BEFORE THE UNITED STATES
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF	)	
	)	Docket No. 50-285
OMAHA PUBLIC POWER DISTRICT	)	
	)	April 23, 2014
FORT CALHOUN STATION	)	

PETITION TO INTERVENE AND REQUEST FOR ADJUDICATORY HEARING BY SIERRA CLUB

INTRODUCTION

Fort Calhoun Station is a nuclear reactor located on the Missouri River near Blair, Nebraska. It is owned by and licensed to Omaha Public Power District (OPPD). Fort Calhoun generates 484 megawatts of electricity. The reactor was first licensed in 1973. The license was renewed in 2003, extending the term of the license to 2033.

In early June of 2011, the Missouri River flooded, causing flood waters to encircle the Fort Calhoun reactor. At that time Fort Calhoun was shut down, and had been since April of 2011, for refueling. Since the flood, Fort Calhoun remains shut down as the NRC continues to inspect and investigate the consequences of the flood. In November of 2011, a special oversight panel was created pursuant to Inspection Manual 0350. A Confirmatory Action Letter (CAL) was issued to OPPD on June 11, 2012. The CAL was revised and updated on February 26, 2013.

In addition, the 0350 panel issued a Restart Checklist Basis Document on November 13, 2012, describing in more detail what OPPD had to do before the Fort Calhoun reactor would be allowed to restart. The Basis Document was revised and updated on March 7, 2013, and again on November 15, 2013.

In June of 2012, the Sierra Club filed a petition to revoke Fort Calhoun's license pursuant to 10 C.F.R. § 2.206. On May 13, 2013, the NRC's Petition Review Board accepted four issues for review:

- Structural support beams and columns are not within allowable limits for stress and loading.

- Flood protection measures at Fort Calhoun are inadequate and create an on-going, high-risk danger to public safety.

- The flood risks of the six dams upstream of Fort Calhoun are either unevaluated or unresolved.

- 614 primary reactor containment electrical penetration seals containing Teflon had not been replaced, even though the NRC notified all reactor operators almost 20 years ago that Teflon seals should be replaced.

The 2.206 petition has not yet been ruled upon and is still pending.

On December 17, 2013, Fort Calhoun was allowed to restart and a new CAL was issued. The 0350 panel is still overseeing the operation of Fort Calhoun.

As a result of inspections by the 0350 panel and information obtained by the Sierra Club, it is apparent that significant modifications will be necessary for Fort Calhoun to comply with its licensing basis. These modifications will require a license amendment pursuant to 10 C.F.R. § 50.59. The primary modifications that the Sierra Club believes require a license amendment are:

- Modifications for flood protection, including for protection of severe flooding in the event of upstream dam failures.

- Reconstituting the design basis and licensing basis documents.

- Modifications to repair or replace the inadequate structural beams and columns.

- Modifications necessary to address the problem that the Fort Calhoun reactor was built above karst terrain.

STANDING

Pursuant to the Atomic Energy Act, the Commission must grant a hearing on a license amendment application "upon the request of any person whose interest may be affected by the proceeding, and shall admit any such person as a party to such proceeding." 42 U.S.C. § 2239(a)(1)(A). To support the request, a petitioner must provide the Commission with information regarding "(1) the nature of the petitioner's right under the governing statutes to be made a party; (2) the nature of the petitioner's property, financial, or

other interest in the proceeding; and (3) the possible effect of any decision or order on the petitioner's interest." Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. (Vermont Yankee Nuclear Power Station), 60 N.R.C. 548, 552 (2004)(citing 10 C.F.R. § 2.309(d)(1)). "The NRC generally uses judicial concepts of standing in interpreting this regulation." Entergy Nuclear Vermont Yankee, 60 N.R.C. at 552. Thus, a petitioner may intervene if it can specify facts showing "that (1) it has suffered or will suffer a distinct and palpable harm constituting injury-in-fact within the zone of interests arguably protected by the governing statutes, (2) the injury is fairly traceable to the action being challenged, and (3) the injury will likely be redressed by a favorable determination." Id. at 552-53. In determining whether a petitioner has met the requirements for establishing standing, the Commission "construe[s] the petition in favor of the petitioner." Id. at 553.

Member organizations such as the Sierra Club may intervene on behalf of their members if they can "demonstrate that the licensing action will affect at least one of [their] members, . . . identify that member by name and address, and . . . show that [they are] authorized by that member to request a hearing on his or her behalf."

Because they live within 50 miles of the Fort Calhoun reactor, the individual members who have submitted declarations of standing have presumptive standing by virtue of their proximity to the reactor. Pacific Gas & Electric Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), 56 N.R.C. 142, 168 (2002).

TIMELINESS

The criteria under 10 C.F.R. § 2.309(c)(1) weigh heavily in favor of considering this petition. Each criterion is examined below.

Good cause. The Sierra Club has shown good cause for being allowed to file this petition at this time. OPPD representatives have stated that they do not intend to request a license amendment, or that a license amendment request will be made at some unspecified time in the future, regarding the issues presented in the Sierra Club's contentions upon which this petition is based.

The evidence shows that there are significant issues that require a license amendment. But the NRC allowed OPPD to restart the Fort Calhoun reactor without addressing these issues with a license amendment.

So, even though there is no Federal Register notice or any other type of notice as described in 10 C.F.R. §

2.309(b)(3) and (4), this petition is timely under the circumstances.

Nature of Petitioner's rights under the Atomic Energy Act to be made a party to the proceeding. Under the Atomic Energy Act, the Commission must grant a hearing in a proceeding upon "the request of any person whose interest may be affected by the proceeding, and shall admit any such person as a party to such proceeding." 42 U.S.C. § 2239(a)(1)(A). As described in this Petition and in the attached declarations of individual Sierra Club members, these members have economic, aesthetic, health, safety, and environmental interests, and interests in open and transparent government and corporate decision-making, that they want to protect. Operation of Fort Calhoun with the significant modifications that have been made, or should be made, as described in the contentions submitted herein without a license amendment, poses a grave threat to those interests.

Nature and extent of Petitioner's property, financial or other interest in the proceeding. The interest of the Sierra Club and its members in this proceeding are fully described in this Petition and in the attached declarations.

Possible effect of any order that may be entered in the proceeding on the Petitioner's interests. Any order issued by the NRC in this proceeding will have potentially fundamental effects on the interests of the Sierra Club and its members who live in western Iowa and eastern Nebraska. The issues presented in the contentions submitted herein involve significant issues of safety and protection of the environment.

Flood protection is extremely important, especially after the flooding incident at Fort Calhoun in 2011 and the tragedy at Fukushima shortly before that. Climate change will make flooding more unpredictable and more extreme in the future. The likelihood of upstream dam failure would cause flooding as devastating as the tsunami at Fukushima, if not more so. The lack of flood protection at Fort Calhoun resulted in a Yellow finding, indicating the significance of this issue.

The NRC cited OPPD for failure to maintain and update design basis documents as required. The NRC specifically alerted OPPD, along with other nuclear plant licensees, in 1992 and 1996 about the need to assure adequate and current design basis documentation, including all calculations. The failure at Fort Calhoun to maintain this documentation calls into question all the evaluations, repairs, and

upgrades recently completed and currently underway. The NRC noted in an inspection report that Fort Calhoun "is currently trying to evaluate, repair, maintain or modify systems, structures, components or procedures with processes that require accurate design information and historical perspective that was intended to be contained or referenced in the design basis documents." But without current and accurate design basis documents, that effort was and is impossible.

OPPD revealed in 2012 that containment internal structures do not conform with its license. 47 of 135 beams and 5 of 14 columns (more than a third of each) do not meet acceptance criteria for working stress and/or ultimate strength. OPPD found that loads on the beams cannot support the loads they were designed for, let alone the new power uprate loads. The inadequate support beams and columns will obviously require significant modifications. Equipment that supports air cooling, steam generators, and Class I piping is affected. NRC staff has said that a license amendment will probably be necessary. NRC staff has also said that the margins of safety have clearly been affected.

Pursuant to an open records request to OPPD, citizens in Omaha obtained access to two reports that were prepared by the firm Dames and Moore prior to original construction

of the Fort Calhoun reactor. Those reports clearly show that the Fort Calhoun reactor was built above karst geology. Karst is fractured limestone or other soluble rock formations. The NRC has issued guidance on the siting of nuclear facilities in karst terrains, underscoring the danger of siting such a facility in an area susceptible to ground collapse. Aside from the instability of a karst area, another problem resulting from constructing a nuclear reactor on karst geology is that the fractured nature of the rock makes it vulnerable to groundwater contamination. In the case of the Fort Calhoun area, the karst terrain creates danger of collapse of the underlying support of the reactor, which could cause damage to the containment vessel holding the radioactive fuel or the spent fuel pools holding radioactive fuel, or leakage of radioactive substances into the groundwater and into the Missouri River. For example, leaks of radioactive tritium at nuclear reactors are not uncommon.

Thus, an order granting this Petition would require OPPD to amend its license to ensure that the above-described issues are adequately addressed. As a result, the safety and environmental concerns of the Sierra Club and its members would be alleviated.

Availability of other means whereby the Petitioner's interest will be protected. The CALs, the Restart Checklist Basis Documents, and the 0350 process all are inadequate to protect the interest of the Sierra Club and its members. None of these procedures allow the persons affected by the safety and environmental issues described herein to really present evidence in support of their concerns nor to effectively question the positions taken by OPPD and the NRC. The CALs, the Restart Checklist Basis Documents, and the 0350 process all rely on the NRC's willingness to be an effective regulator. The public has no real input into any of that process. The process does not demonstrate that the NRC, as the regulator, has intervened on behalf of the public to require any particular action by the licensee to ensure that Fort Calhoun will operate safely prior to restart.

Nor does the procedure authorized by 10 C.F.R. § 2.206 (2.206 petition) provide a meaningful vehicle for the public to ensure that Fort Calhoun will be operated safely with protection for the environment. For example, the NRC reported that since 1975 only two out of 387 2.206 petitions have been granted.

As noted above, a 2.206 petition was filed with respect to Fort Calhoun and that four issues were accepted

for review. However, even though NRC Directive 8.11 requires that a proposed decision by the Director of Operations on a 2.206 petition be issued within 120 days after the petition is accepted for review, the NRC has stated that the Director's proposed decision on this petition is estimated to be February 28, 2015. This is about a year and a half beyond the NRC's own self-imposed deadline in its own guidance document.

Extent to which Petitioner's interests will be represented by existing parties. The interests of the Sierra Club and its members will not be represented by either OPPD or the NRC. OPPD has made it clear that it did not intend to seek a license amendment for the issues presented in this petition prior to restart, or possibly at all. And the NRC has made it clear that it would not require a license amendment on the issues prior to restart, if at all.

As clear evidence that OPPD and the NRC have absolutely no interest in adequate public participation in the license amendment process, OPPD, prior to restart of Fort Calhoun, requested two license amendments and requested a no significant hazards consideration and that the license amendment request be expedited under exigent circumstances. The NRC was only too happy to oblige. The

only alleged basis for a finding of exigent circumstances was that public involvement would delay the restart of the reactor. That is not the definition of exigent circumstances under 10 C.F.R. § 50.91.

Extent to which the Petitioner's participation will broaden the issues or delay the proceeding. The issues presented in this Petition are already part of the CAL and 0350 process. The Sierra Club simply wants the NRC to follow its established procedures for considering a license amendment application with respect to the issues set forth in the Sierra Club's contentions herein.

Extent to which the Petitioner's participation may reasonably be expected to assist in developing a sound record. If granted, a hearing on the Sierra Club's contentions would provide an opportunity to assure the public that the NRC has conducted an adequate assessment of the safety of the reactor at Fort Calhoun. Without an adequate license amendment proceeding, there will be no record. As previously explained, OPPD and the NRC have no intention of processing a license amendment with respect to the issues presented in the Sierra Club's contentions.

ADDITIONAL COMMISSION AUTHORITY

In addition to its authority to convene a license amendment proceeding under 10 C.F.R. § 2.309, the

Commission can convene such a proceeding, including an adjudicatory public hearing, under its inherent supervisory authority. See, Statement of Policy on Conduct of Adjudicatory Proceedings, 48 N.R.C. 18, 20 (1998). In the interest of assuring adequate protection of the health and safety of the public, the Commission must consider what amendment(s) to the license is/are required by the cumulative changes that have been made or should be made to address the issues in the Sierra Club's contentions. The safety of the public and the protection of the environment depend on the outcome.

LEGAL STANDARDS GOVERNING LICENSE AMENDMENTS

10 C.F.R. §§ 50.90-50.92 provide the applicable process when a licensee wishes to request a license amendment. Specifically, § 50.91 provides for notice and comment regarding license amendment applications, as well as consultation with the State in which the facility is located; and § 50.92 provides the standard considered by the NRC when determining whether to issue an amendment.

Section 50.59 establishes for a licensee to request a license amendment before it may make "changes in the facility as described in the [updated] final safety analysis report [UFSAR], make changes in the procedures as described in the [UFSAR], and conduct tests or experiments

not described in the [USFAR]." 10 C.F.R. § 50.59(c)(1). Section 50.59 states that a licensee need not request a license amendment pursuant to § 50.90 if "(i) A change to the technical specifications incorporated in the license is not required, and (ii) The change, test, or experiment does not meet any of the criteria in paragraph (c)(2) of this section." Id. § 50.59(c)(1)(i)-(ii).

In other words, a licensee must request a license amendment if the proposed action requires that existing technical specifications be changed (see 10 C.F.R. § 50.59(c)(1)(i)), or if a change, test, or experiment satisfies any of the eight criteria in section 50.59(c)(2). See id. § 50.59(c)(1)(ii). The § 50.59(c)(2) criteria require a licensee to seek a license amendment if the proposed change, test, or experiment would:

(i) Result in more than a minimal increase in the frequency of occurrence of any accident previously evaluated in the [UFSAR];

(ii) Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the [UFSAR];

(iii) Result in more than a minimal increase in the consequences of an accident previously evaluated in the [UFSAR];

(iv) Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the [UFSAR];

(v) Create a possibility for an accident of a different type than any previously evaluated in the [UFSAR],

(vi) Create a possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the [UFSAR];

(vii) Result in a design basis limit for a fission product barrier as described in the [UFSAR] being exceeded or altered; or

(viii) Result in a departure from a method of evaluation described in the [UFSAR] used in establishing the design bases or in the safety analyses.

Finally, 10 C.F.R. § 2.105 implements the hearing opportunity provision for license amendment procedures that is mandated by section 189a of the AEA, and Subpart C of 10 C.F.R. Part 2 contains the general rules governing hearing requests and subsequent hearing-related activities.

PETITIONER'S CONTENTIONS AND SUPPORTING INFORMATION

CONTENTION 1

Modifications for flood protection, including for protection of severe flooding in the event of upstream dam failures, require a license amendment.

Basis for the Contention

After Fort Calhoun was flooded in June of 2011, the NRC found deficiencies with respect to the failure of Fort Calhoun to maintain procedures and equipment that would protect the reactor from the effects of a design basis flood. Those deficiencies resulted in a Yellow (substantial safety significance) finding as documented in NRC Inspection Report 05000285/1010007 (ML102800342).

OPPD claims to have made significant modifications in flood protection equipment and procedures to address a design basis flood and also to protect Fort Calhoun from increased flooding due to upstream dam failures. According to a meeting held between staff and consultants from OPPD and NRC, OPPD indicated that it would request a license amendment for modifications to flood protection (ML13112A052).

According to at least three reports from NRC personnel, the risk of increased flooding damage from upstream dam failures on nuclear plants is well-known. OPPD claims to have undertaken modifications to protect against

a beyond design basis flood due to upstream dam failures. These modifications require a license amendment.

Facts Upon Which Petitioner Intends to Rely In Support of This Contention

Fort Calhoun Station sits at normal water level on the edge of the Missouri River. So any rise in the normal water level of the river would impact Fort Calhoun.

In 2009, the NRC conducted a flood risk assessment which found that the protection measures were only designed to handle floods to 1,009 feet above sea level, which was below the NRC mandated elevation of 1,014 feet for Fort Calhoun. The risk assessment stated that at 1,010 feet, flooding would have "led to a 100 percent chance of a fuel damage if the emergency gasoline pumps didn't work."

A flood assessment performed by the NRC in 2010 and noted in a Notice of Violation on October 6, 2010 (ML102800342) indicated that the Fort Calhoun Station did not have adequate procedures against external flooding events. The assessment also indicated that the facility was not adequately prepared for a "worst-case" flooding scenario. A number of potential flood water penetration points were discovered that could have impacted the raw feed water supply to the cooling system, the auxiliary

water supply and main switchgear (electrical room). The result was a Yellow finding.

After the flood of June 2011, OPPD was required by the NRC to take corrective actions to ensure adequate protection of Fort Calhoun against flooding events. As reported in an inspection report and notice of violation dated March 11, 2013 (ML13070A399), OPPD changed the UFSAR to incorporate use of backflow through the circulating water system for a flow path for raw water, and implemented a flooding mitigation modification that would have used components which did not meet full quality requirements for their designated function. In supporting the Notice of Violation, the NRC said, "Had the licensee appropriately evaluated these two changes, they would have determined that a license amendment was required for implementation of both changes since both resulted in more than a minimal increase in the likelihood of occurrence of a malfunction of a system, structure, or component important to safety."

So, instead of requesting a license amendment, OPPD changed its approach to flood protection. This approach to flood protection was presented to the NRC at a technical meeting on April 22, 2013 (ML13112A052, ML13134A186), discussing potential license amendment requests. In that presentation, the new process was described as installing

new throttle valves and relying on manual controls, rather than automatic operation of sluice gates. The design purports to allow operators more direct control of the intake bay level for both rising and lowering river level during a flood.

A more complete discussion of OPPD's revised flood mitigation strategy purporting to mitigate the effects of a beyond design basis flood was presented at a closed session of the April 22, 1013, meeting (ML13114A936, ML13114A881). As summarized by the NRC in ML13114A881:

> The strategy involved a means for removing decay heat from the fuel in the reactor vessel (assuming the reactor coolant system (RCS) is intact) and for providing makeup water to the spent fuel pool that is lost due to boil off of the water. The means for removing decay heat from the fuel in the reactor vessel includes the following attributes: 1) rapidly going to cold shutdown conditions on indications that a beyond design basis flood is forthcoming, 2) providing a means of supplying water to the steam generators in a flooded condition, 3) removing decay heat by steaming through blocked open main steam safety valves, 4) using nitrogen in the pressurizer and safety injection tanks for pressure control of the primary system, and 5) providing makeup water to the RCS as needed to maintain the primary system pressure.

Based on the foregoing, it is clear that the flood mitigation strategy being implemented at Fort Calhoun is a significant modification that requires a license amendment.

It is also important to ensure through a license amendment proceeding that the flood mitigation strategy

described above is sufficient to protect Fort Calhoun from the impact of upstream dam failures. There are six dams on the Missouri River upstream of Fort Calhoun. The NRC has been assessing the impact of upstream dam failures on nuclear reactors at least since 2010. In a July 19, 2010 memorandum by Lois James of the Division of Risk Assessment (redacted version at ML13039A086), the issues involved in potential dam failures were discussed generically, but Fort Calhoun was mentioned specifically:

> Additionally, an NRC inspection on March 2010 at the Fort Calhoun Station (FCS) identified an apparent violation for failure to maintain adequate procedures for flood protection at the site, as stated in its licensing basis (ML101670034). Since FCS is located in close proximity to the Missouri River, and its base elevation (1004 feet mean sea level (MSL)) is not far above the normal river levels, NRR is currently evaluating the flooding licensing basis with respect to severe precipitation events. Current NRC assessments of external flooding vulnerabilities indicates that all normal plant equipment fails when floods reach 1010 MSL, and that essential safety-related components fail between 1010 MSL and 1014 MSL. Review of flooding extrapolation updates performed by USACE for the FCS region indicate an increase in potential elevation for floods with a return period of up to 500 years, not previously considered by the licensee (ML101670034). FCS is also located downstream from several large dams, and its IPEEE submittal states that failure of the larger dam would cause a flood wave that would reach the site in 2.6 days, which would reach a peak elevation of 1029 feet MSL in 3.9 days. Based on the increase in estimated flood levels, the use of NSAC-60 dam failure rates, and the recent experience with flood routing analysis in the ONS dam failure studies, a potential for an increase in risk due to this hazard is also expected at the FCS

> site (attenuated only by the distance to the set of dams located upstream).

(taken from the unredacted version of the report).

Then in July of 2011 a report prepared by NRC staff members Richard H. Perkins, Michelle T. Bensi, Jacob Philip, and Selim Sancaktar analyzed the issue of upstream dam failures (redacted version at ML113500495). One of the reactors highlighted in the report was Fort Calhoun. The report had this to say:

> The base plant elevation (1,004 ft MSL) is not substantially higher than normal river levels. The Updated Safety Analysis Report (USAR) specifies that the design flood elevation is 1,006 ft MSL (FCS 2010, p. 8). In 1993, the U.S. Army Corps of Engineers estimated the probable maximum flood (absent upstream dam failure) to be 1,009.3 ft. MSL. (FCS 2010, p. 7). Without special provisions, safety-related components at the plant are protected from flooding by hardened features up to an elevation of 1,007 ft MSL. Floodgates permanently mounted adjacent to openings can be installed to provide further flood protection of most components up to an elevation of 1,009.5 ft MSL (FCS 2010, p. 8). Based on more recent information (USACE 2004), NRC documents (USNRC 2010d, USNRC 2010h) have questioned the accuracy of existing flood estimates included in plant specific documents. . . . .
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> Inspectors have identified an apparent violation of Technical Specification 5.8.1.a at Fort Calhoun Station for failure to maintain adequate procedures to protect the intake structure and auxiliary building during external flooding events. It was determined that it is not sufficient to stack and/or drape sandbags on floodgates to protect the aforementioned structures up to an elevation of 1,013 ft MSL (as credited in the USAR and in station operating procedures). The flat surface on the top of the floodgates is too narrow to support a stacked sandbag

> configuration capable of retaining 4 feet static head of water. Moreover, the required actions pose a safety risk to plant personnel (USNRC 2010h). The Significance Determination Process has resulted in the issuance of a yellow finding regarding this apparent violation (USNRC 2010b).
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> The Significance Determination Process results described above are based on consideration of external flooding due to events that exclude dam failures. . . . As illustrated above, recent regulatory activity suggests that Fort Calhoun Station may not have been protected from flooding even without consideration of upstream dam failure. An upstream dam failure further exacerbates this condition.
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> A significant contributor to the elevated risk at Fort Calhoun Station comes from its reliance on the placement of temporary barriers to protect the plant during a large external flood event. These protective measures require significant physical actions on the part of plant personnel. Consequently, a nontrivial probability exists that the procedures will be unsuccessful.

(taken from the unredacted version of the report).

The report goes on to discuss the various regulatory requirements that would apply to actions and structures that would protect a nuclear reactor from flooding. 10 C.F.R. Part 50, Appendix A, General Design Criteria – 2 requires that structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as floods. Regulatory Guide 1.59 discusses the design basis floods that a nuclear reactor should be designed to withstand. The Guide also addresses

the acceptability of using alternatives to hardened facilities for flood protection.

Regulatory Position 1 of Regulatory Guide 1.59 specifies that safety-related structures, systems, and components identified in Regulatory Guide 1.29 [seismic design classification] should be designed to resist the worst flood probable at the site due to a range of phenomena including probable maximum flood. Regulatory Position 1 explicitly specifies that "[f]lood conditions that could be caused by dam failures . . . should be considered in establishing the design basis flood."

The Standard Review Plan established criteria that the NRC is to use in reviewing applications to construct and operate nuclear reactors to determine if the application meets NRC regulations. The Standard Review Plan requires the consideration of upstream dam failures in determining a design basis flood. The report by Perkins, et al. concluded:

> Both the 1975 and 1980 versions of Section 2.4.4 of the Standard Review Plan emphasize dam failures under seismic mechanisms (both in section title and in content) coincident with floods less than the PMF [Probable Maximum Flood]. . . . In the 1981 and newer versions of the Standard Review Plan (including the most recent 2007 revision), the treatment of dam failures in Section 2.4.4 is not limited to seismically induced failures and the title of the section is revised to reflect that change.

So, in the case of Fort Calhoun, any flood protection measures undertaken by OPPD must account for the impact of upstream dam failures. And in fact, OPPD claims that it has designed protection from a flood beyond the design basis.

There is one additional report relevant to the flooding issue at Fort Calhoun. This report, written on July 1, 2011, by NRC Senior Reactor Analyst David Loveless, was addressed specifically to the flooding issues at Fort Calhoun. Every effort by interested parties to obtain a copy of the Loveless report has been stonewalled by the NRC, but there is a memo from Thomas Blount to Elmo Collins, then the Region IV Administrator, dated March 6, 2012 (ML12229A184). That memo states:

> The technical review conducted by Mr. Loveless concluded that based on as-built design and current compensatory actions, the Fort Calhoun Station would not be able to survive a gross failure of the Oahe dam. According to the Fort Calhoun USAR, the total failure of a large dam upstream of the plant site is not considered credible by the Corps of Engineers. However, through reviews of Corps documents, we have learned that often the Corps refers to a lack of credibility when the return time is greater than 500 years. This is significantly lower than the maximum return time we would consider safe for the operation of a nuclear power plant. According to the most recent Corps of Engineers assessment, the water height at Fort Calhoun, following an Oahe dam rupture, could be as high as 1060 feet MSL. This flood would result in flooding of all major plant equipment including the main control room and would likely require complete abandonment of the site for weeks.

> The assumptions used in Mr. Loveless' analysis were based on generic data from reputable sources. This data may be conservative because a specific evaluation of the Missouri River dams was not completed. It is the opinion of the panel that obtaining additional information is justified, specifically with regards to consideration of what the design basis flooding event should be. Consideration should be given to the cascading dam failure event identified in Mr. Loveless' analysis.

Thus, the Loveless report, as well as all of the other information presented above, clearly establish that adequate flood protection at Fort Calhoun requires significant modifications and therefore, a license amendment.

CONTENTION 2

Reconstituting the design basis and licensing basis documents require a license amendment.

Basis for the Contention

The licensee of a nuclear reactor has primary responsibility for operating its reactor safely and in compliance with its license. Since a reactor's design and operation are not static, certain changes are necessary over the course of the reactor's operating life. Reactor licensees must follow NRC regulations to justify and implement changes in the design basis and licensing basis for their reactors. The licensee's obligations are accomplished by creating and maintaining design basis documents.

OPPD has claimed since at least 1987 that it has been reconstituting the design basis documents for Fort Calhoun. The NRC specifically alerted OPPD, along with all nuclear reactor licensees, in 1992 and 1996 about the need to assure adequate and up-to-date design basis documentation, including all calculations. However, the design basis documents for Fort Calhoun are still not fully reconstituted.

To this day, OPPD has not maintained and updated the design basis documents for Fort Calhoun. OPPD must be required to obtain a license amendment to comply with its duty to update and maintain accurate design basis documents.

Facts Upon Which Petitioner Intends to Rely In Support of This Contention

According to 10 C.F.R. § 50.2, design basis means "that information which identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values chosen for controlling parameters as reference bounds for design."

The licensing basis for a nuclear reactor is comprised of selected information exchanged between a licensee and the NRC relating to design features, equipment descriptions, operating practices, site characteristics,

programs and procedures, and other factors that describe a plant's design, construction, maintenance, and operation. Licensing basis information is contained in a variety of document types (e.g., final safety analysis report, license amendments, etc.). Each licensing basis document has certain characteristics in terms of change control mechanisms, reporting of changes to the NRC, dealing with discrepancies, and the possible involvement of the public. Nuclear Energy Institute, The Nuclear Regulatory Process (March 2007).

NRC regulations define a reactor's current licensing basis (CLB) as follows:

> The set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect. The CLB includes the NRC regulations contained in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 54, 55, 70, 72, 73, 100 and appendices thereto; orders; license conditions; exemptions; and technical specifications. It also includes the plant-specific design-basis information defined in 10 CFR 50.2 as documented in the most recent final safety analysis report (FSAR) as required by 10 CFR 50.71 and the licensee's commitments remaining in effect that were made in docketed licensing correspondence such as licensee responses to NRC bulletins, generic letters, and enforcement actions, as well as license commitments documented in NRC safety evaluations or licensee event reports.

10 C.F.R. § 54.3.

In a technical journal article in 1989, several OPPD employees wrote that OPPD had initiated a program to reconstitute Fort Calhoun's design basis documents. The article states:

> This management of information has been necessary to ensure that design basis documents (DBDs) adequately reflect the interrelated nature of component, system, and plant design; are complete and accurate; and are produced and maintained in a cost-effective manner.

Beach, D.R.; Erickson, E.A.; Gambir, S.K.; Parsons, R.D., Transactions of the American Nuclear Society, V. 59 (June 1989).

But contrary to OPPD's stated effort to reconstitute its design basis documents, an NRC inspection report issued on December 31, 2012 (ML12366A158), found that the design basis documents were still incomplete. The report stated:

> The NRC identified a non-cited violation of 10 CFR 50 Appendix B, Criterion V, "Procedures," for failing to follow a quality procedure. Specifically; PED-QP-13 "Design Basis Document Control," requires FCS to update and maintain their Design Basis Documents. The licensee has failed to maintain these design documents.
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> Several NRC inspections of FCS [Fort Calhoun Station] in 1985 highlighted several significant weaknesses. Specifically, NRC Inspection Report 50-285/85-22 states, "There appear to be several significant weaknesses which were identified in your design control processes. One of them was your failure to obtain, maintain, and use design basis information to assure that the original design margins are not unintentionally abrogated. We are also concerned that post-modification testing procedures were inadequate to confirm that the physical modifications fulfill the

functional design requirements of the system or component. In general it was determined that the accessibility and retrievability of the original design specifications and some design basis information appeared to be a significant obstacle. There was also noted a strong over reliance on the USAR for such information. It is important to note that the lack of Design Basis Records had been identified by FCS as a generic concern prior to it being noted by the NRC. FCS had attempted to locate original architect/engineer design records on specific issues.

In response to NRC Violations from issues noted in NRC Inspection Reports 50-285/85-22 and 50-285/85-29 FCS docketed to the NRC a Corrective Action Implementation Plan. One item in this plan included the Reconstitution of Design bases. Specifically, "To locate and organize design bases records in such a way that a set of system oriented design bases documents (DBD) can be generated. . . These DBDs will be prepared to reflect the current design condition of the plant, combined with an historical perspective of the justification for the current plant configuration or generic subject area. The DBDs will be controlled documents to be updated as plant configuration or issues change. The primary purpose of the DBDs will be to evaluate the impact of modifications and changes in operating procedures, to support safety evaluations, and to determine the impact of new regulations or regulatory concerns" LIC-87-691).

Based on NRC concerns and an independent assessment FCS had performed in 1988 on all its nuclear related activities FCS developed and docketed (LIC-88-1094) the Safety Enhancement Program (SEP). The purpose of the SEP was to consolidate the concerns that led to FCS being placed on the list of plants requiring additional NRC attention into a corrective action program leading to excellence. Item Number 4 of the SEP was to develop the DBDs. This item would constitute the Design Bases reconstitution and verification. FCS later committed item Number 4 of the SEP to the NRC in LIC-89-1006 with the objective to maintain the plant and system level DBDs for safety systems for the life of the plant.

PED-QP-13, Design Basis Document Control is the quality procedure FCS uses to control and maintain the DBDs. Section 4.2.1 states, "Once issued, the DBDs are high level design documents for the Fort Calhoun Station. These documents shall be used as the requirement source for developing configuration changes and as a reference for other activities including operations, testing, licensing, and training." Section 4.8 states, "DBDs are lifetime QA Records as defined in the FCSQA Plan Section 3.4."

Based on condition reports and discussions with plant engineers and managers the NRC has determined that FCS has not been updating and maintaining the DBDs as required by PED-QP-13. Many condition reports indicate that the DBDs contain inaccurate, inadequate, or otherwise missing information. The NRC has become aware of a concern among FCS personnel regarding the historical quality of the DBDs in general.

FCS Root Cause Analysis (RCA) of Engineering Design/Configuration Control (2012-08125), recently determined, "There are known issues with the quality of DBDs and inconsistent guidance on how to use them. . . . There is no formal guidance or process to locate and retrieve all design and licensing basis requirements associated with an engineering activity. . . The barrier of reliable design and licensing basis documents is failed." The RCA did not identify that FCS had realized they were violating a quality procedure by not updating and maintaining the DBDs. The RCA did not demonstrate knowledge of the historical perspective of the DBDs or the significance of inaccurate, inadequate, or otherwise missing information.

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Because FCS continues to not maintain and update DBDs, the performance deficiency is indicative of current plant performance.

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The finding has potential consequence in that FCS has a documented history of not ensuring all applicable regulatory requirements and the design basis are used

> in the production of quality documents. FCS is currently trying to evaluate, repair, maintain or modify systems, structures, components or procedures with processes that require accurate design information and historical perspective that was intended to be contained or referenced in the DBDs. Many FCS license required processes currently under NRC scrutiny; Design Control, Technical Specification compliance, 10 CFR 50.59, and 10 CFR 50.72 require accurate, assessable, and understandable Design Basis information.

The above discussion amply demonstrates that the design basis documents are essential to the safe and proper operation of Fort Calhoun, and that the design basis documents are inextricably intertwined with the licensing basis for the reactor. The above discussion also shows that the significant deficiencies and required changes to the design basis documents for Fort Calhoun are "changes in the procedures as described in the final safety analysis report as updated, requiring a license amendment. 10 C.F.R. § 50.59(c)(1).

CONTENTION 3

Modifications to repair or replace the inadequate structural beams and columns require a license amendment.

Basis for Contention

In response to the Confirmatory Action Letter and 0350 review process at Fort Calhoun, it was discovered that 47 of 135 concrete support beams and 5 of 14 concrete support

columns in the containment structure do not meet acceptance criteria for working stress and/or ultimate strength. OPPD found that these support structures cannot support the loads for which they were designed. Equipment that supports air cooling, steam generators, and Class I piping is affected.

Based on a presentation by OPPD to NRC technical staff (ML12349A151), OPPD's proposed modifications to address the inadequate support structures is to cast new concrete structures in the same locations as the current structures. This will certainly be a significant modification to the structure of the Fort Calhoun reactor. Such a significant modification will require a license amendment.

Facts Upon Which Petitioner Intends to Rely In Support of This Contention

The containment internal structures in pressurized water reactors are typically constructed of conventionally reinforced concrete and tend to be more massive in nature than the internal structures in boiling water reactors because they typically support the reactor pressure vessel, steam generators, and other large equipment and tanks. D.J. Naus, C.B. Oland, B.R. Ellingwood, Report On Aging of Nuclear Power Plant Reinforced Concrete Structures (March 1996)(ML072830854).

Investigation of the problem at Fort Calhoun revealed that 47 of 135 beams and 5 of 14 columns did not meet acceptance criteria for working stress and/or ultimate strength (ML12349A151 at p. 27). The structures are operable in an outage condition, but are inadequate during normal operation (ML12349A151 at p. 37). Yet the NRC allowed Fort Calhoun to restart without the structural problems being corrected because they are allegedly operable. Based on the analysis of OPPD's own consultants, however, the structures are operable only during shutdown, not when the reactor is in operation.

According to the presentation by OPPD's technical consultants there are significant challenges to installing replacement beams and columns. These challenges include numerous interferences, such as coolant pump motor cable and conduit, large ventilation ductwork, conduit banks, component cooling water piping, pipe supports, and miscellaneous steel platforms, stairs, etc; containment configuration that is not conducive to material handling; and the fact that the concrete must be pumped long distances (ML12349A151 at p. 50).

The OPPD presentation also contains a modification analysis describing the analyses required to complete the modifications to the containment internal structures,

including finalizing the structural analysis of the containment internal structures; optimizing the design of new columns and beams; designing the relocation of interferences, including seismic and hydraulic analysis of piping rerouting, seismic and cable analysis for conduit rerouting, seismic and air flow analysis of ductwork rerouting, and structural analysis of new commodity supports; determining the impact on other analyses such as containment pressure analysis, high energy line break analysis for columns and relocated equipment, containment sump analysis, and other analyses as required (ML12349A151 at p. 55-56).

Based on the foregoing, two facts are clear: addressing the problem of inadequate beams and columns is a significant task and involves major modifications, and if these structures are operable only in an outage situation, Fort Calhoun should not have been allowed to restart until the problem is solved and a license amendment is obtained.

CONTENTION 4

Modifications necessary to address the problem that the Fort Calhoun reactor was built above karst terrain require a license amendment.

Basis for Contention

A geotechnical study at Fort Calhoun conducted after the June 2011 flood made reference to a 1968 study which

stated that the Fort Calhoun reactor was constructed above karst geological formations. Karst is composed of a soft rock, such as limestone, with fissures and fractures that make the formation unstable and allow liquids, such as tritium leaking from the Fort Calhoun reactor, to seep into the groundwater.

Since this issues has come to light, there has been no serious effort to determine the nature and extent of the problem, and thus, no effort to address the problem. The NRC has policies and guidance concerning the construction of nuclear reactors on karst geology, thus confirming the significance of the issue.

Addressing this problem at Fort Calhoun will require major modifications and a corresponding license amendment.

Facts Upon Which Petitioner Intends to Rely In Support of This Contention

Two reports were prepared in 1967 and 1968 at the Fort Calhoun site by the consulting firm, Dames and Moore, prior to construction of the Fort Calhoun reactor. Those reports examined the geology of the proposed reactor site and the appropriateness of the plant design to the chosen site. The 1967 study (found at www.houseoffoust.com/data/calhoun/ Dames-Moore-1967.pdf) focused mainly on soil and land properties at the Fort Calhoun site. In the 1968 report

(found at www.houseoffoust.com/data/calhoun/Dames-Moore-1968.pdf), however, a more thorough investigation of the underlying geology was conducted.

That investigation found what appears to be a part of a long horizontal vein of vertical cavities and voids in the bedrock. While Dames and Moore was not able to conclusively prove the interconnectedness of the karst formation, they did find matching evidence in a nearby quarry that led them to believe the findings at the reactor site were part of a larger formation. The report observes:

> Initially, the present study consisted of 12 test borings in the proposed plant area. During the course of the field investigation, however, a cavity was encountered in the underlying limestone. The presence of cavities was particularly significant in view of the fact that a foundation system utilizing piles bearing on rock was desired by the structural engineers. Eight additional borings were drilled in an attempt to define the nature and extent of the void. Certain of these borings also encountered limestone solution cavities. Since all previous explorations at the site revealed sound limestone, it was believed that the observed cavitation was confined to a limited area. It was, therefore, decided to relocate the plant 90 feet upstream, in an attempt to avoid the zone of observed cavitation.
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> The rock in the revised plant area was then explored. A program of 118 borings, located on a random grid pattern within the revised plant area, was formulated. During the course of this investigation, it was discovered that the general plant area is underlain by limestone containing solution cavities. As the investigation continued, it became apparent that a conventional pile foundation was not feasible for this project because of the uncertainty of rock conditions at any given location.

So there is no question that there is karst terrain directly beneath the Fort Calhoun reactor.

According to the Dames and Moore report, it was decided that open-end pipe piles would be used for foundation support and a test boring would be drilled through and beneath each pile to evaluate rock conditions under all piles installed to support Class I structures. The Dames and Moore report discussed the ways to address the existence of the karst terrain as follows:

> The heavy structures of the station which are sensitive to settlement, may be supported either by spread or mat foundations established in the lower compact sands (or on bedrock) or piles installed to sound bedrock.
>
> Several alternate foundation schemes were investigated. On the basis of data originally presented during the progress of this work and in our previous report, the designers, Gibbs & Hill, Inc., selected a pile foundation. . . .
>
> As a result of the high pile design loads it is necessary to reach the limestone bedrock at the site to achieve the required pile capacities. Since the limestone contains areas of solution cavities, an extensive program of rock exploration and subsequent remedial pile installation operations are anticipated. Also, the reduction of inter-granular soil pressures from the conventional mat foundation to those below a pile cap result in a situation where the underlying soils are more susceptible to liquefaction.

The Dames and Moore report then goes on to note the difficulties with installing open-end piles:

Class I Structures: A number of difficulties may be encountered in installing open-end concrete filled pipe piles. It may prove difficult to adequately clean a driven pile for two reasons:

1) The fine sand which overlies the bedrock in the area may flow into the pile from beneath the tip as the pile is being jetted, despite careful seating attempts. (This was a recurring and difficult problem in drilling operation during performance of the boring program.) Should the sand inflow become severe, the lateral and uplift capacities of the piles could be affected due to significant disturbance of the peripheral soils.

2) Fine to coarse gravel was encountered in numerous borings in the lower sand strata. It may prove difficult to remove the larger gravel from within the pile in jetting operations, thus resulting in incomplete and unsatisfactory concreting of the pile.

Based on the foregoing, Dames and Moore made several recommendations to address the problem of the karst terrain during construction of the Fort Calhoun reactor.

Two post-flood investigations by consulting firms HDR Engineering and Stevenson and Associates made no effort to investigate the impact of the karst terrain under the reactor. The post-flood investigations only analyzed the effect of the flood on the topsoil around the reactor. Unfortunately, the NRC is using these investigations to pretend that there is no problem with the issue of the karst geology under the reactor.

However, the NRC does have guidance on siting nuclear reactors in karst terrain. A.G. Franklin, D.M. Patrick,

D.K. Butler, W.E. Strohm, Jr., and M.E. Hynes-Griffin, Foundation Considerations in Siting of Nuclear Facilities in Karst Terrains and Other Areas Susceptible to Ground Collapse (May 1981). That document first describes the collapse mechanism of karst as follows:

> An understanding of the mechanisms of sinkhole development and contributing or modifying factors is essential in evaluating the degree of hazard. The development of sinkholes, often by sudden collapse of the ground surface, is related to stratigraphy, groundwater lowering, and erosion of overburden soils into solution features. . . . Roof collapse of cavities near the bedrock furface by increased solution or increased roof loading results in dropout of shallow overburden. While solution enlargement of cavities and weakening of the roof structure is a relatively slow process, collapse occurs suddenly. Sinkhole enlargement, sometimes to several hundred feet in diameter, progresses rapidly by erosion of overburden soils into open voids by surface drainage, especially during heavy rains. However, the most common development of sinkholes endangering structures is the collapse of cavities in relatively thick cohesive soil overburden. Downward seepage causes progressive raveling and erosion of cohesive soils bridging solution slots or fissures in the limestone bedrock. Upward enlargement of the soil cavity, to a diameter sometimes larger than 100 ft in clays, continues as long as eroding soil is carried away by circulating groundwater in the bedrock openings. Otherwise, the process stops by clogging of openings with soft, wet soils. Roof collapse, forming a dropout, occurs when the roof load exceeds the shear strength of the roof soil. In sandy soils sand raveling into solution fissures progresses into funnel-shaped surface depressions that may be over 100 ft in diameter.

The guidance document then goes on to discuss the proper evaluation of the underlying geology before siting a nuclear reactor:

> For major structures, a complete geologic profile, showing all solution features, quality and condition of overburden and bedrock, and groundwater conditions, is necessary in evaluating foundation problems and treatment alternatives. All cavities bridged by overburden should be either grouted or excavated and backfilled, depending on the depth of overburden. For shallow overburden where excavation is carried to the bedrock surface, the distribution of solid rock zones, compressibility and erosion resistance of infilling materials, and depth of infilling materials in solution-widened joints require evaluation to determine:
>
> a. Required excavation and type of backfill to replace soft or compressible materials.
>
> b. Choice of foundation type, such as mat, spread footings, piles, or caissons (piers).
>
> c. Requirements for checking conditions exposed by the excavation and verifying soundness of rock below foundation elements after excavation.
>
> For deep overburden, the type and amount of infilling materials in solution features require evaluation to determine whether grouting would be an effective treatment.
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> All solution features in the bedrock surface must be well defined and evaluated to determine the feasiblility of treatment to provide a competent foundation. Cavities bridged by overburden, filled solution channels, soft soil zones between limestone pinnacles, and other solution features should be either grouted or excavated and backfilled with concrete or compacted soil, depending on the type of structure and foundation. Extensive surface and subsurface drainage control measures (drainage

ditches, subdrains) may be required to prevent infiltration and downward migration of surface water.

The guidance document also warns that cavities below bedrock surface must be defined and evaluated to assess their effect on cavity stability. Natural cavities below bedrock surface can increase in size by dissolution of the carbonate rock, progressive spalling or fall-in of roof rock, or by erosion of infilling materials. In addition, cavities within the influence zone of structure loading should be evaluated for stability. There is no indication that any of this was done prior to construction of the Fort Calhoun reactor. And without a complete, accurate and current set of design basis documents, there is no way to know what was done in constructing the reactor.

The structural stability of the Fort Calhoun reactor is not the only issue that must be addressed. The other problem caused by constructing a nuclear reactor on karst terrain is that leaks from the reactor are carried through the cavities in the rock formation into the groundwater. At the Fort Calhoun site the contaminated groundwater would find its way to the Missouri River. And leaks from nuclear reactors, especially of radioactive tritium, are common. Tritium, which is a radioactive form of hydrogen, has leaked from at least 48 reactor sites. Leaks from at least

37 of those facilities contained concentrations exceeding the federal drinking water standard, sometimes at hundreds of times the limit.

Tritium moves through the soil quickly, and when it is detected it often indicates the presence of more powerful radioactive isotopes that are often spilled at the same time. For example, cesium-137 combined with tritium at Fort Calhoun in 2007. Strontium-90 was discovered with tritium in 2005 at Indian Point. The primary cause of these leaks is the corrosion and degradation of underground pipes that have been buried under the reactors for 30-40 years.

Exelon, the company now operating Fort Calhoun, has had a history of tritium leaks at several of the reactors it owns and operates. But Exelon refused to excavate and examine the integrity of the underground piping. Because of the cost of such an effort, Exelon said in a presentation to the NRC in 2009, "Excavations have significant impact on plant operations." Given the history of tritium leaks at reactors operated by Exelon, the prior leaks at Fort Calhoun, and the existence of karst geology under the Fort Calhoun Reactor, it is imperative that this issue be examined through a license amendment proceeding.

CONCLUSION

Based on the foregoing, Petitioner has demonstrated that it has standing and that its contentions should be admitted. The significant modifications that have been made or should be made, require a formal license amendment proceeding. The Commission should either clarify that the CAL and 0350 processes are license amendment proceedings convened under 10 C.F.R. § 2.309 requiring an adjudicatory hearing, or in the alternative, pursuant to 10 C.F.R. § 50.59 and its inherent supervisory authority, find that such a proceeding is in the public interest to fulfill the NRC's mandate to ensure adequate protection of the public health and safety. The Petitioner should be permitted to intervene in this proceeding and is entitled under 10 C.F.R. § 309 to a hearing on its contentions.

/s/ Wallace L. Taylor

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