attention to a limited range of accident sequences, the decisionmaking process should consider the time variation of NPSH for a broad range of accident sequences such as typically found in a probabilistic risk assessment (PRA)."

To that end, the staff reviewed the Fort Calhoun Individual Plant Examination (IPE) (Reference 2). The Fort Calhoun IPE states that the containment temperature and pressure control function is important for all core damage sequences. As part of the review, the staff also evaluated the effect of the loss of the containment spray pumps due to insufficient

subcooling. To the best of our knowledge, the licensee has not evaluated the effect of the loss of subcooling on the containment spray pumps.

During the recirculation phase following a LOCA, the containment spray pumps and the HPSI pumps take suction from the containment sump. The containment spray pumps, in conjunction with heat exchangers, maintain the sump water temperature to below 250 degrees Fahrenheit. The HPSI pumps provide cooling water to the reactor core. With a loss of the containment spray pumps, it is important to ensure that the increase in sump water temperature does not prevent the HPSI pumps from performing their design function.

The staff performed its own calculations assuming a saturated sump. A saturated sump occurs when the containment pressure and the vapor pressure of the sump water are equal. When this occurs, the containment pressure and the vapor pressure cancel each other out in the NPSH calculation. The remaining components of the NPSH calculation are the static head and the frictional losses. The credited subcooling is added to the difference between the static head and the frictional losses in the NPSH calculation. The staff calculations demonstrated that the HPSI pumps had approximately 18 feet of margin without subcooling credit, that is, the static head minus the frictional losses was 18 feet. This analysis was based on the information presented in Section 6.2, "Safety Injection System," of the Fort Calhoun USAR. Based on this analysis, the staff concluded that the loss of the containment spray pumps following a large-break LOCA would not have adverse effects on the HPSI pump performance.

While the staff did not independently verify the licensee's value of required subcooling equal to 8.99 feet for the containment spray system pumps, the staff's evaluation, which follows the recommendation of the ACRS, provides assurance that the requirements of 10 CFR 50.46, i.e., long-term core cooling, will be met even if the containment spray pumps are lost due to insufficient subcooling following a large-break LOCA. Based on this conclusion and the insights provided by the Fort Calhoun IPE, the Fort Calhoun USAR, and the information provided by the licensee, the staff has determined that the licensee has provided sufficient information to meet the requests of GL 97-04. The staff considers GL 97-04 closed for Fort Calhoun Station.

However, the staff has determined that the 1992 50.59 evaluation did not consider the potential loss of containment spray due to inadequate subcooling. The licensing basis change from 0 feet to 8.99 feet of subcooling credit should have received prior review by the staff because it created the possibility of a malfunction of a different type. The staff also acknowledges that the loss of the containment spray due to inadequate subcooling is a low safety significant event.

### 3.0 REFERENCES

1. Seale, R. L., ACRS, to S. A. Jackson, Chairman USNRC, "Credit for Containment Overpressure to Provide Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps," December 12, 1997.
2. Gates, W. G., OPPD, to USNRC, "NRC Generic Letter 88-20 Submittal for Fort Calhoun Station 'Individual Plant Examination for Severe Accident Vulnerabilities' (TAC NO. 74412)," December 1, 1993.

Principal Contributor: K. Kavanagh

Date: March 7, 2000