Omaha Public Power District
444 South 16th Street Mall
Omaha, NE 68102-2247

LIC-12-0080
June 11, 2012

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

References:
1. Docket Number 50-285
2. Letter from NRC (E. E. Collins) to OPPD (D. J. Bannister) dated October 6, 2010 (NRC 10-0080)(EA-10-084)
3. Letter from NRC (J. A. Clark) to OPPD (D. J. Bannister) dated May 11, 2012 (NRC-12-0049)(EA-2012-095)
4. Letter from NRC (N. F. O'Keefe) to OPPD (R. T. Ridenoure) dated October 14, 2005 (NRC-05-0124)

SUBJECT: Response to NRC Inspection Report 05000285/2012002, EA-2012-095

In Reference 3, the Nuclear Regulatory Commission (NRC) transmitted violation (VIO 05000285/2012002-03, "Failure to Meet Design Basis Requirements for Design Basis Flood Event") to the Omaha Public Power District (OPPD). This violation is related to a previously issued Yellow finding regarding the ability to mitigate an external flooding event (Reference 2). Specifically, OPPD failed to translate design basis requirements for protection of the safety-related raw water system during a design basis flood for flood levels between 1,010-1,014 feet mean sea level (MSL) as identified in the Updated Safety Analysis Report (USAR).

OPPD denies that a violation of NRC requirements occurred, in that, OPPD is in compliance with the flood protection requirements as noted in the Fort Calhoun Station (FCS) USAR. However, OPPD recognizes that protection of the safety-related raw water system during a design basis flood event is of the utmost importance. The protection of the raw water system includes protection of the intake structure sluice gates motor operated valves (MOVs) from river-born debris. To ensure protection of the raw water system for design basis floods between 1,010–1,014 feet MSL, OPPD has revised procedures to control raw water levels within the intake structure cells, installed temporary measures to protect the sluice gate MOVs from river-born debris, and permanent modifications to protect the sluice gate MOVs will be completed prior to plant restart. These actions increase the safety margin of the raw water system.

The enclosure to this letter contains the reasons for denying the violation. This response contains no commitments. Should you have questions or comments, please contact me.

D. J. Bannister
Site Vice President and CNO

Enclosure

DJB/rmc

c: E. E. Collins, Jr., NRC Regional Administrator, Region IV
R. P. Zimmerman, NRC Director, Office of Enforcement
L. E. Wilkins, NRC Project Manager
J. C. Kirkland, NRC Senior Resident Inspector

Statement of VIO 05000285/2012002-03:

N/A. The inspectors identified a violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," for failure to meet design basis requirements for protection of the safety related raw water system during a design basis flood for flood levels between 1,010-1,014 feet mean sea level as identified in Updated Safety Analysis Report, Section 9.8, "Raw Water System." Specifically, the design basis states that water level inside the intake cells can be controlled during a design basis flood by positioning the exterior sluice gates to restrict the inflow into the cells. This finding, and its corrective actions, will be managed by the Manual Chapter 0350 Oversight Panel.

This finding was more than minor because it adversely impacted the equipment performance and protection against external events attributes of the Mitigating Systems Cornerstone objective of ensuring the availability, reliability and capability of systems that respond to initiating events to prevent undesirable consequences. The significance of this finding is bounded by the significance of a related Yellow finding regarding the ability to mitigate an external flooding event (Inspection Report 05000285/2010008). This finding has a cross-cutting aspect in the area of problem identification and resolution, corrective action program, for failure to thoroughly evaluate problems such that the resolutions address causes and extent of conditions [P.1(c)]. (Section 1R01)

The inspection report description of the violation also states:

(3) Failure to Meet Design Basis Requirements for Design Basis Flood Event

Introduction. The inspectors identified a violation of 10 CFR 50, Appendix B, Criterion III, Design Control, for failure to meet design basis requirements for protection of the safety related raw water system during a design basis flood for flood levels between 1,010-1,014 feet mean sea level as identified in Updated Safety Analysis Report, Section 9.8, "Raw Water System." Specifically, the design basis states that water level inside the intake cells can be controlled during a design basis flood by positioning the exterior sluice gates to restrict the inflow into the cells.

Description. The electric motor operators that position the six exterior sluice gates on the intake structure are located at an elevation of 1,010 feet mean sea level outside the east wall of the intake structure. At the design basis flooding elevation of 1,014 feet mean sea level, they would be completely submerged. Therefore, the motors that position the exterior sluice gates may not function when river water level rises above the 1,010 feet mean sea level. The licensee's flooding mitigation strategy involves closing five of the six exterior sluice gates and positioning the remaining gate such that a balance between inflow and raw water pump discharge are balanced (approximately one-inch open) prior to water level rising to 1,010 feet mean sea level.

The inspectors identified that changing river conditions above 1,010 feet mean sea level, could interrupt the pre-established flow balance and jeopardize the control of intake cell water level without the ability to reposition any of the external sluice gates. Should silting or sanding occur that blocks the one slightly open sluice gate, a lowering of cell water level could occur to a level below raw water pump minimum submergence requirements, resulting in loss of the raw water system – the ultimate heat sink. Similarly, should a water-born hazard (floating tree or other large river debris) strike any of the sluice gates, or their motor operators, or their connecting rods such that inflow or leakage is increased to greater than the capacity of two raw water pumps, a raising of cell water level could occur to a level that results in flooding of the raw water pump vaults (1,007.5 feet mean sea level), resulting in a loss of the raw water system.

OPPD Basis for Denial

As stated in the Updated Safety Analysis Report (USAR), and the original plant Final Safety Analysis Report (FSAR), the raw water pumps are protected against flood water up to 1,007.5 feet mean sea level (MSL) by the Class I concrete structure of the intake building. Above 1,007.5 feet MSL, the water level inside the intake structure is controlled by positioning the exterior sluice gates to restrict the inflow into the wet wells to match the rate of pumped outflow. At the time of the February 2012 NRC inspection, Abnormal Operating Procedure (AOP) -1, *Acts of Nature,* lowered the sluice gates when river level was expected to reach 1,007 feet MSL. AOP-1 provided options of maintaining cell level by either adjusting the gates or starting additional raw water pumps to match water inflow. Based on this, the active safety function to position the sluice gates is completed prior to reaching a river level of 1,010 feet MSL.

A calculation was performed using the GOTHIC computer code to model the Missouri River and applicable rooms in the intake structure to verify that sluice gates and raw water pumps could be configured to prevent flooding of the raw water pump rooms. This calculation concluded that with five sluice gates closed and the sixth gate open one inch allows one raw water pump to maintain the water level inside the intake structure below 1,007.5 feet MSL even with the Missouri River level at 1,014 feet MSL. Cycling a second raw water pump would provide additional water removal capacity to compensate for leakage through the closed gates. This calculation validates that the gates are not required to be re-positioned after initial positioning.

OPPD has reviewed the potential for silting or sanding to occur that could block the open sluice gate. A review was performed assuming the minimum raw water pump flow and maximum allowed sluice gate opening. The conclusion of this review was that, although particles carried by the river flow could potentially reach the bottom of the sluice gate opening, the flow velocity through the gate is high enough to prevent particles from accumulating at the opening.

FCS current licensing basis (CLB)

The original NRC Safety Evaluation Report for FCS, Section 3.1.5, *Hydrology* states: "… the Corp of Engineers which indicates that the probable maximum flood (PMF) could result in a corresponding still water level at the site of 1009.3 feet MSL (above mean sea level). Plant grade is at elevation 1004.0 feet MSL. The plant can accommodate flood levels to 1007 feet MSL without special provisions, and up to a still water level of 1,009.3 feet MSL by lowering steel gates mounted above all accesses in safety related structures. The plant could be protected from water levels greater than this (due to wave runup and splash) by construction of temporary earth levees and/or sandbag barriers."

Plant structures were originally designed based on a maximum flood elevation of 1,004.3 feet MSL. The Atomic Energy Commission (AEC) questioned the basis for this elevation stating that the design on flood levels must consider maximum rainfall and snowfall occurring simultaneously over a specified large area draining into the Missouri River. The revised flood elevation design criteria were given in Amendment 12 to the Preliminary Safety Analysis Report, and essential structures were designed for the hydrostatic pressure resulting from flood elevations of 1,014 feet MSL.

AEC question 5.30 from the FSAR requested a description of how the design of the intake structure provides protection for the raw water pumps and their drives against the maximum flood level and how the intake structure is protected against boats and barges.

FSAR Supplement 4 revised Section 9.8.6 to provide updated information and answer this request. It states that the protection of the raw water pumps and their drives is provided at three elevations. The pumps are permanently protected to 1,007.5 feet MSL by the Class I substructure of the intake building. Protection is provided to 1,009.5 feet MSL by steel closures for all openings in the reinforced concrete perimeter wall extending upward from the main operating level. Supplementing the wall with sandbags provides protection to 1,014.5 feet MSL. For water levels above 1,007.5 feet MSL, the water level inside the intake structure is controlled by positioning the exterior sluice gates.

This update provided information that 1,009.3 feet MSL was the computed peak level flood resulting from the simultaneous occurrence of the maximum probable rainstorm and runoff downstream of Gavins Point Dam and the maximum outflow from the dam resulting from the maximum probable rainstorm upstream of Gavins Point. A flood of 1,013 to 1,014 feet MSL required the catastrophic, instantaneous disintegration of the Fort Randall Dam upstream of Gavins Point to occur at the same time.

Discussion on protection of the intake structure from barges or boats stated that the noses of the intake or recirculation channels are armored, the river bottom slopes downward from the bank, thus keeping boats or barges away and any blow would be a glancing one at the worst and any damage is considered unlikely.

AEC follow-up question 9.11 from the FSAR stated that from this response, it was not clear that flood or storm driven barges or boats were included in this consideration, and requested a summary of the analysis that shows that the boats and barges that can be expected to navigate the river are not a danger to the intake structure. This question also requested a discussion on the consequences of ice blockage of the intake structure.

FSAR Supplement 8 revised Section 9.8.6 to state that even a flood or storm driven barge that might strike the intake structure could not block flow sufficiently in the three sections of the structure to decrease the flow from the raw water pumps. Icing conditions at the river water entrance would be prevented by routing a portion of the warm water back upstream of the intake structure.

FCS Unit No. 1 was licensed for construction prior to May 21, 1971, and is committed to the draft General Design Criteria (GDC) published for comment in the Federal Register on July 11, 1967 (32 FR 10213) in lieu of 10 CFR 50, Appendix A. Appendix G of the FCS USAR shows that draft GDC 2 states:

CRITERION 2 - *PERFORMANCE STANDARDS*

Those systems and components of reactor facilities which are essential to the prevention of accidents which could affect public health and safety or to mitigation of their consequences shall be designed, fabricated, and erected to performance standards that will enable the facility to withstand, without loss of the capability to protect the public, the additional forces that might be imposed by natural phenomena such as earthquakes, tornadoes, flooding conditions, winds, ice and other local site effects. The design bases so established shall reflect: (a) Appropriate consideration for the most severe of these natural phenomena that have been recorded for the site and the surrounding area and (b) an appropriate margin for withstanding forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design.

As previously stated, the intake structure is a Class I structure below 1,007.5 feet MSL. The original licensing basis included the potential for flood or storm driven barge impacting the intake structure. This potential impact is also evaluated at river levels below 1,007.5 feet MSL.

An unresolved item (URI) was identified during a 2005 NRC component design basis inspection (Reference 4) that questioned the ability of the intake structure to withstand the impact of a flood driven barge. Since an original calculation could not be located, OPPD performed an intake structure barge impact analysis that considered a defined barge impact up to 1,007.5 feet MSL. In 2010 the NRC reviewed the analysis and closed the URI.

The intake structure complies with Criterion 2. Below elevation 1,007.5 feet MSL protection is provided by the Class I structure. The sluice gates are protected below this elevation from barge and boat impacts, their active safety function is performed when the river is below 1,007 feet MSL and do not require repositioning once they are set. Based on the original NRC Safety Evaluation Report, the plant can also accommodate floods up to a still water level of 1,009.3 feet MSL (no river-borne debris or other hydrodynamic forces). Essential structures are designed for the hydrostatic pressure resulting from flood elevations of 1,014 feet MSL.

Conclusion

The FCS intake structure is designed to withstand hydrostatic and dynamic forces for flood events up to 1,007.5 feet MSL. Operation of the sluice gates is protected below 1,007.5 feet MSL. Impacts to the intake structure are bounded by the barge impact analysis below 1,007.5 feet MSL. From elevation 1,007.5 feet MSL to 1,014 feet MSL, the licensing basis for the intake structure requires evaluation for hydrostatic and not hydrodynamic pressure. Therefore, FCS is in compliance with the CLB and no violation of NRC requirements occurred.

OPPD recognizes the importance of protecting the safety-related raw water system during a design basis flood event. Since the February 2012 inspection AOP-1 has been further revised to position the sluice gates when river level is expected to reach 1,004 feet MSL. Additional procedure changes have been incorporated into Operating Instruction OI-CW-1, *Circulating Water System Normal Operation*, Attachment 18, *Sand Intrusion Mitigation*, to establish a raw water flow path from the circulating water discharge tunnel as a method to respond to potential sanding/silting concerns. A temporary modification has been installed to protect the sluice gate MOVs from river-born debris on the intake veranda. This temporary modification will remain in place until a permanent modification is installed prior to plant start-up.