8.0 COMPARISON OF ENVIRONMENTAL IMPACT OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form...." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

The Omaha Public Power District (OPPD) presents its evaluations of the environmental impacts associated with Fort Calhoun Station Unit 1 (FCS) operating license renewal (the proposed action) and those associated with the selected alternatives in Chapter 4.0 and Chapter 7.0, respectively. In this chapter, OPPD provides a comparative summary of these impacts. The environmental impacts comparison addresses Category 2 issues associated with the proposed action and issues the Nuclear Regulatory Commission (NRC) identifies in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (Reference 8.0-1, Section 8.1) as major considerations in an alternatives analysis. For example, the NRC concluded in the GEIS that air impacts from the proposed action would be small (Category 1), but indicated that there is a potential for major human health concerns associated with air emissions from fossil-fuel generation alternatives (see Section 7.2.3.1). OPPD provides a comparative summary of its conclusions regarding these issues in Table 8.0-1, and a more detailed comparison in Table 8.0-2.

TABLE 8.0-1
IMPACTS COMPARISON SUMMARY

Impact	Proposed Action (License Renewal)	No-Action Alternative			
		Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	MODERATE	SMALL	All impacts are dependent on generation technologies used and location.
Water Use and Quality	SMALL	SMALL	SMALL	SMALL	
Air Quality	SMALL	SMALL	MODERATE	SMALL to MODERATE	
Waste Management	SMALL	SMALL	MODERATE	SMALL	
Ecological Resources	SMALL	SMALL	SMALL	SMALL	
Socioeconomics	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	
Transportation	SMALL	SMALL	SMALL	SMALL	
Human Health	SMALL	SMALL	SMALL	SMALL	
Aesthetics	SMALL	SMALL	SMALL	SMALL	
Cultural Resources	SMALL	SMALL	SMALL	SMALL	

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE - Environmental effects are sufficient to alter noticeably but not to destabilize any important attribute of the resource.

LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource (10 CFR 51, Subpart A, Appendix B, Table B-1, footnote 3).

TABLE 8.0-2
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
	Description			
FCS license renewal for 20 years, followed by decommissioning (Chapter 3).	Decommissioning following expiration of current FCS license. Adopting by reference NRC description in the GEIS, as bounding FCS decommissioning, GEIS description (see Section 7.1).	New construction at Nebraska City site with 75 miles of 345-kV transmission line. Plant characteristics as follows (see Sections 7.2.1.1, 7.2.3.1): One 475-MW (net) tangentially fired, dry bottom unit; capacity factor 0.8. Closed-cycle cooling; mechanical draft cooling towers. Pulverized bituminous coal; 8,500 Btu/pound; 10,000 Btu/kWh; 6.0% ash; 0.34% sulfur; 2,061,000 tons coal/yr.	New construction at Cass County site with 75 miles of 345-kV transmission line. Plant characteristics as follows (see Sections 7.2.1.2, 7.2.3.2): One 480-MW (net) unit; consisting of two 160-MW combustion turbines and a 160-MW heat recovery boiler; capacity factor 0.8. Closed-cycle cooling; mechanical draft cooling towers. Natural gas, 1,000 Btu/scf; 7,000 Btu/kWh; 24,037,000,000 scf gas/yr.	Construct 35 miles of 345-kV transmission line. Could involve construction of new generation capacity out of state. Adopting by reference NRC description in the GEIS of alternate technologies (Section 7.2.1.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Description (Continued)				
		Low NO_x burners, overfire air, selective catalytic reduction (95% NO_x removal efficiency). Wet limestone flue gas desulfurization (90% SO_x removal efficiency); 23,000 tons limestone/yr. Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency). Construction work force: 450 average, 1,200 peak. Additional operating work force: 15.	Dry-low NO_x combustor; selective catalytic reduction (90% NO_x removal efficiency). Construction work force: 200 average, 450 peak. Additional operating work force: 10.	
Land Use Impacts				
SMALL – Adopting by reference applicable NRC findings for GEIS Category 1 issues (Issues 52, 53).	SMALL – Not an impact evaluated in the GEIS (Reference 8.0-1, Section 7.3).	MODERATE – 140 acres of agricultural land converted to industrial use at existing plant site, including 90 acres for waste disposal (subject to prevalent land-use restrictions) and 50 acres for plant facilities. 75 miles of new transmission line, over mostly agricultural land. (see Section 7.2.3.1).	SMALL – 25 acres of agricultural land converted to industrial use at existing plant site. 75 miles of new transmission line, over mostly agricultural land (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of land use impacts from alternate technologies (Reference 8.0-1, Section 8.3). 35 miles of new transmission line, mostly over agricultural land (see Section 7.2.3.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Water Use and Quality Impacts				
SMALL – Adopting by reference applicable NRC findings for GEIS Category 1 issues (Issues 3, 6-12, 32). No applicable Category 2 water-use and quality issues.	SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 89). No Category 2 issues.	SMALL – Construction impacts minimized by use of best management practices. Operation impacts minimized by using closed-cycle cooling, regulatory controls, and discharge to Missouri River (see Section 7.2.3.1).	SMALL – Construction impacts minimized by use of best management practices. Operation impacts minimized by using closed-cycle cooling and regulatory controls (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of water quality impacts from alternate technologies (Reference 8.0-1, Section 8.3).
Air Quality Impacts				
SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 51). No applicable Category 2 issues.	SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 88). No Category 2 issues.	MODERATE – • 1,230 tons SO_x/yr • 430 tons NO_x/yr • 520 tons CO/yr • 62 tons TSP/yr • 14 tons PM_{10}/yr (see Section 7.2.3.1).	SMALL to MODERATE - • 8 tons SO_x/yr • 120 tons NO_x/yr • 180 tons CO/yr • 23 tons TSP/yr (all PM_{10}) (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of air quality impacts from alternate technologies (Reference 8.0-1, Section 8.3).
Waste Management Impacts				
SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issues 77-84). No Category 2 issues.	SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 87). No Category 2 issues.	MODERATE – 74,000 tons ash and 36,000 tons scrubber sludge generated annually (see Section 7.2.3.1).	SMALL –Relatively low waste generation (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of waste management impacts from alternate technologies (Reference 8.0-1, Section 8.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Ecological Resource Impacts				
SMALL – Adopting by reference applicable NRC findings for GEIS Category 1 issues (Issues 15-24, 45-48). OPPD has a current NPDES permit, which constitutes compliance with CWA Section 316(b) requirements to provide best available technology to minimize entrainment and impingement (see Section 4.2, Issue 25; Section 4.3, Issue 26). Thermal discharge from FCS complies with Nebraska Water Quality Standards without recourse to a CWA Section 316(a) variance (see Section 4.4, Issue 27.)Impacts to threatened and endangered species expected to be small due to low potential for occurrence in habitats affected by plant operation and lack of observed impacts during operational monitoring (see Section 4.6, Issue 49).	SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 90). No Category 2 issues.	SMALL - Loss of 140 acres of previously disturbed terrestrial habitat; potential impacts to aquatic ecology minimized by using closed-cycle cooling, regulatory controls, and discharge to Missouri River (see Section 7.2.3.1).	SMALL - Loss of 25 acres of previously disturbed terrestrial habitat; potential impacts to aquatic ecology minimized by closed-cycle cooling and regulatory controls (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of ecological resource impacts from alternate technologies (Reference 8.0-1, Section 8.3). 35 miles of new transmission line, mostly over agricultural land (see Section 7.2.3.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Socioeceonomic Impacts				
SMALL – Adopting by reference applicable NRC findings for GEIS Category 1 issues (Issues 64, 67). Location in area of high population minimizes potential for housing impacts (see Section 4.10, Issue 63). No tax-driven land-use impacts because OPPD is exempt from paying state occupational, personal property, and real estate taxes, and magnitude of the in-lieu payments relative to the receiving county's total revenues is not relevant in assessing new tax-driven land-use impacts (see Section 4.13.2, Issue 69). Capacity of public water supply minimizes potential for related impacts (see Section 4.11, Issue 65).	SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 91). No Category 2 issues.	SMALL to MODERATE – Increased demand for public services from nearby communities during construction and net loss of jobs in Washington County and associated reduction in economic activity from shutdown of FCS may result in noticeable, but not destabilizing, impacts (see Section 7.2.3.1).	SMALL to MODERATE – Net loss of jobs in Washington County and associated reduction in economic activity from shutdown of FCS may result in noticeable, but not destabilizing impacts (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of socioeconomic impacts from alternate technologies (Reference 8.0-1 Section 8.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Transportation Impacts				
SMALL - Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 85.) Capacity of U.S. Highway 75 minimizes potential for related impacts (see Section 4.14, Issue 70).	SMALL – Not an impact evaluated in the GEIS (Reference 8.0-1, Section 7.3).	SMALL – Temporary increase in traffic of 210-570 vehicle round-trips per day during construction; increase of 15 permanent employees for plant operations. Increase of 3-4 train round-trips per week on low-volume rail lines. (see Section 7.2.3.1).	SMALL - Temporary increase in traffic of 300 (maximum) vehicle round-trips per day during construction (see Section 7.2.3.2).	Impact dependent on generation technology and location. Not an impact evaluated in the GEIS.
Human Health Impacts				
SMALL –Adopting by reference applicable NRC findings for GEIS Category 1 issues (Issues 56, 58, 61, 62). Risk from thermophilic microbiological organisms minimal due to poor conditions for supporting populations of pathogenic organisms in the Missouri River, including areas affected by the thermal plume, and low potential for exposure of public in thermally affected zone (see Section 4.8, Issue 57).	SMALL – Adopting by reference applicable NRC finding for GEIS Category 1 issue (Issue 86). No Category 2 issues.	SMALL– Some risk of cancer and emphysema from air emissions and risk of accidents to workers, as the NRC notes in the GEIS Regulatory controls assumed to reduce risks to acceptable levels (see Section 7.2.3.1).	SMALL – Same as for coal-fired alternative (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of human health impacts from alternate technologies (Reference 8.0-1, Section 8.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Human Health Impacts (Continued)				
FCS operations have had no known impact on public health from pathogenic organisms. Risk due to transmission-line induced currents minimal due to conformance with National Electric Safety Code® criteria (see Section 4.9, Issue 59).				
Aesthetic Impacts				
SMALL – Adopting by reference applicable NRC findings for GEIS Category 1 issues (Issues 73,74). No Category 2 issues.	SMALL – Not an impact evaluated in the GEIS (Reference 8.0-1, Section 7.3).	SMALL – Incremental development at existing power plant site remote from major thoroughfares in sparsely populated rural area (see Section 7.2.3.1).	SMALL – Same as coal-fired alternative (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of aesthetic impacts from alternate technologies (Reference 8.0-1, Section 8.3).

TABLE 8.0-2 (CONTINUED)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal) [a]	No-Action Alternative			
	Base (Decommissioning) [a]	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Cultural Resource Impacts				
SMALL – Lack of cultural resources and SHPO consultation minimize potential for impact (see Section 4.15, Issue 71).	SMALL – Not an impact evaluated in the GEIS (Reference 8.0-1, Section 7.3).	SMALL – No known cultural resources in affected onsite areas; preservation measures, if necessary, would minimize impact (see Section 7.2.3.1).	SMALL – Same as coal-fired alternative (see Section 7.2.3.2).	Impact dependent on generation technology and location. Adopting by reference NRC description in the GEIS of cultural resource impacts from alternate technologies (Reference 8.0-1, Section 8.3).

a. See Appendix Table 1.0-1 for a list of issues and applicability.

Impact definitions:

SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE – Environmental effects are sufficient to alter noticeably but not to destabilize any important attribute of the resource.
LARGE – For the issue, environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.
(10 CFR 51, Subpart A, Appendix B, Table B-1, footnote 3.)

Btu = British thermal unit
CO = Carbon monoxide
CWA = Clean Water Act
FCS = Fort Calhoun Station Unit 1
gal. = gallon
GEIS = *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (Ref. 8.0-1)
kV = kilovolt
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_X = nitrogen oxide(s)
NPDES = National Pollutant Discharge Elimination System
OPPD = Omaha Public Power District
PM_{10} = filterable particulates having diameter less than 10 microns
scf = standard cubic foot
SHPO = State Historic Preservation Officer
SO_x = sulfur oxide(s)
TSP = total suspended particulates
yr = year

8.1 REFERENCES

8.0-1 U.S. Nuclear Regulatory Commission. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437. Office of Nuclear Regulatory Research. Washington, D.C., May 1996.

9.0 STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all Federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

9.1.1 GENERAL

Table 9.1-1 lists Omaha Public Power District's (OPPD's) environmental authorizations for current Fort Calhoun Station Unit 1 (FCS) operations. These "authorizations" include permits, licenses, approvals, and other entitlements required for plant operations and related activities. OPPD expects to continue to renew these authorizations as needed during the current license period and through the license renewal period, and will continue to operate FCS in compliance with the provisions of these authorizations and applicable environmental standards and requirements.

Table 9.1-2 lists additional environmental authorizations and consultations that would be required prior to U.S. Nuclear Regulatory Commission (NRC) renewal of the FCS operating license. As indicated, OPPD anticipates that relatively few such authorizations and consultations would be needed. Sections 9.1.2 through 9.1.5 provide more detailed discussions of key authorizations and compliance issues.

As Table 9.1-2 shows, OPPD anticipates that the only state environmental authorizations or consultations required specifically for FCS license renewal are from Nebraska authorities. However, as Section 2.1 notes, the Missouri River roughly follows the Nebraska-Iowa boundary, and OPPD maintains easements on land across the river in Iowa as part of the plant exclusion zone. Considering the potential for impact on shared resources, in particular the Missouri River, OPPD has made efforts to inform potentially affected state agencies in both Nebraska and Iowa about its intent to seek renewal of the FCS operating license. In addition, OPPD has specifically sought consultation from relevant agencies in both states regarding threatened and endangered species and potential for human health impacts from thermophilic microbes (see Appendices 3.0 and 6.0, respectively).

TABLE 9.1-1
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT FORT CALHOUN STATION OPERATIONS

Agency	Authority	Authorization	Number	Issue Date	Expiration	Activity Covered
Federal Authorizations						
U.S. Nuclear Regulatory Commission	Atomic Energy Act [42 USC 2011, et seq.], 10 CFR 50.10	License to operate	DPR-40	5/24/73 (allowed 20% power). Full power license issued 8/9/73	8/9/2013	Operation of FCS
State and Local Authorizations						
Nebraska Department of Environmental Quality	Federal Clean Water Act, Section 402 [33 USC 1251, et seq.]. NAC Title 119, Chapter 2	Industrial Wastewater Facility Permit	NPDES Permit No. NE0000418	4/1/2001	3/31/2006	Wastewater treatment and effluent discharge via outfalls 001-008. Nebraska Department of Environmental Quality considers the permit to certify compliance with state water quality standards for purposes of the Federal Clean Water Act, Section 401.
Nebraska Department of Environmental Quality	Nebraska Statute 81-1513	Consent Order In the Matter of Omaha Public Power District – Fort Calhoun Nuclear Station	Case No. 2206	7/27/99	To be determined as conditions are met.	Increases maximum discharge temperature limits from 110 deg F to 112 deg F. Requires thermal modeling study to determine compliance with state water quality standards.

TABLE 9.1-1 (CONTINUED)
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT FORT CALHOUN STATION OPERATIONS

Agency	Authority	Authorization	Number	Issue Date	Expiration	Activity Covered
Nebraska Game and Parks Commission	Nebraska Statute 37-418	Scientific Collecting Master Permit	Master Permit No. 168	4/16/2001	12/31/2001	Collection of fish species (for radiological environmental monitoring programs).
Nebraska Department of Natural Resources	NAC Title 457	Surface water authorization permits	D-1083 D-1100	12/17/81 8/20/92	Indefinite	Permits withdrawal of water from the Missouri River. Approval for up to approximately 370,000 gpm.
Nebraska Department of Natural Resources	NAC Title 456, Chapter 12	Groundwater well registrations	G-109801A-E G-109802 G-109803 G- 110639	4/30/2001 4/30/2001 4/30/2001 6/29/2001	Indefinite	One-time registration of onsite groundwater wells. Well numbers G-109801A-E and G- 110639 are used for groundwater monitoring.[a] G-109802 and G-109803 supply small amounts of water for operation of sanitary wastewater treatment facilities.

a. Monitoring wells G-109801A through E are associated with post-closure care monitoring of 1.3-acre wastewater treatment sludge landfill, certified closed on August 5, 1997, in accordance with NAC Title 132, Chapter 3. Post-closure plan under review by Nebraska Department of Environmental Quality as of September 2001.

CFR = Code of Federal Regulations
FCS = Fort Calhoun Station Unit 1
gpm = gallons per minute
NAC = Nebraska Administrative Code
NPDES = National Pollutant Discharge Elimination System
USC = U.S. Code

TABLE 9.1-2
ENVIRONMENTAL AUTHORIZATIONS FOR FORT CALHOUN STATION LICENSE RENEWAL[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal application	Environmental report submitted in support of license renewal application.
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires Federal agency issuing a license to consult with U.S. Fish and Wildlife Service (see Appendix 3.0).
Nebraska Department of Environmental Quality	Clean Water Act Section 401 (33 USC 1341)	Certification	Requires Federal agency issuing a license to obtain certification from State that the action complies with state water quality standards.
Nebraska State Historical Society	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires Federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (see Appendix 4.0).

USC = United States Code
a. No renewal-related requirements identified for local or other agencies.

9.1.2 THREATENED AND ENDANGERED SPECIES CONSULTATION

The Endangered Species Act, Section 7 (16 USC 1531 et seq.), requires Federal agencies to ensure that an agency action is not likely to jeopardize any species that is listed or threatened. For actions that may adversely affect such species or their habitats in Nebraska, the act requires consultation with the U.S. Fish and Wildlife Service (FWS). Procedural regulations for the consultation process are set forth at 50 CFR 402, Subpart B. FWS maintains the list of threatened and endangered species at 50 CFR 17.

As discussed in Section 4.6, OPPD does not expect continued operations of FCS to impact the population of any threatened or endangered species, although some listed species have habitats that include the lower Missouri River and elsewhere in the region of FCS. In preparation for the NRC's consultation process, and in consideration of potential impacts to species having special status at the state level, OPPD invited comment from FWS, the Nebraska Game and Parks Commission, and the Iowa Department of Natural Resources regarding potential effects that FCS license renewal might have on species of concern. Appendix 3.0 includes copies of OPPD contact letters and responses.

9.1.3 HISTORIC PRESERVATION CONSULTATION

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires Federal agencies to take into account the effect of activities they license on historic properties, and to afford the Advisory Committee on Historic Preservation an opportunity to comment on the undertaking. Committee regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute State review for Council review (35 CFR 800.7). Although federal law or NRC regulation does not require it, OPPD has chosen to invite comment by the Nebraska SHPO. Appendix 3.0 includes copies of OPPD correspondence with the SHPO. Based on the OPPD submittal, the SHPO concurred with OPPD's conclusion that FCS license renewal would not affect known historic or archaeological resources.

9.1.4 COMPLIANCE WITH NPDES THERMAL DISCHARGE LIMITS

Under authorization from the U.S. Environmental Protection Agency (EPA), the Nebraska Department of Environmental Quality (NDEQ) administers the National Pollutant Discharge Elimination System (NPDES) program in Nebraska. The current NPDES permit for FCS (see Appendix 2.0) authorizes a daily maximum temperature of 110 deg F for cooling water discharges from the plant. OPPD is seeking to permanently increase FCS's NPDES daily maximum temperature limit to 112 deg F to better ensure that the plant can operate at full power under the unusually high ambient river temperatures that have been experienced in recent summers. In the interim period until the NDEQ acts on OPPD's NPDES permit modification request, OPPD has entered into a Consent Order with the NDEQ that allows a daily maximum temperature of 112 deg F (see Appendix 2.0).

This Consent Order requires that OPPD submit water quality information to evaluate the impacts of this temperature increase to verify that instream water quality criteria would be met. OPPD is participating in a cooperative effort with the EPA and the NDEQ to obtain this information. This study, which includes thermal modeling, focuses on power plants and other industrial facilities that discharge to the lower Missouri River and will address potential effects of historically high river temperatures. It is also expected that this study will assist OPPD and the NDEQ to assess the implications of reduced river flows in summer such as those being considered by the U.S. Army Corps of Engineers (see Section 2.2.3).

This study was initiated in the fall of 2001, and it is expected that the final report regarding FCS thermal discharges will be completed in 2002 or early 2003. Subsequent to the release of the report, the NDEQ is expected to make a final determination to issue or deny the requested permit modification. In any event, OPPD would continue to comply with NDEQ thermal discharge standards through the duration of the current operating license and the license renewal term.

9.1.5 WATER QUALITY (401) CERTIFICATION

The Federal Clean Water Act (CWA) Section 401, requires that an applicant for a federal license or permit to conduct an activity that might result in a discharge into navigable waters obtain from the state having jurisdiction certification that the discharge will comply with applicable CWA standards (33 USC 1341). OPPD is applying to the NRC for a license (i.e., license renewal) to continue FCS operations.

The State of Nebraska has EPA authorization to implement the NPDES program in Nebraska for facilities such as FCS. Pursuant to state authority and the EPA authorization, the NDEQ has issued an NPDES permit for FCS (see Appendix 2.0). Title 119, Chapter 59, Section 001.03 of the NDEQ Rules and Regulations requires that the NDEQ review of an application for reissuance of a NPDES permit be sufficiently detailed to ensure that the applicant's discharge is "consistent with existing applicable effluent standards and limitations, water quality standards, best management practices, and other legally applicable requirements" (Reference 9.1-1). It is OPPD's understanding that the NPDES permit issued by the NDEQ constitutes CWA Section 401 certification by the State of Nebraska for the continued operations covered by that permit.

9.2 FEASIBLE ALTERNATIVES

NRC

"The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 45(d) as required by 10 CFR 51.53(c)(2)

It is OPPD's judgment that the representative coal- and gas-fired generation alternatives and purchased power alternative, presented in Section 7.2.1, probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. Although construction and operation details for the purchased power alternative (Section 7.2.1.3) are not known, it is reasonable to assume that any facility offering power for purchase would be in compliance.

9.3 REFERENCES

9.1-1 Nebraska Department of Environmental Quality. Title 119, Chapter 59. www.deq.ne.us/ruleandr.nfs/pages/119-ch59. Accessed June 20, 2001.

APPENDIX 1.0 DISCUSSION OF NRC LICENSE RENEWAL NATIONAL ENVIRONMENTAL POLICY ACT ISSUES

Omaha Public Power District (OPPD) has prepared this *Applicant's Environmental Report - Operating License Renewal Stage; Fort Calhoun Station Unit 1* in accordance with the requirements of the U.S. Nuclear Regulatory Commission (NRC) regulation at 10 CFR 51.53. The NRC included in the regulation a list of National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants. Table 1.0-1 lists these 92 issues with their assigned classifications, i.e., categories, and identifies where Fort Calhoun Station Unit 1 (FCS) addresses each issue in the environmental report (ER). The table also provides a cross-reference to the section in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) containing the NRC's generic analysis. For expediency, OPPD has assigned a number to each issue and uses the issue numbers throughout the ER.

TABLE 1.0-1
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

	Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
1.	Impacts of refurbishment on surface water quality	1	NA[c]	
2.	Impacts of refurbishment on surface water use	1	NA[c]	
3.	Altered current patterns at intake and discharge structures	1	4.1	4.2.1.2.1/4-4
4.	Altered salinity gradients	1	NA[d]	
5.	Altered thermal stratification of lakes	1	NA[e]	
6.	Temperature effects on sediment transport capacity	1	4.1	4.2.1.2.3/4-6
7.	Scouring caused by discharged cooling water	1	4.1	4.2.1.2.3/4-6
8.	Eutrophication	1	4.1	4.2.1.2.3/4-6
9.	Discharge of chlorine or other biocides	1	4.1	4.2.1.2.4/4-10
10.	Discharge of sanitary wastes and minor chemical spills	1	4.1	4.2.1.2.4/4-10

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
11. Discharge of other metals in waste water	1	4.1	4.2.1.2.4/4-10
12. Water use conflicts (plants with once-through cooling systems)	1	4.1	4.2.1.3/4-13
13. Water-use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	2	NA[f]	
14. Refurbishment impacts to aquatic resources	1	NA[c]	
15. Accumulation of contaminants in sediments or biota	1	4.1	4.2.1.2.4/4-10
16. Entrainment of phytoplankton and zooplankton	1	4.1	4.2.2.1.1/4-15
17. Cold shock	1	4.1	4.2.2.1.5/4-18
18. Thermal plume barrier to migrating fish	1	4.1	4.2.2.1.4/4-17
19. Distribution of aquatic organisms	1	4.1	4.2.2.1.6/4-19
20. Premature emergence of aquatic insects	1	4.1	4.2.2.1.7/4-20
21. Gas supersaturation (gas bubble disease)	1	4.1	4.2.2.1.8/4-21
22. Low dissolved oxygen in the discharge	1	4.1	4.2.2.1.9/4-23
23. Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.1	4.2.2.1.10/4-24
24. Stimulation of nuisance organisms (e.g., shipworms)	1	4.1	4.2.2.1.11/4-25

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

	Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
25.	Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	4.2	4.2.2.1.2/4-16
26.	Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	4.3	4.2.2.1.3/4-16
27.	Heat shock for plants with once-through and cooling pond heat dissipation systems	2	4.4	4.2.2.1.4/4-17
28.	Entrainment of fish and shellfish in early life stages for plants with cooling tower-based heat dissipation systems	1	NA[f]	
29.	Impingement of fish and shellfish for plants with cooling tower-based heat dissipation systems	1	NA[f]	
30.	Heat shock for plants with cooling tower-based heat dissipation systems	1	NA[f]	
31.	Impacts of refurbishment on groundwater use and quality	1	NA[c]	
32.	Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	4.1	4.8.1.1/4-116, 4.8.1.2/4-117
33.	Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	NA[g]	
34.	Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river)	2	NA[f]	
35.	Groundwater use conflicts (Ranney wells)	2	NA[h]	

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
36. Groundwater quality degradation (Ranney wells)	1	NA[h]	
37. Groundwater quality degradation (saltwater intrusion)	1	NA[d]	
38. Groundwater quality degradation (cooling ponds in salt marshes)	1	NA[f]	
39. Groundwater quality degradation (cooling ponds at inland sites)	2	NA[f]	
40. Refurbishment impacts to terrestrial resources	2	4.5	3.6/3-6
41. Cooling tower impacts on crops and ornamental vegetation	1	NA[f]	
42. Cooling tower impacts on native plants	1	NA[f]	
43. Bird collisions with cooling towers	1	NA[f]	
44. Cooling pond impacts on terrestrial resources	1	NA[f]	
45. Power line right-of-way management (cutting and herbicide application)	1	4.1	4.5.6.1/4-71
46. Bird collisions with power lines	1	4.1	4.5.6.2/4-74
47. Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.1	4.5.6.3/4-77
48. Floodplains and wetlands on power line right-of-way	1	4.1	4.5.7/4-81
49. Threatened or endangered species	2	4.6	3.9/3-48 4.1/4-1

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
50. Air quality during refurbishment (nonattainment and maintenance areas)	2	4.7	3.3/3-2
51. Air quality effects of transmission lines	1	4.1	4.5.2/4-62
52. Onsite land use	1	4.1	3.2/3-1
53. Power line right-of-way land-use impacts	1	4.1	4.5.3/4-62
54. Radiation exposures to the public during refurbishment	1	NA[c]	
55. Occupational radiation exposures during refurbishment	1	NA[c]	
56. Microbiological organisms (occupational health)	1	4.1	4.3.6/4-48
57. Microbiological organisms (public health) (Plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.8	4.3.6/4-48
58. Noise	1	4.1	4.3.7/4-49
59. Electromagnetic fields, acute effects (electric shock)	2	4.9	4.5.4.1/4-66
60. Electromagnetic fields, chronic effects	NA[i]	4.1	4.5.4.2/4-67
61. Radiation exposures to public (license renewal term)	1	4.1	4.6.2/4-87
62. Occupational radiation exposures (license renewal term)	1	4.1	4.6.3/4-95
63. Housing impacts	2	4.10	3.7.2/3-10, 4.7.1/4-101

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

	Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
64.	Public services: public safety, social services, and tourism and recreation	1	4.1	3.7.4/3-14, 3.7.4.3/3-18, 3.7.4.4/3-19, 3.7.4.6/3-20, 4.7.3/4-104, 4.7.3.3/4-106, 4.7.3.4/4-107, 4.7.3.6/4-107
65.	Public services: public utilities	2	4.11	3.7.4.5/3-19, 4.7.3.5/4-107
66.	Public services: education (refurbishment)	2	4.12	3.7.4.1/3-15
67.	Public services: education (license renewal term)	1	4.1	4.7.3.1/4-106
68.	Offsite land use (refurbishment)	2	4.13.1	3.7.5/3-20
69.	Offsite land use (license renewal term)	2	4.13.2	4.7.4/4-107
70.	Public services: transportation	2	4.14	3.7.4.2/3-17, 4.7.3.2/4-106
71.	Historic and archaeological resources	2	4.15	3.7.7/3-23, 4.7.7/4-114
72.	Aesthetic impacts (refurbishment)	1	NA[c]	
73.	Aesthetic impacts (license renewal term)	1	4.1	4.7.6/4-111
74.	Aesthetic impacts of transmission lines (license renewal term)	1	4.1	4.5.8/4-83
75.	Design basis accidents	1	4.1	5.3.2/5-11, 5.5.1/5-114
76.	Severe accidents	2	4.16	5.3.3/5-12, 5.5.2/5-114
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level radioactive waste)	1	4.1	6.2.4/6-27, 6.6/6-87
78.	Offsite radiological impacts (collective effects)	1	4.1	6.2.4/6-27, 6.6/6-88

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

	Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
79.	Offsite radiological impacts (spent fuel and high-level radioactive waste disposal)	1	4.1	6.2.4/6-28, 6.6/6-88
80.	Nonradiological impacts of the uranium fuel cycle	1	4.1	6.2.2.6/6-20, 6.2.2.7/6-20, 6.2.2.8/6-21, 6.2.2.9/6-21, 6.6/6-90
81.	Low-level radioactive waste storage and disposal	1	4.1	6.4.2/6-36, 6.4.3/6-37, 6.4.4/6-48, 6.6/6-90
82.	Mixed waste storage and disposal	1	4.1	6.4.5/6-63, 6.6/6-91
83.	Onsite spent fuel	1	4.1	6.4.6/6-70, 6.6/6-91
84.	Nonradiological waste	1	4.1	6.5/6-86, 6.6/6-92
85.	Transportation	1	4.1	Addendum 1 (Ref. 1.0-2)
86.	Radiation doses (decommissioning)	1	4.1	7.3.1/7-15, 7.4/7-25
87.	Waste management (decommissioning)	1	4.1	7.3.2/7-19, 7.4/7-25
88.	Air quality (decommissioning)	1	4.1	7.3.3/7-21, 7.4/7-25
89.	Water quality (decommissioning)	1	4.1	7.3.4/7-21, 7.4/7-25
90.	Ecological resources (decommissioning)	1	4.1	7.3.5/7-21, 7.4/7-25
91.	Socioeconomic impacts (decommissioning)	1	4.1	7.3.7/7-24, 7.4/7-25
92.	Environmental justice	NA [i]	4.17	Not addressed in GEIS

FCS = Fort Calhoun Station Unit 1
GEIS = Generic Environmental Impact Statement for License Renewal of Nuclear Plants
gpm = gallons per minute
NA = Not Applicable
NEPA = National Environmental Policy Act
OPPD = Omaha Public Power District

TABLE 1.0-1 (CONTINUED)
FORT CALHOUN STATION ENVIRONMENTAL REPORT
DISCUSSION OF LICENSE RENEWAL NEPA ISSUES

Issue[a]	Category[a]	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)

a. Source: 10 CFR 51, Subpart A, Appendix B, Table B-1 (Issue numbers added by OPPD to facilitate discussion).
b. Source: Reference 1.0-1.
c. NRC findings are not applicable because OPPD has no plans for major refurbishment.
d. Not applicable because FCS is not in a coastal area.
e. Not applicable because FCS does not withdraw cooling water from a lake.
f. Not applicable because FCS is not equipped with cooling ponds or cooling towers.
g. Not applicable because FCS uses less than 100 gallons of groundwater per minute (no dewatering; potable and service water are from municipal supply. Groundwater use limited to occasional withdrawals for maintaining water level in sanitary lagoons and flushing of center pivot irrigation system).
h. Not applicable because FCS does not use Ranney wells.
i. Not applicable. Regulation does not categorize this issue.

APPENDIX 2.0 CLEAN WATER ACT DOCUMENTATION

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Suite 400, The Atrium
1200 'N' Street
P.O. Box 98922
Lincoln, Nebraska 68509-8922
Phone (402) 471-2186

Mike Johanns
Governor

MAR 2 6 2001

RETURN RECEIPT REQUESTED

Mr. Ken Fielding, Vice President
OPPD Fort Calhoun Station
444 South 16th Street Mall
Omaha, NE 68102

RE: NPDES Number NE0000418

Dear Mr. Fielding:

Enclosed is the National Pollutant Discharge Elimination System (NPDES) Permit for OPPD Fort Calhoun Nuclear Station. Monitoring reports prescribed in Appendix A are required to be submitted to NDEQ. Also enclosed is a Signatory Authorization Form to be completed and returned to Sharon Brunke in the NPDES Permits Unit, *only if* there has been change(s) to the most recently submitted form, of which a copy is enclosed.

Questions regarding this permit or monitoring reports should be directed to Brett Anderson of the NPDES Permits Unit of NDEQ at (402) 595-1766. Your cooperation in helping to improve and maintain the quality of Nebraska's waters is appreciated.

Sincerely,

Rudy Fiedler, Acting Unit Supervisor
NPDES Permits Unit
Water Quality Division

Enclosure(s)
sb

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Suite 400, The Atrium
1200 'N' Street
P.O. Box 98922
Lincoln, Nebraska 68509-8922
Phone (402) 471-2186

Mike Johanns
Governor

APR 0 5 2001

WQD-P/C

RETURN RECEIPT REQUESTED

Mr. Ken Fielding, Vice President
OPPD Fort Calhoun Station
444 South 16th Street Mall
Omaha, Nebraska 68102

RECEIVED
APR 0 6 2001

RE: NPDES Permit Number NE0000418

Dear Mr. Fielding:

During a review of your National Pollutant Discharge Elimination System Permit NE0000418, it was noted some errors and omissions were made. Errors were made on Page 6 of 29 and Page 12 of 29. Omissions were made Page 4 of 29, Page 5 of 29, and Page 10 of 29. As a result, we are enclosing the corrected copies. Please remove the existing Page 4 of 29 and Page 5 of 29, Page 6 of 29, Page 10 of 29, and Page 12 of 29 and insert these enclosed corrected pages.

If you have any questions, feel free to contact **Ron Asch at (402) 471-2188.**

Sincerely,

Rudy Fiedler, Unit Supervisor
NPDES Permits Unit
Municipal and Industrial Section
Water Quality Division

Enclosure

pc: Gretchen Johnson, Data Processing w/enc
Brett Anderson, NDEQ w/enc

STATE OF NEBRASKA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Suite 400, The Atrium
1200 'N' Street
P.O. Box 98922
Lincoln, Nebraska 68509-8922
Phone (402) 471-2186

Mike Johanns
Governor

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the Federal Water Pollution Control Act, (33 U.S.C. §1251 et. seq., as amended to date), the Nebraska Environmental Protection Act (Neb. Rev. Stat. §81-1501 et. seq., as amended to date) and the Rules and Regulations promulgated pursuant to these Acts, **Omaha Public Power District (OPPD) Fort Calhoun Nuclear Station, Fort Calhoun, Nebraska** is authorized to discharge noncontact cooling water and treated wastewater to **Missouri River** in accordance with the effluent limitations, monitoring requirements, and other conditions set forth herein. This authorization to discharge is limited to the noncontact cooling water and wastewater treated by the facility described and this noncontact cooling water and treated wastewater must be discharged via the outfalls described herein. Issuance of an NPDES permit by the Nebraska Department of Environmental Quality does not relieve the permittee of other duties and responsibilities under the Nebraska Environmental Protection Act, as amended, or any rules and regulations promulgated pursuant to this Act. Requirements pertaining to sludge generated at this facility are also set forth in this permit.

NPDES Permit No.:	NE0000418
Facility Name:	Omaha Public Power District (OPPD) Fort Calhoun Nuclear Station
Facility Location:	NW¼, NW¼, Section 21, Township 18 North, Range 12, East, Washington County, Nebraska.

This authorization to discharge shall become effective on April 1, 2001. This authorization to discharge shall expire at midnight, on March 31, 2006.

Pursuant to a Delegation Memorandum dated July 26, 1999, and signed by the Director, the undersigned hereby executes this document on behalf of the Director.

Signed this 23rd day of March 2001

Jay D. Lingenberg
Deputy Director, Programs

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PART I EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. **Requirements for Outfall 001:** The flow authorized for discharge through Outfall 001 is once through condenser cooling water and low volume wastewater [(a)]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the drainage to the Missouri River (receiving waters). This discharge shall be monitored and limited as specified in the following table.

		LIMITATION			
PARAMETER	UNITS	DAILY MINIMUM	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
pH (00400)	S.U.	6.5	9.0	Monthly	Grab
		LIMITATIONS			
PARAMETERS	UNITS	30 DAY AVERAGE	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
Flow (50050)	MGD	Report	Report	Continuous	Metered
Oil and Grease (00552)	mg/L	Report [(d)]	10 [(d)]	Monthly	Grab
Temperature (00011)	°F	Report	110 [(b)]	Continuous	Recorder
Total Residual Chlorine [(c)] (50060)	mg/l	Report	0.20	Monthly	Grab
Total Suspended Solids (00530)	mg/l	30	100	Monthly	Grab

Footnotes:

(a) This permit specifically authorizes the discharge described in the permit application and the supplemental information provided during the permit review process. These discharges were identified as once through condenser cooling water and low volume wastewater during the application process. Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

(b) Case No. 2206 Consent Order allows a daily maximum temperature limitation of 112°F from this point of discharge until NDEQ makes a final determination to issue or deny the permit modification to allow a temperature increase from this outfall or the NDEQ determines that OPPD has not complied satisfactorily with the terms of the Consent Order.

(c) If chlorine is **not used** for macro-invertebrate control, the total residual chlorine monitoring and daily maximum limitation shall not apply.

(d) This parameter limitation shall be calculated and reported on a net basis, if the oil and grease and total suspended solids samples of the intake water and effluent discharge are sampled during the same time frame.

PART I. INTAKE WATER MONITORING REQUIREMENTS

B. **Requirements for Intake Water for Outfall 001:** The permittee is authorized to monitor the intake water for Outfall 001 designated as once through condenser cooling water and low volume wastewater discharge [(a)]. To comply with these monitoring requirements, samples shall be taken at the intake. This discharge shall be monitored and limited as specified in the following table.

		LIMITATIONS		
PARAMETERS	UNITS	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
Flow (50050)	MGD	Report	Continuous	Calculated or Metered
Oil and Grease (00552)	mg/L	Report	Monthly	Grab
Total Suspended Solids (00530)	mg/l	Report	Monthly	Grab

Footnotes:

[(a)] This permit specifically authorizes the monitoring of intake water described in the permit application and the supplemental information provided during the permit review process.

PART I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

C. **Requirements for Outfall 002:** The flow authorized for discharge through Outfall 002 is low volume wastewater discharge (water treatment plant discharge) [a]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the Missouri River (receiving waters). This discharge shall be monitored and limited as specified in the following table.

		LIMITATIONS			
PARAMETER	UNITS	DAILY MINIMUM	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
pH (00400)	S.U.	6.5	9.0	Monthly	Grab
		LIMITATIONS			
PARAMETERS	UNITS	30 DAY AVERAGE	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
Flow (50050)	MGD	Report	Report	Daily	Calculated or Metered
Conductivity (00094)	µmho/cm	Report	Report	Monthly	Grab
Oil and Grease (00552)	mg/L	Report	10	Monthly	Grab
Total Suspended Solids (00530)	mg/l	30	100	Monthly	Grab

Footnotes:

[a] This permit specifically authorizes the discharge described in the permit application and the supplemental information provided during the permit review process. The discharge identified during the application as a low volume wastewater discharge (water treatment plant discharge). Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

PART I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

D. **Requirements for Outfalls 003 and 004:** The flows authorized for discharge through Outfall 003 and Outfall 004 are the traveling screen backwash plant discharge and the surface spray discharge [a]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the Missouri River (receiving waters). This discharge shall be monitored and limited as specified in the following table.

		LIMITATIONS			
ARAMETERS	UNITS	30 DAY AVERAGE	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
No Monitoring Parameters					

Footnotes:

[a] This permit specifically authorizes the discharges described in the permit application and the supplemental information provided during the permit review process. The discharges identified during the application as the traveling screen backwash plant discharge and the surface spray discharge. Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

PART I.

E. **Requirements for Outfall 005:** The flow authorized for discharge through Outfall 005 is the warmwater recirculation for deicing [a]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the Missouri River (receiving waters). This discharge shall be monitored and limited as specified in the following table.

		LIMITATIONS			
PARAMETER	UNITS	DAILY MINIMUM	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
Temperature (00011)	°F	Report	110 [b]	Continuous	Recorder

Footnotes:

[a] This permit specifically authorizes the discharge described in the permit application and the supplemental information provided during the permit review process. The discharge was identified as the warmwater recirculation for deicing during the application process. Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

[b] Case No. 2206 Consent Order allows a daily maximum temperature limitation of 112°F from this point of discharge until NDEQ makes a final determination to issue or deny the permit modification to allow a temperature increase from this outfall or the NDEQ determines that OPPD has not complied satisfactorily with the terms of the Consent Order.

PART I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

F. **Requirements for Outfall 006:** The flow authorized for discharge through Outfall 006 is condensation tank discharge [(a)]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the Missouri River (receiving waters). This discharge shall be monitored and limited as specified in the following table.

		LIMITATIONS			
PARAMETERS	UNITS	30 DAY AVERAGE	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
No Monitoring Parameters					

Footnotes:

[(a)] This permit specifically authorizes the discharges described in the permit application and the supplemental information provided during the permit review process. The discharges identified during the application as the condensation tank discharge. Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

PART I.

G. **Requirements for Outfall 007**: The flow authorized for discharge through Outfall 007 is the controlled sanitary lagoon discharge [a]. To comply with these monitoring requirements, samples shall be taken prior to discharge e to the Missouri River (receiving waters). This discharge shall be monitored and limited as specified in the following table.

		LIMITATION			
PARAMETER	UNITS	DAILY MINIMUM	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
pH (00400)	S.U.	6.5	9.0	During each Drawdown Event[b]	Grab
		LIMITATIONS			
PARAMETER	UNITS	30 Day Average	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
Flow (50050)	MGD	Report	Report	Daily During Drawdown Event	Calculated or Metered
Ammonia as Nitrogen (00610)	mg/L	Report	Report	During each Drawdown Event[b]	Grab
Carbonaceous Biochemical Oxygen Demand (5-Day) (80082)	mg/L	25	40	During each Drawdown Event[b]	Grab
Duration of Discharge (81381)	Days	Report	Report	During each Drawdown Event[b]	Calculated
Total Suspended Solids (00530)	mg/L	80	120	During each Drawdown Event[b]	Grab

May 1 through September 30

PARAMETER	UNITS	LIMITATIONS		MONITORING FREQUENCY	SAMPLE TYPE
		30 DAY AVERAGE	DAILY MAXIMUM		
Fecal Coliform Colonies (74055)	#/100ml	200	400	During each Drawdown Event[b]	Grab

Footnotes.

[a] This permit specifically authorizes the discharges described in the permit application and the supplemental information provided during the permit review process. The discharge identified during the application as the controlled sanitary lagoon discharge. Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

[b] Two grab samples must be collected during each discharge event. One prior to the drawdown event and a second sample shall be collected prior to stopping the drawdown event.

PART I.

H. CONTROLLED DISCHARGE LAGOON REQUIREMENTS

1. Discharges, if necessary, are required to occur within the following two calendar periods:

   a. Between April 1 and June 30

   b Between October 1 and December 31, but prior to ice formation on the lagoon cell.

   c. The drawdown flow rate shall be measured or calculated at least once per day during each drawdown period.

   d. The duration of the drawdown (number of days) and the daily average of flow (in MGD) shall be reported.

   e. No cell shall be drawn down below the depth of two feet.

   * When a lagoon cell is discharging through an overflow structure, the permittee shall sample the effluent and contact NDEQ immediately.

2. Prior to drawing down any lagoon cell:

   a. The cell(s) to be drawn down shall be isolated from the lagoon cell(s) that is receiving raw wastewater for a minimum of seven days.

   b. Compliance with permit limits must be verified.

3. Drawdowns, if necessary, must last a minimum of five days.

4. If the drawdown lasts under twenty days, the effluent must be sampled on the first and last days of the drawdown.

5. If the drawdown lasts longer than twenty days, an effluent sample shall be taken once every seven days.

PART I.

I. LAND APPLICATION MONITORING REQUIREMENTS

Requirements for Outfall 008: The flow authorized for discharge through Outfall 008 is the discharger into the land application system [a]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the land application system. This discharge shall be monitored and limited as specified in the following table.

		LIMITATION			
PARAMETERS	UNITS	DAILY MINIMUM	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
pH (00400)	S.U.	Report	Report	Twice per Season [b]	Grab
		LIMITATIONS			
PARAMETERS	UNITS	30 DAY AVERAGE	DAILY MAXIMUM	MONITORING FREQUENCY	SAMPLE TYPE
Flow (50050)	MGD	Report	Report	Daily	Calculated or Metered
Ammonia as Nitrogen (00610)	mg/L	Report	Report	Twice per Season [b]	Grab
Conductivity (000094)	µmho/cm	Report	Report	Twice per Season [b]	Grab
Total Chlorides (00940)	mg/L	Report	Report	Twice per Season [b]	Grab
Total Kjeldahl Nitrogen (00625)	mg/L	Report	Report	Twice per Season [b]	Grab
Nitrate as Nitrogen (00620)	mg/L	Report	Report	Twice per Season [b]	Grab

Footnotes:

[a] This permit specifically authorizes the discharges described in the permit application and the supplemental information provided during the permit review process. The discharges identified during the application as the condensation tank discharge. Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

[b] Land application compliance samples shall be collected twice during each season. One sample shall be collected at the start of land application season. The second sample shall be collected prior to the end of the land application season. The land application season is from April 1 through October 31 each year.

PART I. STORM WATER MONITORING REQUIREMENTS

J. **Requirements for the Storm Water Outfalls:** The flows authorized for discharge through these Outfalls is storm water from the switching yard and two other storm water outfalls [a]. To comply with these monitoring requirements, samples shall be taken prior to discharge to the Missouri River (receiving waters). This discharge shall be monitored as specified in the following table. The Department may request sampling of the two other storm water outfalls identified in the Pollution Prevention Plan (Fort Calhoun Station Unit No. 1, Standing Order: **SO-G-108**).

PARAMETER	UNITS	REPORTING REQUIREMENT	MONITORING FREQUENCY	SAMPLE TYPE
Flow (50050)	MGD	Report	[b]	Calculated or Metered
Total Ammonia as Nitrogen (00610)	mg/L	Report	[b]	[c]
Biochemical Oxygen Demand (5-Day) (00310)	mg/L	Report	[b]	[c]
Chemical Oxygen Demand (81017)	mg/L	Report	[b]	[c]
Fecal Coliform (74055)	mg/L	Report	[b]	[c]
Fecal Streptococcus (74054)	mg/L	Report	[b]	[c]
Total Nitrate as Nitrogen (00620)	mg/L	Report	[b]	[c]
Total Kjeldahl Nitrogen (00625)	mg/L	Report	[b]	[c]
Oil and Grease (00552)	mg/L	Report	[b]	[c]
pH (00400)	mg/L	Report	[b]	[c]
Dissolved Phosphorus (00666)	mg/L	Report	[b]	[c]
Total Phosphorus (00665)	mg/L	Report	[b]	[c]
Total Dissolved Solids (70295)	mg/L	Report	[b]	[c]
Total Suspended Solids (00530)	mg/L	Report	[b]	[c]

Footnotes:

[a] This permit specifically authorizes the discharges described in the permit application and the supplemental information provided during the permit review process. These discharges were identified as storm water discharges in the Pollution Prevention Plan (Fort Calhoun Station Unit No. 1, Standing Order: **SO-G-108**). Department approval is required prior to adding any additional discharge sources or modification of the existing system that may increase the pollutant loadings or significantly increase flows.

[b] and [c] See Part II. A. Other Requirements, Paragraphs 10 and 11.

PART II

A. OTHER REQUIREMENTS

1. The wastewater shall not cause: noxious odors, floating, suspended, colloidal or settleable materials that produce objectionable films, colors, turbidity or deposits; and the occurrence of undesirable or nuisance aquatic life.

2. Sludge shall be disposed of or utilized in a manner approved by the Department of Environmental Quality.

3. This permit may be reopened and modified after the public notice and opportunity for a public hearing for reasons specified in NDEQ Title 119 - Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System, Chapter 14. These reasons include but are not limited to: the effluent has been monitored for two years and a written request by the permittee provides justification for reducing the frequency of monitoring of any parameter(s) in this permit or if new information becomes available that justifies an increase or decrease of any effluent limitation(s) in this permit. The results of a water quality study may be considered new information.

4. The permittee shall analyze wastewater parameters using the approved methods listed in 40 CFR, Part 136, as adopted in NDEQ Title 121 - Effluent Guidelines and Standards, Chapter 8.

5. This facility is to be operated and maintained by operators certified in accordance with NDEQ Title 197 - Rules and Regulations for the Certification of Wastewater Treatment Facility Operators in Nebraska.

6. The Minimum Limit (ML) is defined as the level at which the entire analytical system gives acceptable calibration points. If the analytical results are below the ML, the results should be reported as "**as a numerical value less than the detection limit (i.e. <0.005)**".

7. The permittee shall notify the NDEQ Permits and Compliance Section prior to adding any compound (i.e., biocides or conditioners) to the noncontact cooling water. The notification shall include: the quantity to be added, Material Safety Data Sheets (MSDS), and any information regarding the compound's toxicity to aquatic life.

8. There shall be no discharge of polychlorinated biphenyl compounds (**PCBs**) from any outfall at any time.

9. Chlorine may not be injected into any single generating unit for more than two (2) hours per day unless the permittee demonstrates to the Department that injection for more than two (2) hours is required for macro invertebrate control. Both simultaneous multi-unit and sequential chlorination for are allowed for power plants rated at greater than 25 megawatts. Simultaneous multi-unit chlorination for power plants at rated at less than 25 megawatts is allowed.

10. The switching yard storm water outfall shall be sampled and the results reported as an addendum to the regular discharge monitoring report once during the first year and the fifth year of this permit term during discharge event. The storm water sample points and sampling techniques to be used were identified in the Pollution Prevention Plan (Fort Calhoun Station Unit No. 1, Standing Order **SO-G-108**).

11. The Department may request the sampling of the other storm water outfalls identified in the Pollution Prevention Plan - Fort Calhoun Station Unit No. 1, Standing Order **SO-G-108.**

12. Best management practices shall be employed to prevent and minimize pollutant releases into the storm water discharges.

APPENDIX A - Standard Conditions for NPDES and NPP Permits.

These general conditions are applicable to all NPDES and NPP permits. These conditions shall not preempt any more stringent requirements found elsewhere in this permit.

A. General Conditions

1. Information Available

All permit applications, fact sheets, permits, discharge data, monitoring reports, and any public comments concerning such shall be available to the public for inspection and copying, unless such information about methods or processes is entitled to protection as trade secrets of the owner or operator under Neb. Rev. Stat. §81-1527, (Cum. Supp. 1992) and Title 115, Chapter 9.

2. Duty to Comply

All authorized discharges shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

The permittee shall comply with all conditions of this permit. Failure to comply with these conditions may be grounds for administrative action or enforcement proceedings including injunctive relief and civil or criminal penalties.

The filing of a request by the permittee for a permit modification, revocation and reissuance, termination or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize, prevent or correct any adverse impact to the environment resulting from noncompliance with this permit, including such accelerated or additional monitoring as required by the NDEQ to determine the nature and impact of the noncompliant discharge.

4. Permit Actions

This permit may be modified, suspended, revoked or reissued, in part or in whole, in accordance with the regulations set forth in NDEQ Titles 119 and/or 127. In addition, this permit may be modified, revoked and reissued to incorporate standards or limitations issued pursuant to Sections 301(b)(2)(c), 301(b)(2)(d), 304(b)(2), 307(a)(2), or 405(d) of the Clean Water Act, Public Law 100-4 (i.e., industrial categorical standards and municipal sludge regulations) and Title 121.

5. Toxic Pollutants

The permittee shall not discharge pollutants to waters of the State that cause a violation of the standards established in NDEQ Titles 117, 118 or 121. All discharges to surface waters of the State shall be free of toxic (acute or chronic) substances which alone or in combination with other substances, create conditions unsuitable for aquatic life outside the appropriate mixing zone.

Appendix A (continued)

6. Oil and Hazardous Substances/Spill Notification

Nothing in this permit shall preclude the initiation of any legal action or relieve the permittee from any responsibilities, liabilities or penalties under Section 311 of the Clean Water Act. The permittee shall conform to the provisions set forth in NDEQ Title 126 in the event of a release of a reportable quantity of oil or hazardous substances. If the permittee knows, or has reason to believe, that oil or hazardous substances were released at the facility and could enter waters of the State or any of the outfall discharges authorized in this permit, the permittee shall immediately notify the Department of a release of oil or hazardous substances. During Department office hours (i.e., 8:00 a.m. to 5:00 p.m., Monday through Friday, except holidays), notification shall be made to the LUST/ER Section (telephone number 402/471-4230). When the LUST/ER Section cannot be contacted, the permittee shall report to the Nebraska State Patrol for referral to the NDEQ Emergency Response Team (telephone number 402/471-4545). It shall be the permittee's responsibility to maintain current telephone numbers necessary to carry out the notification requirements set forth above.

7. Property Rights

The issuance of this permit does not convey any property rights of any sort or any exclusive privileges nor does it authorize any damage to private property or any invasion of personal rights nor any infringement of federal, state or local laws or regulations.

8. Severability

If any provision of this permit is held invalid, the remainder of this permit shall not be affected.

9. Other Rules and Regulations Liability

The issuance of this permit in no way relieves the obligation of the permittee to comply with other rules and regulations of the Department.

10. Inspection and Entry

The permittee shall allow the Director or his authorized representative, upon the presentation of his identification and at a reasonable time:

a. to enter upon the permittee's premises where a regulated facility or activity is located or conducted, or records are required to be kept under the terms and conditions of the permit,

b. to have access to and copy any records required to be kept under the terms and conditions of the permit,

c. to inspect any facilities, equipment (including monitoring and control), practices or operations regulated or required in the permit, and

d. to sample or monitor any substances or parameters at any location.

Appendix A (continued)

11. Penalties

Violations of the terms and conditions of this permit may result in the initiation of criminal and/or civil actions. Civil penalties can result in fines of up to $10,000.00 per day [Neb. Rev. Stat. §81-1508, as amended to date. Criminal penalties for willful or negligent violations of this permit may result in penalties of $10,000.00 per day or by imprisonment. Violations may also result in federal prosecution.

B. Management Requirements

1. Duty to Provide Information

The permittee shall furnish to the Department within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit; or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records retained as a requirement of this permit.

2. Duty to Reapply

The permittee shall apply for a reissuance of this permit, if an activity regulated by this permit is to be continued after the expiration date of this permit. The application shall be submitted at least 180 days before the expiration of this permit on an application form supplied by the Department, as set forth in NDEQ Titles 119 and/or 127.

3. Signatory Requirements

All reports and applications required by this permit or submitted to maintain compliance with this permit, shall be signed and certified as set forth in this section.

a. Permit applications shall be signed by a **cognizant official** who meets the following criteria:

(1) for a corporation: by a principal executive officer of at least the level of vice-president,

(2) for a partnership or sole proprietorship: by a general partner or the proprietor, respectively, or

(3) for a municipality, state, federal or other public facility: by either a principal executive officer or highest ranking elected official.

b. Discharge monitoring reports and other information shall be signed by the cognizant official or by an **authorized representative**.

c. An authorized representative is designated by the cognizant official. The authorized representative is responsible for the overall operation of the facility (i.e., a plant manager, a well field operator or a wastewater treatment plant superintendent).

d. Any change in the signatories shall be submitted to the Department, in writing, within 30 days after the change.

Appendix A (continued)

e. Certification. All applications, reports and information submitted as a requirement of this permit, shall contain the following certification statement:

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

C. Monitoring and Records

1. Representative Sampling

Samples and measurements taken as required within this permit shall be representative of the discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water or substance. Monitoring points shall not be changed without notification to the Department and with the written approval of the Director.

a. Composite sampling shall be conducted in one of the following manners:

(1) continuous discharge - a minimum of one discrete aliquot collected every three hours,

(2) less than 24 hours - a minimum of hourly discrete aliquots or a continuously drawn sample shall be collected during the discharge, or

(3) batch discharge - a minimum of three discrete aliquots shall be collected during each discharge.

b. Composite samples shall be collected in one of the following manners:

(1) the volume of each aliquot must be proportional to either the waste stream flow at the time of sampling or the total waste stream flow since collection of the previous aliquot,

(2) a number of equal volume aliquots taken at varying time intervals in proportion to flow,

(3) a sample continuously collected in proportion to flow, and

(4) where flow proportional sampling is infeasible or nonrepresentative of the pollutant loadings the Department may approve the use of time composite samples.

c. Grab samples shall consist of a single aliquot collected over a time period not exceeding 15 minutes.

d. All sample preservation techniques shall conform to the methods adopted in NDEQ Title 121, Chapter 8, unless:

(1) in the case of sludge samples, alternative techniques are specified in the 40 CFR, Part 503, or

Appendix A (continued)

(2) other procedures are specified in this permit.

2. **Flow Measurements**

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be used to insure the accuracy and reliability of measurements. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of +/- 10% from the true discharge rates throughout the range of expected discharge volumes. Guidance in selection, installation, calibration and operation of acceptable flow measurement devices can be obtained from the following references:

a. "Water Management Manual," U. S. Department of Interior, Bureau of Reclamation. Second Edition, Revised Reprint, 1974, 327 pp. Available from the U. S. Government Printing Office, Washington, DC 20402. Order by Catalog Number 127.19/2:W29/2, Stock Number S/N 24003-0027

b. "Flow Measurement in Open Channels and Closed Conduits," U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 484, October, 1977, 982 pp. Available in paper copy or microfiche from National Technical Information Service (NTIS), Springfield, VA 22151. Order by NTIS Number PB-273 535/5ST.

c. "NPDES Compliance Sampling Manual," U. S. Environmental Protection Agency, Office of Water Enforcement, Publication MCD-51, May, 1988, 140 pp. Available from the General Services Administration (8FFS), Centralized Mailing Lists Services, Building 41, Denver Federal Center, Denver, CO 80225.

3. Test Procedures

Test procedures used for monitoring required by this permit, shall conform to the methods adopted in NDEQ Title 121, Chapter 8 unless:

a. in the case of sludge samples, alternative techniques are specified in the 40 CFR, Part 503; or

b. other procedures are specified in this permit.

4. **Averaging of Measurements**

Averages shall be calculated as an arithmetic mean except:

a. bacterial counts which shall be calculated as a geometric mean, or

b. where otherwise specified by the Department.

5. Retention of Records

The permittee shall retain records of all monitoring activities for a period of at least three years (five years for sludge; see below) as set forth in NDEQ Titles 119 and/or 127. The types of records that must be retained include, but are not limited to:

Appendix A (continued)

a. calibration and maintenance records,

b. original strip chart recordings,

c. copies of all reports required by this permit,

d. monitoring records and information, and

e. electronically readable data.

The permittee shall retain records of monitoring required by this permit that are related to sludge use and disposal for a period of five years or longer, as required in 40 CFR, Part 503.

6. Record Contents

Records of sampling or monitoring information shall include:

a. the date(s), exact place, time and methods of sampling or measurements,

b. the name(s) of the individual(s) who performed the sampling or measurements,

c. the date(s) the analyses were performed,

d. the individual(s) who performed the analyses,

e. the analytical techniques or methods used,

f. the results of such analyses, and

g. laboratory data, bench sheets and other required information.

D. Reporting Requirements

1. Immediate Notification

a. NPP permittees shall report immediately to the publicly owned treatment works (POTW), any discharge to the POTW that may result in a violation of NDEQ Title 127, Chapter 3.

b. All permittees shall report immediately to the NDEQ:

(1) discharges of oil or hazardous substances which threaten waters of the State or public health and welfare, and

(2) discharges causing in-stream toxicity (i.e., a fish kill) or an immediate threat to human health.

Initial notification may be verbal. A written noncompliance notification shall be submitted as set forth in Section D. 3. of this Appendix.

Appendix A (continued)

2. **24-Hour Reporting**

The permittee shall report to the NDEQ, within 24 hours of becoming aware of:

a. any noncompliance which may endanger the environment or human health or welfare,

b. any unanticipated bypass as set forth in NDEQ Titles 119 and/or 127,

c. all upsets as set forth in NDEQ Titles 119 and/or 127,

d. any discharge to a POTW that causes a violation of the prohibited discharge standards set forth in NDEQ Title 127, Chapter 3, or

e. any noncompliance of an effluent limitation in this permit.

Initial notification may be verbal. A written noncompliance notification shall be submitted as set forth in Section D. 3. of this permit.

If sampling performed by an industrial user (NPP permittee) indicates a permit effluent violation, the permittee shall notify the Department and the city within 24 hours of becoming aware of the violation. The permittee shall resample and have it analyzed. The results of the resampling analysis shall be submitted to the Department and the city within 30 days after becoming aware of the violation.

3. **Written Noncompliance Notification**

a. The permittee shall submit a written noncompliance report to the NDEQ:

(1) within five days of becoming aware of any noncompliance with the:

(a) NPP effluent limitations or requirements set forth in this permit, or

(b) NPDES toxic pollutant effluent limitations or requirements set forth in this permit.

(2) within seven days of becoming aware of any other noncompliance with the NPDES requirements and/or effluent limitations set forth in this permit.

b. the written notification shall be submitted on a noncompliance form supplied by the Department and shall include:

(1) a description of the discharge and cause of noncompliance,

(2) the period of noncompliance, including exact dates and times, or if not corrected, the anticipated time the noncompliance is expected to continue, and

(3) the steps taken to reduce, eliminate and prevent the reoccurrence of the noncompliance.

The submittal of a written noncompliance report does not relieve the permittee of any liability from enforcement proceedings that may result from the violation of permit or regulatory requirements.

Appendix A (continued)

4. **Quarterly Discharge Monitoring Reports (DMRs)**

The permittee shall report the monitoring results required by this permit on a DMR form supplied or approved by the Department. Monitoring results shall be submitted on a quarterly basis using the reporting schedule set forth below, unless otherwise specified in this permit or by the Department.

Monitoring Quarters	DMR Reporting Deadlines
January - March	April 28
April - June	July 28
July - September	October 28
October - December	January 28

If the permittee monitors any pollutant more frequently than required by this permit, using procedures specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted on the DMR. The frequency of the analysis shall also be reported on the DMR.

5. **Changes in Discharge**

Any facility expansion, production increases or process modifications which will result in new or substantially increased discharges of pollutants or a change in the nature of the discharge of pollutants must be reported by the permittee 180 days prior to the expansion, increases or modifications, either by amending his original application or by submitting a new application. This permit may be modified or revoked and reissued as a result of this notification to maintain compliance with applicable state or federal regulations.

6. **Changes in Toxic Discharges from Manufacturing, Commercial, Mining and Silvicultural Facilities**

Permittees discharging from manufacturing, commercial, mining and silvicultural facilities shall report to the Department:

a. if any toxic pollutant not limited in this permit is discharged from any NPDES outfall as a result of any activity that will or has occurred and results in its routine or frequent discharge. The Department shall be informed if that discharge exceeds the following notification levels:

(1) 100 micrograms per liter (0.1 mg/l) for any toxic pollutant,

(2) 200 micrograms per liter for acrolein and acrylonitrile (0.2 mg/l),

(3) 500 micrograms per liter for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol (0.5 mg/l),

(4) 1000 micrograms per liter for antimony (1 mg/l),

(5) five times the maximum concentration value reported for that pollutant in the permit application or

(6) an alternative level established by the Director, and

Appendix A (continued)

b. if any toxic pollutant not limited in this permit is discharged from an NPDES outfall as a result of any activity that will or has occurred and results in its nonroutine discharge. The Department shall be informed if that discharge exceeds the following notification levels:

(1) 500 micrograms per liter (0.5 mg/l) for any toxic pollutant,

(2) 1000 micrograms for antimony (1 mg/l),

(3) ten times the maximum concentration value reported for that pollutant in the permit application, or

(4) an alternative level established by the Director.

7. **Changes in Sludge Quality**

The permittee shall provide written notice to the Department of any alteration or addition that results in a significant change in the permittee's sludge use or disposal practices. This permit may be modified or revoked and reissued as a result of this notification to maintain compliance with applicable state or federal regulations.

8. **Changes of Loadings to Publicly Owned Treatment Work (POTW)**

POTW's shall notify the Department of the following:

a. any new introduction of pollutants from dischargers subject to the categorical pretreatment discharge limitations set forth in NDEQ Title 121, Chapter 2, and

b. any substantial change in the volume or character of pollutants being introduced into the POTW.

Notification shall be made 180 days in advance whenever possible. Information on the quantity and quality of new discharges and their anticipated impact on the POTW shall be included.

9. **Transfers**

The permittee shall notify the Department at least 30 days prior to the proposed transfer of ownership of this permit or the permitted facility to another party as set forth in NDEQ Title 119, Chapter 12 and/or NDEQ Title 127, Chapter 14. The Department may modify or revoke and reissue this permit according to the regulations set forth in NDEQ Titles 119 and/or 127.

10. **Compliance Schedules**

The permittee shall submit a written report of compliance or noncompliance with any compliance schedule established in this permit. The written report shall be submitted within 14 days following all deadlines established in the compliance schedule. If compliance has not been achieved, the report shall include an alternative completion date, an explanation of the cause of the noncompliance and an explanation of the steps being taken to ensure future compliance. The submission of this report does not ensure the Department's acceptance of alternative compliance dates nor does it preclude the Department from initiating enforcement proceedings based upon the reported noncompliances.

Appendix A (continued)

E. Operation and Maintenance

1. Proper Operation and Maintenance

The permittee shall, at all times, maintain in good working order and operate as efficiently as possible, any facilities or systems of control installed by the permittee in order to achieve compliance with the terms and conditions of this permit. This would include, but not be limited to, effective performance based on designed facility removals, effective management, adequate operator staffing and training, adequate laboratory and process controls, and adequate funding which reflects proper user fee schedules.

2. Treatment System Failure and Upset

An upset is an affirmative defense to an enforcement action brought for noncompliance with technology-based permit effluent limitations if the permittee can demonstrate, through properly signed, operating logs or other relevant evidence, that:

a. an upset occurred and the specific cause was identified,

b. that the facility was properly operated and maintained at such time,

c. the Department was notified within 24 hours of the permittee becoming aware of the upset, and

d. the permittee took action to reduce, eliminate and prevent a reoccurrence of upset, including minimizing adverse impact to waters of the State.

3. Bypassing

Any diversion from or bypass of the treatment facilities is prohibited, unless:

a. it is unavoidable to prevent loss of life, personal injury or severe property damage,

b. no feasible alternative exists, i.e., auxiliary treatment facilities, retention of untreated wastes or maintenance during normal periods of equipment downtime,

c. the permittee submits notice to the Department within 24 hours of becoming aware of the bypass or if the bypass is anticipated or should have been anticipated, the Department is notified at least ten days prior to the bypass, and

d. the bypass is conducted under conditions determined to be necessary by the Director to minimize any adverse effects.

If the bypass is needed for regular preventative maintenance for which back-up equipment should be provided, the bypass will not be allowed. When a bypass occurs, the burden is on the permittee to demonstrate compliance with items "a" through "d" above.

Additionally, NPP permittees shall report any bypasses to the POTW. Unanticipated bypasses shall be reported immediately and anticipated bypasses shall be reported at least ten days in advance.

Appendix A (continued)

All NPDES permittees shall notify the general public that a bypass of the treatment system is occurring. The public notification shall include:

a. location of the bypass,

b. the date the bypass started,

c. anticipated length of time the bypass will occur, and

d. an estimate of the total volume of wastewater bypassed.

4. **Removed Substances**

Solids, sludge, filter backwash or other pollutants removed in the course of treatment or control of wastewater shall be disposed of at a site and in a manner approved by the Nebraska Department of Environmental Quality. The disposal of nonhazardous industrial sludges shall conform to the standards established in or to the regulations established pursuant to 40 CFR, Part 257. The disposal of sludge shall conform to the standards established in or to the regulations established pursuant to 40 CFR, Part 503. If solids are disposed of in a licensed sanitary landfill, the disposal of solids shall conform to the standards established in Title 132. Publicly owned treatment works shall dispose of sewage sludge in a manner that protects public health and the environment from any adverse effects which may occur from toxic pollutants as defined in Section 307 of the Clean Water Act. This permit may be modified or revoked and reissued to incorporate regulatory limitations established pursuant to 40 CFR, Part 503.

F. Definitions

Administrator: The Administrator of the USEPA.

Aliquot: An individual sample having a minimum volume of 100 milliliters (unless the test method calls for a smaller sized sample) that is collected either manually or in an automatic sampling device.

Biweekly: Once every other week.

Bimonthly: Once every other month.

Bypass: The intentional diversion of wastes from any portion of a treatment facility.

Daily Average: An effluent limitation that cannot be exceeded and is calculated by averaging the monitoring results for any given pollutant parameter obtained during a 24-hour day.

Department: Nebraska Department of Environmental Quality.

Director: The Director of the Nebraska Department of Environmental Quality.

Industrial User: A source of indirect discharge (a pretreatment facility).

Monthly Average: An effluent limitation that cannot be exceeded, calculated by averaging the monitoring results for any given pollutant parameter obtained during a calendar month.

Appendix A (continued)

Publicly Owned Treatment Works (POTW): A treatment works as defined by Section 212 of the Clean Water Act (Public Law 100-4) which is owned by the state or municipality, excluding any sewers or other conveyances not leading to a facility providing treatment.

Sludge: Any solid, semisolid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility or any other such waste having similar characteristics and effect.

30-Day Average: An effluent limitation that cannot be exceeded, calculated by averaging the monitoring results for any given pollutant parameter obtained during a calendar month.

Total Toxic Organics (TTO): The summation of all quantifiable values greater than 0.01 milligrams per liter (mg/l) for toxic organic compounds that may be identified elsewhere in this permit. (If this term has application in this permit, the list of toxic organic compounds will be identified; typically in the Limitations and Monitoring Section(s) or in an additional Appendix to this permit.)

Toxic Pollutant: Those pollutants or combination of pollutants, including disease causing agents, after discharge and upon exposure, ingestion, inhalation or assimilation into an organism, either directly from the environment or indirectly by ingestion through food chains will, on the basis of information available to the administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunction (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring.

Upset: An exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee, excluding such factors as operational error, improperly designed or inadequate treatment facilities or improper operation and maintenance or lack thereof.

Volatile Organic Compounds (VOC): The summation of all quantifiable values greater than 0.01 milligrams per liter (mg/l) for volatile, toxic organic compounds that may be identified elsewhere in this permit. (See the definition for Total Toxic Organics above. In many instances, VOCs are defined as the volatile fraction of the TTO parameter. If the term "VOC" has application in this permit, the list of toxic organic compounds will be identified; typically in the Limitations and Monitoring Section(s) or in an additional Appendix to this permit.)

Weekly Average: An effluent limitation that cannot be exceeded, calculated by averaging the monitoring results for any given pollutant parameter obtained during a fixed calendar week. The permittee may start their week on any weekday but the weekday must remain fixed unless a change is approved by the Department.

"X" Day Average: An effluent limitation defined as the maximum allowable "X" day average of consecutive monitoring results during any monitoring period where "X" is a number in the range of one to seven days.

G. **Abbreviations**

CFR: Code of Federal Regulations

kg/Day: Kilograms per Day

MGD: Million Gallons per Day

Appendix A (continued)

mg/L: Milligrams per Liter

NDEQ: Nebraska Department of Environmental Quality

NDEQ Title 115: Rules of Practice and Procedure

NDEQ Title 117: Nebraska Surface Water Quality Standards

NDEQ Title 118: Ground Water Quality Standards and Use Classification

NDEQ Title 119: Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System

NDEQ Title 121: Effluent Guidelines and Standards

NDEQ Title 126: Rules and Regulations Pertaining to the Management of Wastes

NDEQ Title 127: Rules and Regulations Governing the Nebraska Pretreatment Program

NDEQ Title 132: Rules and Regulations Pertaining to Solid Waste Management

NPDES: National Pollutant Discharge Elimination System

NPP: Nebraska Pretreatment Program

POTW: Publicly Owned Treatment Works

ug/L: Micrograms per Liter

WWTF: Wastewater Treatment Facility

APPENDIX B. Total Toxic Organic (TTO) and Volatile Organic Compounds

If required in Part I of this permit, the permittee shall monitor for the following compounds to demonstrate compliance with the TTO effluent limitations.

1. **Volatile Fraction.** To be analyzed using EPA Method 624 or 1624 as set forth in NDEQ Title 121, Chapter 8.

Acrolein	1,4-Dichlorobenzene
Acrylonitrile	1,2-Dichloropropane
Benzene	1,3-Dichloropropylene
Bromoform	Ethylbenzene
Carbon tetrachloride	Methyl bromide
Chlorobenzene	Methyl chloride
Chlorodibromomethane	Methylene chloride
Chloroethane	1,1,2,2-Tetrachloroethane
2-Chloroethylvinyl ether	Tetrachloroethylene
Chloroform	Toluene
Dichlorobromomethane	1,2-Trans-dichloroethylene
1,1-Dichloroethane	1,1,1-Trichloroethane
1,2-Dichloroethane	1,1,2-Trichloroethane
1,1-Dichloroethylene	Trichloroethylene
1,2-Dichlorobenzene	Vinyl chloride
1,3-Dichlorobenzene	

2. **Acid Fraction.** To be analyzed using EPA Method 625 or 1625 as set forth in NDEQ Title 121, Chapter 8.

2-Chlorophenol	N-nitrosodimethylamine
2,4-Dichlorophenol	N-nitrosodi-n-propylamine
2,4-Dimethylphenol	N-nitrosodiphenylamine
4,6-Dinitro-o-cresol	Parachlorometa cresol
2,4-Dinitrophenol	Pentachlorophenol
2-Nitrophenol	Phenol
4-Nitrophenol	2,4,6-Trichlorophenol

3. **Base/Neutral Fraction.** To be analyzed using EPA Method 625 or 1625 as set forth in NDEQ Title 121, Chapter 8.

Acenaphthene	Diethyl phthalate
Acenaphthylene	Dimethyl phthalate
Anthracene	Di-N-Butyl phthalate
Benzidine	2,4-Dinitrotoluene
Benzo(a)anthracene	2,6-Dinitrotoluene
Benzo(a)pyrene	Di-n-octyl phthalate
3,4-Benzofluoranthene	1,2-Diphenylhydrazine (as Azobenzene)
Benzo(ghi)perylene	Fluoranthene
Benzo(k)fluoranthene	Fluorene
Bis(2-chloroethoxy)methane	Hexachlorobenzene
Bis(2-chloroethyl)ether	Hexachlorobutadiene
Bis(2-chloroisopropyl)ether	Hexachloroethane

Appendix B - (Continued)

3. **Base/Neutral Fraction.** To be analyzed using EPA Method 625 or 1625 as set forth in NDEQ Title 121, Chapter 8 (Continued).

Bis(2-ethylhexyl)phthalate	Hexachlorocyclopentadiene
4-Bromophenyl phenyl ether	Indeno(1,2,3-cd) pyrene
Butylbenzyl phthalate	Isophorone
2-Chloronaphthalene	Naphthalene
4-Chlorophenyl phenyl ether	Nitrobenzene
Chrysene	Phenanthrene
Dibenzo(a,h)anthracene	Pyrene
3,3-Dichlorobenzidine	1,2,4-Trichlorobenzene

4. **Pesticide Fraction.** To be analyzed using EPA Method 608 as set forth in NDEQ Title 121, Chapter 8.

Aldrin	Endrin
Alpha-BHC	Endrin aldehyde
Beta-BHC	Heptachlor
Gamma-BHC	Heptachlor epoxide
Delta-BHC	PCB-1242
Chlordane	PCB-1254
4,4'-DDT	PCB-1221
4,4'-DDE	PCB-1232
4,4'-DDD	PCB-1248
Dieldrin	PCB-1260
Alpha-endosulfan	PCB-1016
Beta-endosulfan	Toxaphene
Endosulfan sulfate	

5. **Dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin).** To be analyzed for using Environmental Protection Agency (EPA) Method 613 as set forth in NDEQ Title 121, Chapter 8.

Nebraska Department of Environmental Quality

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT
for OMAHA PUBLIC POWER DISTRICT FORT CALHOUN NUCLEAR STATION
26 August 2000 Draft

Fact Sheet Contents Summary

A. Applicant Information
B. Facility Description
C. Receiving Waters
D. Description of Existing Discharge Limitations and Requirements
E. Proposed Permit Changes
F. Supporting Documentation
G. Rational for Effluent Limitations and Requirements
H. Submission of Written Comments
I. Attachments

A. **Applicant Information**

Permittee Name: **Omaha Public Power District - Fort Calhoun Station**
U.S. Highway 75
Fort Calhoun, Nebraska 68023

B. **Facility Description**

Omaha Public Power District Fort Calhoun Station is a nuclear powered steam electric generating plant (SIC Number 4911). The effluents from the OPPD Fort Calhoun Station are discharged into the Missouri River.

C. **Receiving Waters**

1. The general and numerical criteria that make up the water quality standards are provided in NDEQ Title 117 - Nebraska Surface Water Quality Standards.

2. The various wastewaters are discharged into the Missouri River. This segment is designated as MT1-10000 of the Missouri Tributaries River Basin. The following beneficial uses of this surface water are as follows:

Recreation: Full Body Contact
Aquatic Life: Warm Water Class A
Industrial Water Supply
Public Drinking Water Supply
Aesthetics
Endangered Species: Pallid Sturgeon.
Threatened Species: Lake Sturgeon.
Key Species: Blue Catfish, Channel Catfish and Flathead Catfish, Paddlefish

D. **Description of Discharges**

The process water from OPPD Fort Calhoun Nuclear Station is discharged from eight different outfalls. The primary process water discharged from Outfall 001 is noncontact cooling water. The primary process water discharged from Outfalls 002 is the water treatment plant discharge. The primary process water discharged from Outfall 003 is recirculated back wash water to the cooling water traveling inlet screen. The primary process water discharged from Outfall 004 is recirculated water to reduce the foam by surface spray at the cooling water inlet. The primary process water discharged from Outfall 005 is recirculated water to de-ice the cooling water inlet during the freezing weather. The primary process water discharged from Outfall 006 is water from the condensation tank. The primary process water discharged from Outfall 007 is treated sanitary wastewater from a lagoon system. The treated sanitary wastewater the lagoon system discharged from Outfall 008 is land applied to agricultural cropland.

The primary pollutants of concern are ammonia as nitrogen, carbonaceous biochemical oxygen demand, conductivity, oil and grease, pH, total suspended solids, and water temperature.

E. **Proposed Permit Changes**

1. All the seasonal hydrazine parameters and limitations have been deleted from Outfall 001 in the draft permit.

2 The existing permit footnotes page has been deleted from the permit.

3. A storm water parameters and monitoring requirements have been added to the permit

F. **Supporting Documentation**

The following is a brief explanation of the regulatory provisions on which permit requirements are based. Including appropriate supporting references in accordance with NDEQ Titles 119 and 121. The following items were used to develop the basis of the draft permit:

1. The NPDES permit application for reissuance was received 4 April 1999.

2. A letter dated 11 September 2000, Hutchens (OPPD) to Asch (NDEQ) stating that no modifications had been made and current application were correct.

3. Letter dated 22 September 1999, Rice (NDEQ) to Fielding (OPPD) administratively extending the existing NPDES permit beyond its normal expiration date.

4. Letter dated 17 July 1999, Kovar (NDEQ) to Neal (OPPD) containing a copy of a consent order addressing the temperature limitations in the NPDES permit NE0000418.

5. Memorandum dated 20 May 1999 with attached OPPD letter, Walker (NDEQ.) to Rice (NDEQ) requesting a variance from hydrazine during period of high sediment loading causing inference in the analysis process.

6. Letter dated February 16, 1994, (NDEQ) to Ambrose (Lindsay Mfg Co.) responding to comments concerning the draft permit placed on public notice May 10, 1993. The letter was.

7. NDEQ Title 117 - Nebraska Surface Water Quality Standards, February 7, 2000.

8. NDEQ Title 119 - Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System, January 5, 1992.

9. NDEQ Title 121 - Effluent Guidelines and Standards, January 5, 1992, Chapters 2 - Steam Electric Power Generating Point Source Category.

10. 40 CFR (Code of Federal Regulations), Part 122.44 - Establishing limitations standards, and other permit conditions (applicable to State NPDES programs), (d) Water quality standards and State requirements (1) (v).

11. 40 CFR Part 125, Criteria and Standards for National Pollutant Discharge Elimination System, Subpart H.

12. 40 CFR Part 423, Steam Electric Power Generating Point Source Category.

13. NDEQ "NPDES Permitting Procedure" document, August, 1996.

14. Federal Clean Water Act (33 U.S.C. §§ 1251 et seq.);

15. Nebraska Nongame and Endangered Species Conservation Act (Neb. Rev. Stat. §§ 37-430 through 37-438).

16. Technical Support Document for Water Quality-based Toxic Control (EPA 505/2-90-001 PB91-127415, March, 1991

G. Rational for Effluent Limitations and Requirements

1. **Permit Term**

This permit is being issued for a five-year term. This term is in accordance with NDEQ Title 119, Chapter 30 and the "Basin Management Approach to the NPDES Permitting Reissuance Schedule".

2. **Wasteload Allocations**

No Wasteload allocations (WLA) were calculated for the discharge from Outfall 001. The reasonable potentials for ammonia as nitrogen, hydrazine, and nitrite/nitrate as nitrogen were calculated. No water quality impacts were indicated for ammonia as nitrogen, hydrazine, or nitrite/nitrate as nitrogen.

3. **Outfall 001 - Effluent Parameters, Limitations, and Requirements**

a. Sampling Requirements

Sampling point for Outfalls 001 was established prior to the effluent being discharged back into the Missouri River. The sampling frequency was established in accordance with NDEQ Title 119, Chapter 41. The compliance samples shall be collected using grab sampling techniques, except the permitttee chooses to continuously monitor the flow and water temperature using recording devices.

b. pH Range

The draft permit establishes a pH range effluent limitation of 6.5 to 9.0. This provision is based on regulations promulgated in NDEQ Title 117, Chapter 4. The sampling frequency is monthly.

c. Flow

The draft permit establishes a flow monitoring requirement. The permittee choose to monitor the flow requirement by continuous monitoring by either calculation or metering.

d. Oil and Grease

The draft permit establishes 30-day average monitoring requirement and a daily maximum limitation of 10 mg/L for oil and grease. This categorical parameter was added because low volume waste is discharge into this outfall. The limitation is based on the water quality criteria for oil and grease established in accordance with NDEQ Title 117, Chapter 4. The sampling frequency is monthly.

e. Temperature

The draft permit establishes 30-day average monitoring requirement and a daily maximum limitation of 110 °F for temperature. This daily maximum limitation was established according to Section 316a of the Federal Clean Water Act (33 U.S.C. §§ 1251 et seq.). The sampling frequency is continuous by recorder. Consent Order No. 2206 allows a daily maximum temperature limitation of 112°F from this point of discharge until NDEQ makes a final determination to issue or deny the permit modification of the existing system that may increase the pollutant loadings or significantly increase flows.

f. Total Residual Chlorine

The draft permit establishes 30-day average monitoring requirement and a daily maximum limitation of 0.20 mg/L for total residual chlorine. This categorical parameter was added because total residual chlorine may be used to control macro-invertebrates in this outfall. The categorical limitation is based on the total residual chlorine limitation established in accordance with NDEQ Title 121, Chapter 2 and 40 CFR Part 423. If the permittee chooses not to use chlorine for macro-invertebrate control, this parameter and limitation shall not apply. The sampling frequency is monthly.

g. Total Suspended Solids

The draft permit establishes 30-day average limitation of 30 mg/L and a daily maximum limitation of 100 mg/L for total suspended solids. This categorical parameter and limitations were added because low volume waste is discharge into this outfall. The sampling frequency is monthly.

4. **Outfall 002 - Effluent Parameters, Limitations, and Requirements**

a. Sampling Requirements

This is the water treatment plant discharge. The sampling point for effluent Outfall 002 has been established prior to discharge to the Missouri River. The monitoring frequency shall be monthly. Compliance samples shall be collected using grab sampling techniques.

b. pH Range

The draft permit establishes a pH range effluent limitation of 6.5 to 9.0. This provision is based on regulations promulgated in NDEQ Title 117, Chapter 4. The sampling frequency is monthly.

c. Flow

The draft permit establishes a daily flow monitoring requirement. The permittee shall monitor the flow by either calculation or metering.

d. Conductivity

The draft permit established conductivity monitoring requirements. This provision is based on regulations promulgated in NDEQ Title 117, Chapter 4. The sampling frequency is monthly.

e. Oil and Grease

The draft permit establishes 30-day average monitoring requirement and a daily maximum limitation of 10 mg/L for oil and grease. This categorical parameter was added because low volume waste is discharge into this outfall. The limitation is based on the water quality criteria for oil and grease established in accordance with NDEQ Title 117, Chapter 4. The sampling frequency is monthly.

f. Total Suspended Solids

The draft permit establishes a 30-day average limitation of 30 mg/L and a daily maximum limitation of 100 mg/L for total suspended solids. These categorical limitations are based on the total suspended solids limitations established in accordance with NDEQ Title 121, Chapter 2 and 40 CFR Part 423. The sampling frequency is monthly.

5. **Outfalls 003 and 004 - Effluent Parameters, Limitations, and Requirements**

Outfall 003 is the discharge used to backwash the intake screens for outfall 001. The draft permit establishes no monitoring parameters or requirement for this outfall. The discharge from this outfall is recirculated intake water from once through noncontact cooling water through Outfall 001

Outfall 004 is the discharge used to reduce the foam build-up upstream of the intake screen for outfall 001. The draft permit establishes no monitoring parameters or requirement for this outfall. The discharge from this outfall is recirculated intake water from once through noncontact cooling water through Outfall 001.

6. **Outfall 005 - Effluent Parameters, Limitations, and Requirements**

a. Sampling Requirements

Outfall 005 is the discharge used to de-ice the intake screen for outfall 001. The sampling point for effluent Outfall 005 has been established prior to discharge into the Missouri River. The monitoring frequency shall be quarterly. The permittee shall monitor the flow during each discharge event by either calculation or metering.

b. Flow

The draft permit establishes a flow monitoring requirement. The permittee shall monitor the flow during each discharge event by either calculation or metering.

c. Temperature

The draft permit establishes 30-day average monitoring requirement and a daily maximum limitation of 110 °F for temperature. This daily maximum limitation was established according to Section 316a of the Federal Clean Water Act (33 U.S.C. §§ 1251 et seq.). The sampling frequency is continuous by recorder. Consent Order No. 2206 allows a daily maximum temperature limitation of 112°F from this point of discharge until NDEQ makes a final determination to issue or deny the permit modification of the existing system that may increase the pollutant loadings or significantly increase flows.

7. **Outfall 006 - Effluent Parameters, Limitations, and Requirements**

Outfall 006 is the discharge condensation water. The draft permit establishes no monitoring parameters or requirement for this outfall. The discharge from this outfall is condensation water accumulated in a storage tank.

8. **Outfall 007 - Effluent Parameters, Limitations, and Requirements**

a. Sampling Requirements

This is a discharge from the sanitary lagoon system. The sampling point for effluent Outfall 007 has been established at the sanitary lagoon and prior to discharge to the Missouri River. The monitoring frequency shall be in accordance with the controlled lagoon discharge requirements. Compliance samples shall be collected using grab sampling techniques.

b. pH Range

The draft permit establishes a pH range effluent limitation of 6.5 to 9.0. This provision is based on regulations promulgated in NDEQ Title 117, Chapter 4.

c. Flow

The draft permit establishes a flow monitoring requirement. The permittee shall monitor the flow during each discharge event by either calculation or metering.

d. Duration of Each Flow Event

The draft permit requires measurement of the duration of each flow event. The length of each discharge event in days shall be reported. This requirement may be met by calculation in accordance with NDEQ Title 119, Chapter 41.

e. Carbonaceous Biochemical Oxygen Demand

The draft permit establishes 30 day average limitation of 25 mg/L and a daily maximum limitation of 40 mg /L for carbonaceous biochemical oxygen demand. This parameter and limitations are based on regulations promulgated in NDEQ Title 121, Chapter 3.

f. Total Suspended Solids

The draft permit establishes a 30-day average limitation of 80 mg/L and a daily maximum limitation of 120 mg/L for total suspended solids. This parameter and limitations are based on regulations promulgated in NDEQ Title 121, Chapter 3.

g. Ammonia as Nitrogen

The draft permit establishes 30-day average and daily maximum monitoring requirements for ammonia as nitrogen. This parameter and monitoring requirements were established according to regulations promulgated in NDEQ Title 119, Chapter 19.

h. Fecal Coliforms

The draft permit establishes 30-day average of 200 colonies per 100 ml of effluent and daily maximum of 400 colonies per 100 ml of effluent for fecal coliform bacteria. These limitations apply during May 1 though September 30 each year. These limitations are established according to NDEQ Title 117, Chapter 4.

9. **Outfall 008 - Effluent Parameters, Limitations, and Requirements**

a. Sampling Requirements

Sampling point for Outfall 008 was established prior to the effluent being discharged to the irrigation system. The sampling frequency was established in accordance with NDEQ Title 119, Chapter 41. The compliance samples shall be collected using grab sampling techniques. Irrigation compliance samples shall be collected two times during the irrigation season. One sample shall be collected at the beginning of the irrigation season. The second sample shall be collected prior to the end of the irrigation season.

b. pH Range

The draft permit establishes a pH effluent limitation range of 6.0 to 9.0 standard units. This pH effluent range limitations has been place in other similar land application permits.

c. Flow

The draft permit established monthly flow monitoring. The flow monitoring requirement may be met by calculation or metering.

d. Ammonia as Nitrogen

The draft permit established 30-day average concentration and daily maximum concentration reporting requirements for ammonia as nitrogen. This ammonia as nitrogen monitoring requirements has been place in other similar land application permits.

e. Chloride

The draft permit established 30-day average concentration and daily maximum concentration reporting requirements for chloride. The chloride monitoring requirement has been place in other similar land application permits.

f. Conductivity

The draft permit established 30-day average concentration and daily maximum concentration reporting requirements for conductivity. These conductivity monitoring requirements have been place in other similar land application permits.

g. Nitrate as Nitrogen

The draft permit established 30 day average concentration monitoring and daily maximum concentration requirements for nitrate as nitrogen. These nitrate as nitrogen monitoring requirements have been place in other similar land application permits. The monitoring frequency shall be monthly by grab sample in accordance with regulations promulgated in NDEQ Title 119, Chapter 41.

h. Total Kjeldahl Nitrogen

The draft permit established 30 day average concentration monitoring and daily maximum concentration requirements for total Kjeldahl nitrogen. These total Kjeldahl nitrogen monitoring requirements have been place in other similar land application permits. The monitoring frequency shall be monthly by grab sample in accordance with regulations promulgated in NDEQ Title 119, Chapter 41.

10. **Storm Water Outfalls - Effluent Parameters and Monitoring Requirements**

a. Sampling Requirements

Sampling points for these Outfalls were established and identified in the Pollution Prevention Plan (Fort Calhoun Station Unit No. 1, Standing Order: **SO-G-108**. The storm water discharge from the switching yard shall be sample once during the first year and during the fifth year of this permit term. The sampling frequency for the other two outfalls will at the request of the NDEQ as needed. These sampling frequencies were established according to NDEQ Title 119, Chapter 41. The compliance samples shall be collected using sampling techniques and sampling points identified in Standing Order: **SO-G-108**.

b. Flow

The draft permit established flow requirement that may be met by calculation or metering.

c. Ammonia as Nitrogen

The draft permit established a reporting requirement for ammonia as nitrogen according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

d. Biochemical Oxygen Demand

The draft permit established a reporting requirement for biochemical oxygen demand according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

e. Chemical Oxygen Demand

The draft permit established a reporting requirement for chemical oxygen demand according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

f. Fecal Coliform

The draft permit established a reporting requirement for fecal coliform according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119

g. Fecal Streptococcus

The draft permit established a reporting requirement for fecal streptococcus according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

h. Nitrate as Nitrogen

The draft permit established a reporting requirement for nitrate as nitrogen according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

i. Total Kjeldahl Nitrogen

The draft permit established a reporting requirement for total Kjeldahl nitrogen according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

j. Oil and Grease

The draft permit establishes a reporting requirement for oil and grease according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

k. pH Range

The draft permit establishes a pH effluent reporting requirement according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

l. Dissolved Phosphorus

The draft permit establishes a reporting requirement for dissolved phosphorus according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

m. Total Phosphorus

The draft permit establishes a reporting requirement for total phosphorus according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

n. Total Dissolved Solids

The draft permit establishes a reporting requirement for total dissolved solids according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119.

o. Total Suspended Solids

The draft permit establishes a reporting requirement for total suspended solids according to 40 CFR, Part 122.26 as adopted in NDEQ Title 119

11. **Other Requirements**

a. Chemical Analyses Methods

Analyses of the proposed technology-based and water quality-based NPDES permit parameters shall be in accordance with the methods set forth in 40 CFR Part 136 as adopted in NDEQ Title 121.

b. Prohibited Pollutant Discharges

There shall be no discharge of polychlorinated biphenyl compounds (PCBs) or 126 toxic pollutants in detectable amounts from any outfall at any time.

c. The Minimum Detection Level

For the purpose of this permit, the Minimum Limit (ML) shall be the permit limit found in Part I. of this permit. Compliance with these limits will be based upon applicable and appropriate detection limits. If the result of analysis is above a detection limit, it shall be reported. If an analysis result is stated as "not detectable", the results shall be reported as "less than the detection limit".

d. Discharge Monitoring Reports

According to Appendix A. D. 4 the permit requires that monitoring results gathered during the previous 3 months be summarized for each month and reported on the Discharge Monitoring Report Form on a quarterly basis.

H. Submission of Written Comments

A copy of the fact sheet, draft permit, attachments, comments and other public information are available for review and copying at the Department's office between 8:00 a.m. and 5:00 p.m., weekdays.

Nebraska Department of Environmental Quality
Suite 400, The Atrium, 1200 N Street
Lincoln, Nebraska
Telephone (402) 471-4220
FAX (402) 471-2909

The public may make written comment upon or object to the draft permit or may make a written request for a public hearing during the public comment period specified in the attached public notice. All comments, objections and/or petitions for a hearing shall be considered prior to making a final decision regarding this application. These comments, objections and/or petitions for a hearing must state the nature of the issues to be raised, and all arguments and factual grounds supporting such positions. All comments, objections and/or petitions for a hearing should be sent to:

Rudy Fiedler, Acting Unit Supervisor
NPDES Permits Unit
Municipal and Industrial Section
Nebraska Department of Environmental Quality
P.O. Box 98922
Lincoln, Nebraska 68509-8922

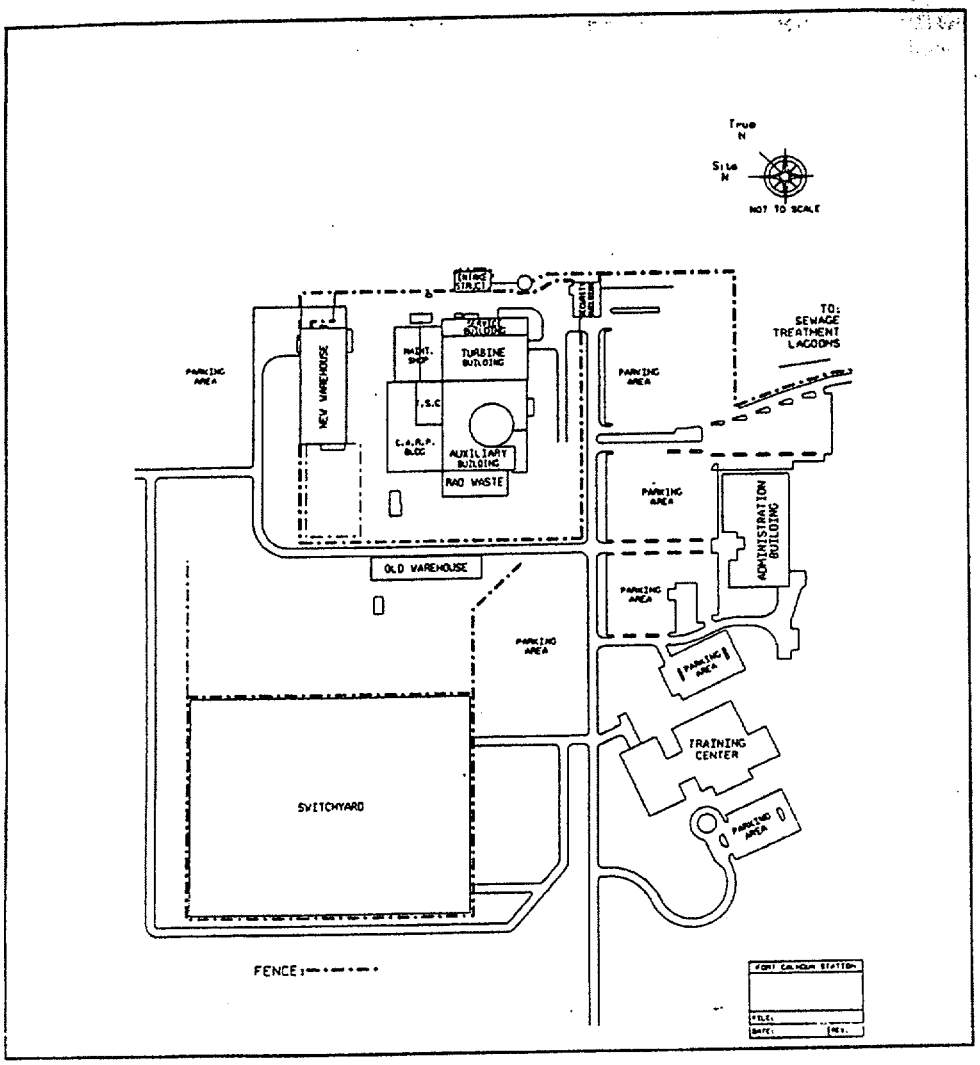
J. Fact Sheet Attachments

1. Maps of the site.
2. NPDES permit NE0000418

FORT CALHOUN STATION
STANDING ORDER

SO-G-108
PAGE 21 OF 32

Attachment 10.1

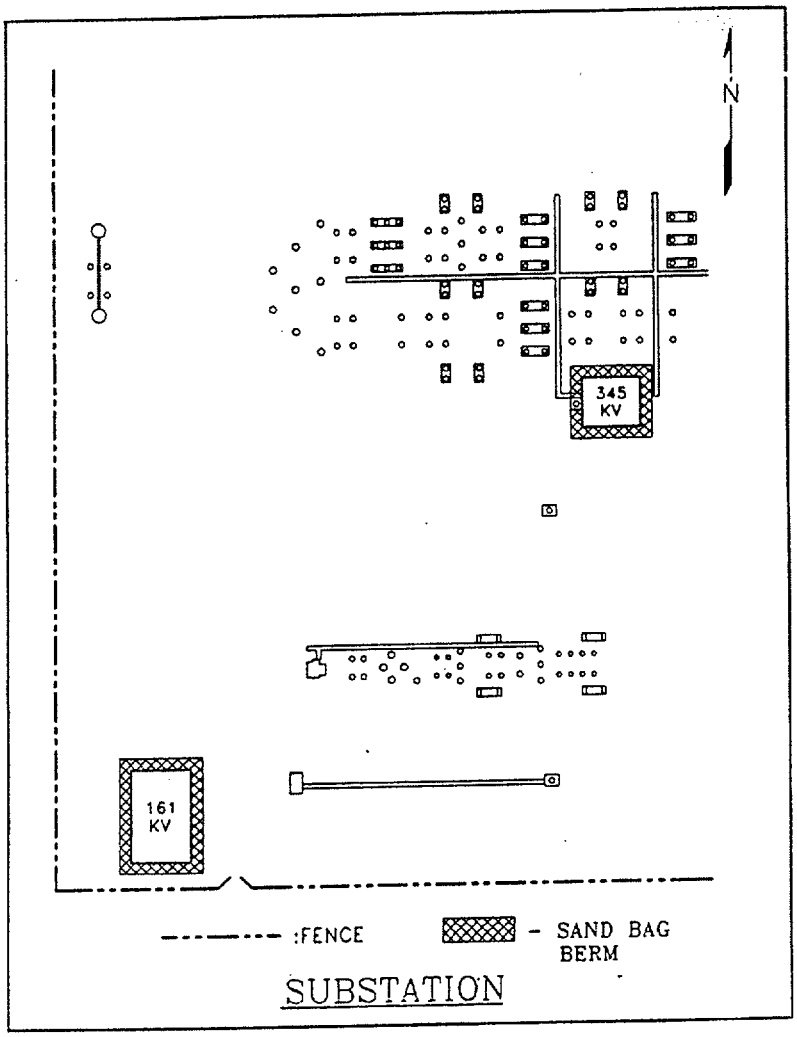


R3

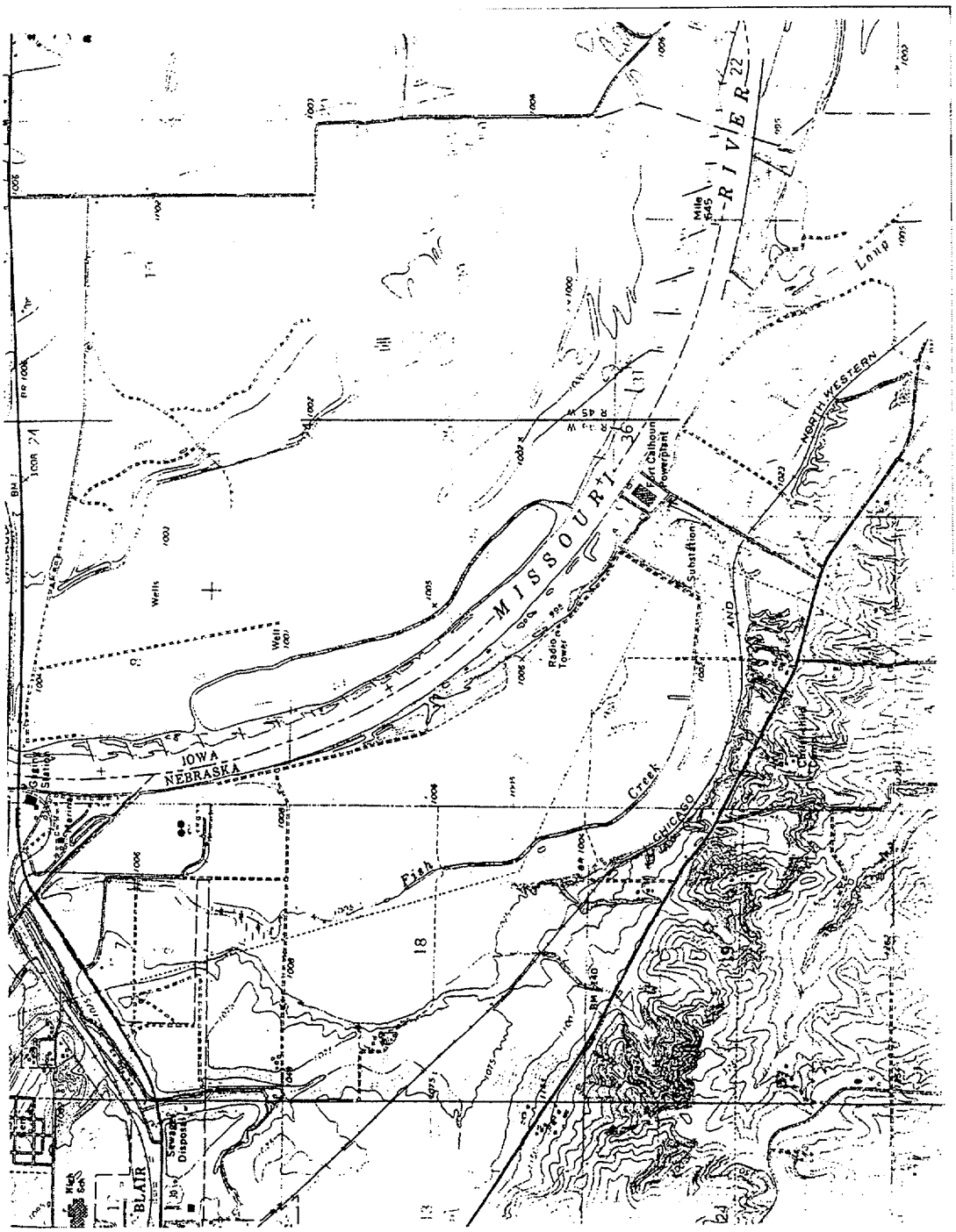
FORT CALHOUN STATION
STANDING ORDER

SO-G-108
PAGE 22 OF 32

Attachment 10.1



R3


MISSOURI RIVER
IOWA
NEBRASKA
BLAIR
Fish Creek
Loop
NORTHWESTERN
CHICAGO
Wells
Radio Tower
Substation
Mile 645
18
22
36

BEFORE THE NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

IN THE MATTER OF	)	
OMAHA PUBLIC POWER	)	CASE NO. 2206
DISTRICT - FORT CALHOUN	)	
NUCLEAR STATION,	)	CONSENT ORDER
Respondent.	)	

The Omaha Public Power District (OPPD), Respondent, and the Nebraska Department of Environmental Quality (NDEQ) stipulate and agree as follows:

1. The Respondent's Fort Calhoun Nuclear Station is a nuclear-fired steam electric generating station and the permittee under a National Pollutant Discharge Elimination System (NPDES) Permit #NE0000418 issued pursuant to the Nebraska Environmental Protection Act (Act) and Title 119 - Rules and Regulations Governing the Issuance of Permits under the National Pollutant Discharge Elimination System on November 20, 1997.

2. Respondent's NPDES permit authorizes the discharge of identified pollutants from designated outfalls in accordance with specific permit conditions. The permit contains effluent limitations and monitoring requirements for temperature applicable to outfalls 001 and 005. Outfall 001 discharges once through condenser cooling water during normal operation and outfall 005 discharges warmwater recirculation for deicing.

3. The effluent limitation for temperature for both these outfalls is 110 degrees Fahrenheit (°F) as a daily maximum, measured continuously and reported quarterly. This

effluent limitation is based on protecting the water quality of the receiving stream, the Missouri River.

4. On or about May 10, 1999, the Respondent requested a variance from the permit effluent limitation for temperature to allow a 2°F increase in the temperature discharge from outfalls 001 and 005 in anticipation of potential low stream flows in the Missouri river and high ambient water temperatures. As justification for the increase in temperature, the Respondent presented discharge temperature modeling data to the NDEQ on June 21, 1999. In further support of the request, the Respondent stated that significant social and economic hardship could result if power output would have to be curtailed in order to comply with the temperature limit.

5. Neb. Rev. Stat. §81-1513 authorizes the Director of the NDEQ to grant a variance from rules and regulations. The parties have agreed that the Respondent's request may be pursued as an application for a permit modification.

6. In order to completely evaluate the effect of a 2°F increase in the temperature discharge from outfalls 001 and 005, the NDEQ requires additional information to verify that the instream water quality criteria for temperature of 90°F as a maximum with a maximum temperature change of 5°F from natural conditions are not and will not be exceeded outside the applicable mixing zone identified for these discharges to the Missouri River.

7. Pending NDEQ consideration of the Respondent's application for a permit modification to increase the temperature of its discharges from outfalls 001 and 005 from a maximum of 110°F to a maximum of 112°F, the parties agree as follows:

A. The following effluent limitation shall be met at the point of discharge from outfalls 001 and 005:

Parameter	Monthly Average	Daily Maximum	Measurement Frequency
Temperature	**Report**	**112°F**	**Continuous**

B. The Respondent shall not be required to submit non-compliance reports for exceedances of the temperature effluent limitation for outfalls 001 and 005 during the term of this Consent Order provided that the Respondent complies with the limitation set forth in paragraph A.

C. The Respondent shall submit water quality information to evaluate the impact of a 2°F increase in the temperature discharge from outfalls 001 and 005 to verify that the instream water quality criteria for temperature of 90°F as a maximum with a maximum temperature change of 5°F from natural conditions are not, and will not, be exceeded outside the mixing zone identified for these discharges to the Missouri River. The Respondent shall submit any additional information required by the NDEQ to evaluate the application for a permit modification in accordance with any schedule established by the NDEQ.

8. This Consent Order shall remain in effect until the NDEQ makes a final determination to issue or deny the permit modification to allow a temperature increase in the discharges from outfalls 001 and 005 or the NDEQ determines that the Respondent has not complied satisfactorily with the terms of this Consent Order. Failure to submit any information deemed necessary by the NDEQ to evaluate the application for a permit modification may result in denial of the application.

3

9. Nothing in this Consent Order shall be deemed to modify or suspend or relieve the Respondent of the obligation to comply with any of the conditions of the Respondent's NPDES permit except as modified by this Consent Order. Nothing in this Consent Order precludes the Respondent from requesting any other permit modification of its NPDES permit.

10. This Consent Order may be modified by a specific written amendment agreed to and signed by the parties as identified below. The NDEQ reserves the right to revoke or modify the conditions of this Consent Order and seek enforcement for any violation of the Act or this Consent Order.

11. Signatures:

A. For the Respondent: The undersigned representative of the Respondent certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Order and to bind the Respondent.

Agreed this 27th day of July, 1999.

By: W. L. Mead
Division Manager -
Title: Environmental and Governmental Affairs

B. For the NDEQ:

IT IS SO ORDERED and agreed this 27th day of July, 1999.

By:
Michael J. Linder
Director

Omaha Public Power District

1623 HARNEY ▪ OMAHA, NEBRASKA 68102 ▪ TELEPHONE 536-4000 AREA CODE 402

July 1, 1976

Department of Environmental Control
Mailbox 94653, State House Station
1424 "P" Street
Lincoln, Nebraska 68509

Attn: Mr. D. T. Drain

Gentlemen:

Fort Calhoun Station
Intake Monitoring Report

In compliance with NPDES Permit No. 0000418 for [redacted] four (attached) copies of "Intake Monitoring Report Fort Calhoun Station Unit No. 1 NPDES Permit No. 0000418" are submitted. This report discusses the findings of Omaha Public Power District's intake monitoring program at Fort Calhoun Station Unit No. 1. Additional copies are available at your request.

Sincerely,

W. C. Jones
Section Manager - Operations

WCJ/LGH:jmm

Attach.

cc: Mr. T. E. Short
Mr. G. G. Bachman
Mr. T. P. Harding
Mr. W. D. Dermyer
Mr. B. E. Dose, Jr.
Mr. L. G. Harrow
Mr. Chester Culley
F. C. File

State of Nebraska
Department of
Environmental Control

J. James Exon
Governor
Dan T. Drain
Director

Mail, Box 94653 State House Station Office, 1424 'P' Street Lincoln, Nebraska 68509 (402) 471-2186

January 19, 1977

WPC-SS

Mr. Gerald Bachman
Assistant to the General Manager
Omaha Public Power District
1623 Harney Street
Omaha, Nebraska 68102

RE: Intake Monitoring Report Fort Calhoun Station
Unit II, No. 1 NPDES No. NE 0000418

Dear Mr. Bachman:

The review of the above-referenced document has been completed. Our staff agrees with the general discussion and data presentations in this report, however, we would offer the following comments.

The staff feels that although it is true that the majority of fish impinged at this power station are young-of-the year fish which under normal conditions do have high mortality rates, they do not generally agree that the loss would result in a minimal effect on fish populations in the vicinity of the power station or the river as a whole. We feel that fish which have reached the size of those impinged have a much better chance for survival than do smaller larval fish and therefore may be of more importance to the fisheries as a whole.

Entrainment losses at this facility were evaluated using the conservative approach by assuming 100% mortality of entrained organisms. We have used this approach based on the lack of adequate information to support a lesser percentage of mortality. However, we do agree that there is a potential for organisms to pass through the cooling system unharmed and we have tempered our final conclusions based on this assumption.

Based on the information available at this time, we have concluded that the losses due to entrainment and impingement at the facility are within the acceptable range. However, should future information refute this conclusion it may be necessary to consider additional fish protective devices should an economically and biologically acceptable method be developed.

In an effort to reduce the monitoring burden and to confine submittal of information to that which would best define the environmental losses due to operation of the intake structure, we will no longer require information on zooplankton, phytoplankton and macroinvertebrates. We feel due to the regeneration capacity of these populations the effort necessary to define the effects of this facility is unwarranted at this time.

We would be very interested in seeing any information that OPPD may develop concerning condenser passage of larval fish, compensatory mechanisms and fishes recruitment potentials in the Missouri River whereever such information is available.

If you have any questions or comments, please contact Mr. Robert Todd of this office.

Very truly yours,

Robert B. Wall, Chief
Water Pollution Control Division

RDT/th

cc: Ralph Langemeier, EPA

State of Nebraska
Department of
Environmental Control

J. James Exon
Governor
Dan T. Drain
Director

Mail, Box 94653 State House Station Office, 1424 'P' Street Lincoln, Nebraska 68509 (402) 471-2186

February 2, 1977

WPC-SS

Mr. Gerald Bachman
Assistant to the General Manager
Omaha Public Power District
1623 Harney
Omaha, Nebraska 68102

Dear Mr. Bachman:

This is to correct a typographical error in our letter dated January 19, 1977 which discussed the intake monitoring report for the Fort Calhoun Unit II. This should be changed as the review was conducted on the Fort Calhoun Unit I intake monitoring report.

This letter serves to verify that all comments and approvals stated in the above-referenced letter were addressed to Fort Calhoun Unit I only and should in no way be interpreted as approval of the proposed intake system for Fort Calhoun Unit II.

If you have any questions, please contact our office.

Very truly yours,

Robert B. Wall, Chief
Water Pollution Control Division

RDT/th

cc: Ralph Langemeier, EPA

APPENDIX 3.0 THREATENED AND ENDANGERED SPECIES CORRESPONDENCE

DNR = Department of Natural Resources
FWS = U.S. Fish and Wildlife Service
NGPC = Nebraska Game and Parks Commission
OPPD = Omaha Public Power District

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

August 7, 2001
01-EA-239

Mr. John Cochnar
Regional Coordinator, Endangered Species Program
U.S. Fish and Wildlife Service
Lakewood, Colorado 80225

Subject: Fort Calhoun Station Unit 1
License Renewal Project
NRC Informal Consultation Preparation

Dear Mr. Cochnar:

Omaha Public Power District (OPPD) is preparing an application to renew the operating licenses for Fort Calhoun Station Unit 1, and we intend the application be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts to threatened and endangered species resulting from continued operation of the facility or refurbishment activities associated with the license renewal. OPPD believes that operation of the plant has no adverse impact on any protected species. In addition, there are no planned operational or refurbishment activities for the period of extended operations that would invalidate this conclusion. The NRC may request an informal consultation from your agency on this matter.

To assist you in making your determination, a figure is enclosed which depicts the Fort Calhoun site and the associated transmission line corridors.

It is our intent that, by contacting you at this point in the process, we can identify any deficiencies, concerns, or data needed so that those areas identified can be addressed to ensure that the consultation process proceeds smoothly and efficiently.

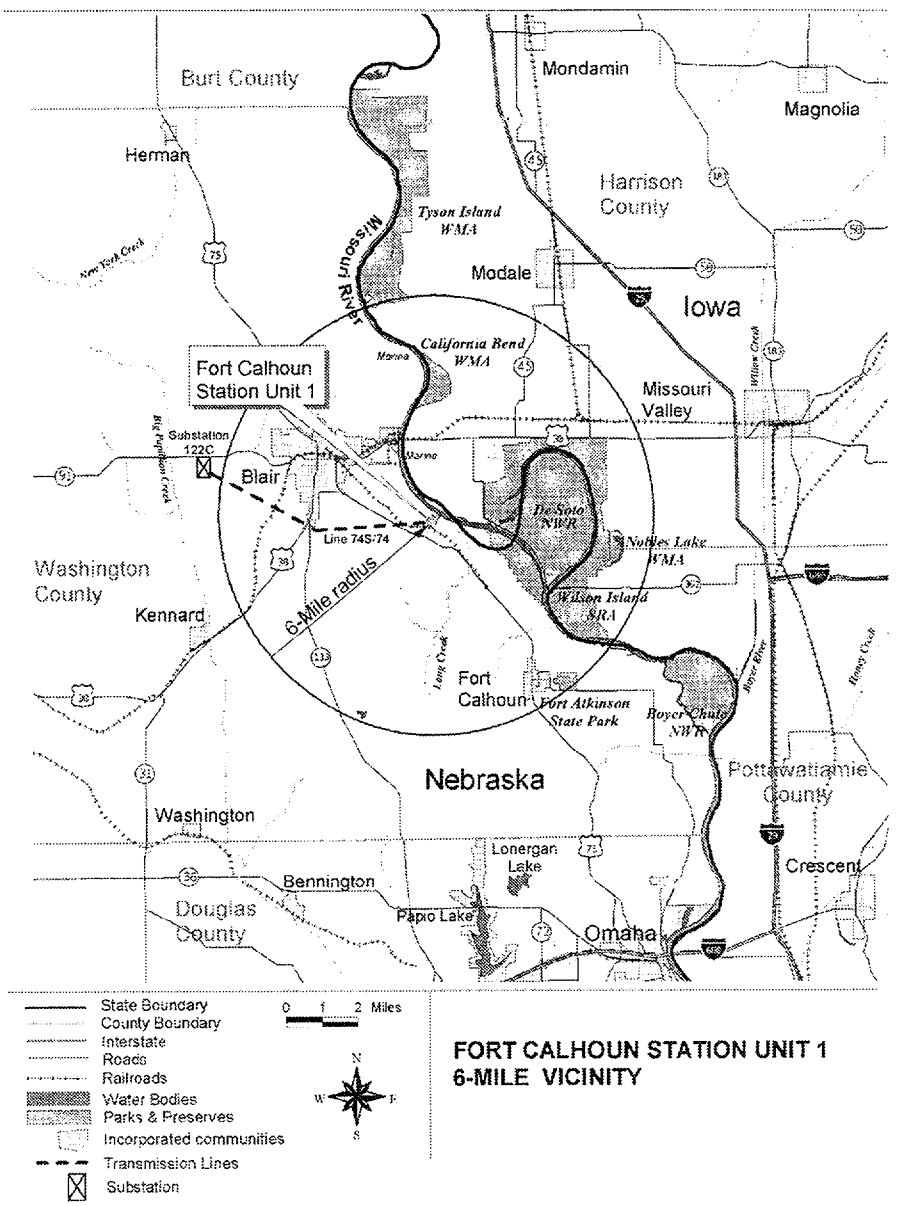
We would appreciate it if you would provide your comments and any additional information or actions that might be required from OPPD to expedite the upcoming consultation process.

If you have any comments or questions, please contact me at (402) 636-2313.

Sincerely yours,

Donovan C. Hutchens
Manager – Environmental and Regulatory Affairs

Attachment



FORT CALHOUN STATION UNIT 1
6-MILE VICINITY

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

August 7, 2001
01-EA-242

Mr. Rex Amack
Director
Nebraska Game and Parks Commission
2200 North 33rd Street
P. O. Box 30370
Lincoln, Nebraska 68503-0370

Subject: Fort Calhoun Station Unit 1
License Renewal Project
NRC Informal Consultation Preparation

Dear Mr. Amack:

Omaha Public Power District (OPPD) is preparing an application to renew the operating licenses for Fort Calhoun Station Unit 1, and we intend the application be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts to threatened and endangered species resulting from continued operation of the facility or refurbishment activities associated with the license renewal. OPPD believes that operation of the plant has no adverse impact on any protected species. In addition, there are no planned operational or refurbishment activities for the period of extended operations that would invalidate this conclusion. The NRC may request an informal consultation from your agency on this matter.

To assist you in making your determination, a figure is enclosed which depicts the Fort Calhoun site and the associated transmission line corridors.

It is our intent that, by contacting you at this point in the process, we can identify any deficiencies, concerns, or data needed so that those areas identified can be addressed to ensure that the consultation process proceeds smoothly and efficiently.

We would appreciate it if you would provide your comments and any additional information or actions that might be required from OPPD to expedite the upcoming consultation process.

If you have any comments or questions, please contact me at (402) 636-2313.

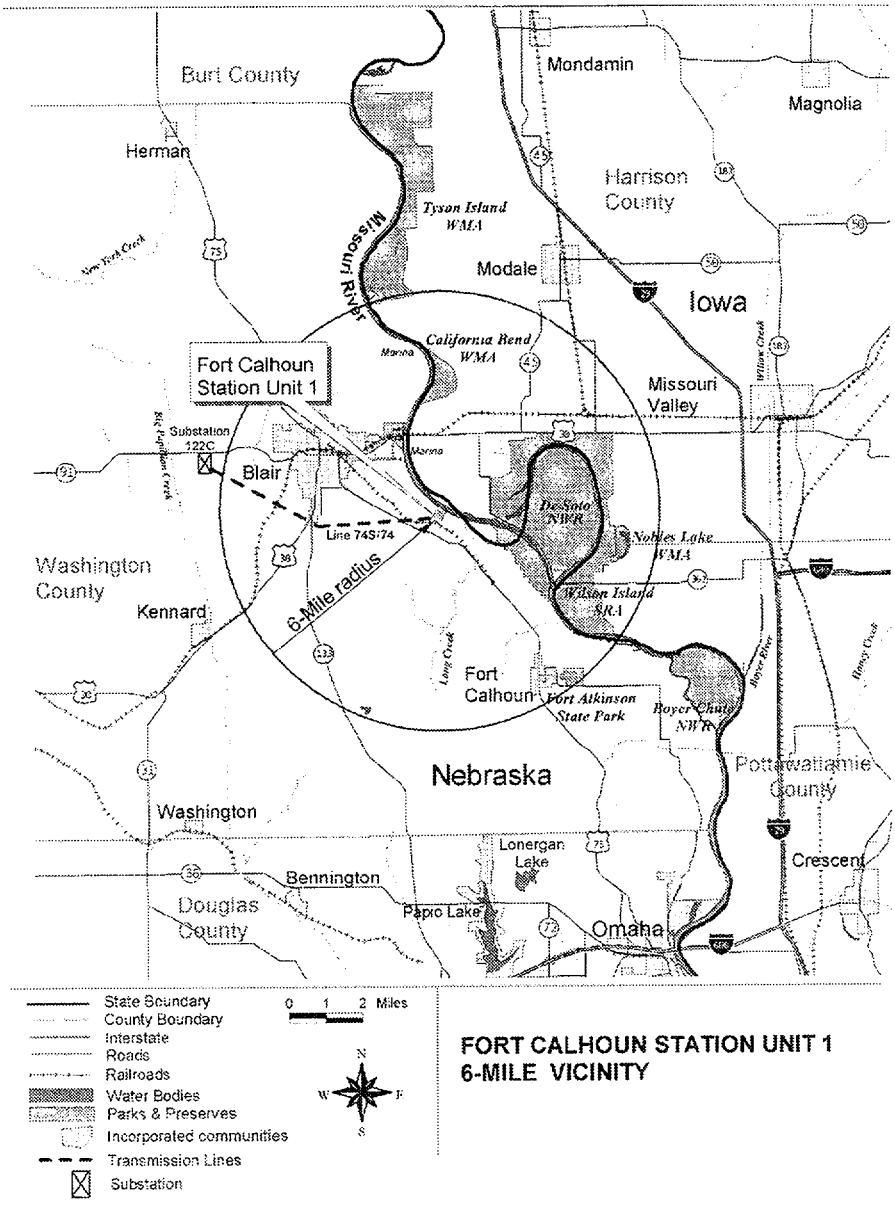
Sincerely yours,

Donovan C. Hutchens
Manager – Environmental and Regulatory Affairs

Attachment

45-5124

Employment with Equal Opportunity



FORT CALHOUN STATION UNIT 1
6-MILE VICINITY

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

August 7, 2001
01-EA-241

Ms. Angela Chen
Iowa Department of Natural Resources
Henry A. Wallace Building
502 East 9th
Des Moines, Iowa 50319

Subject: Fort Calhoun Station Unit 1
License Renewal Project
NRC Informal Consultation Preparation

Dear Ms. Chen:

Omaha Public Power District (OPPD) is preparing an application to renew the operating licenses for Fort Calhoun Station Unit 1, and we intend the application be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts to threatened and endangered species resulting from continued operation of the facility or refurbishment activities associated with the license renewal. OPPD believes that operation of the plant has no adverse impact on any protected species. In addition, there are no planned operational or refurbishment activities for the period of extended operations that would invalidate this conclusion. The NRC may request an informal consultation from your agency on this matter.

To assist you in making your determination, a figure is enclosed which depicts the Fort Calhoun site and the associated transmission line corridors.

It is our intent that, by contacting you at this point in the process, we can identify any deficiencies, concerns, or data needed so that those areas identified can be addressed to ensure that the consultation process proceeds smoothly and efficiently.

We would appreciate it if you would provide your comments and any additional information or actions that might be required from OPPD to expedite the upcoming consultation process.

If you have any comments or questions, please contact me at (402) 636-2313.

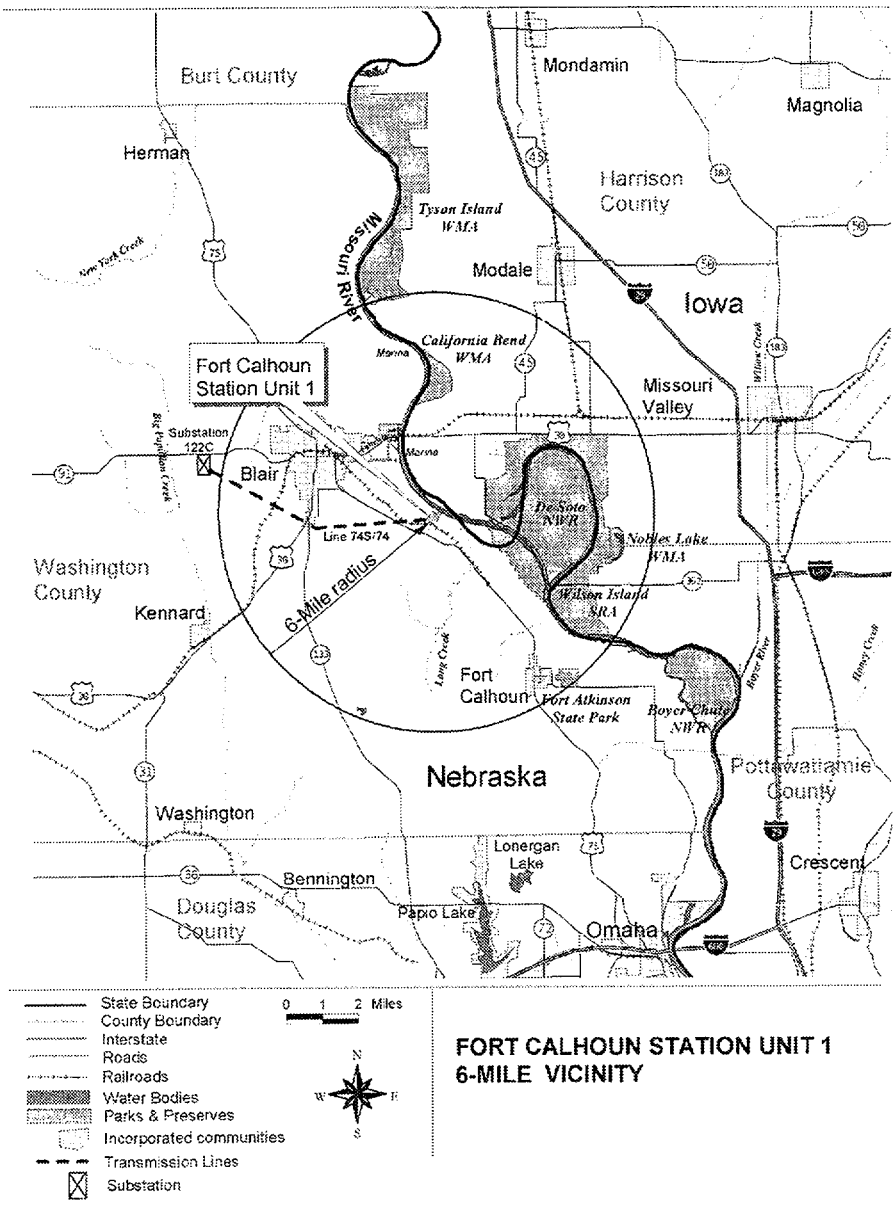
Sincerely yours,

Donovan C. Hutchens
Manager – Environmental and Regulatory Affairs

Attachment

45-5124

Employment with Equal Opportunity



FORT CALHOUN STATION UNIT 1
6-MILE VICINITY

Fields of Opportunities

STATE OF IOWA

THOMAS J. VILSACK, GOVERNOR
SALLY J. PEDERSON, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
JEFFREY R. VONK, DIRECTOR

September 4, 2001

Mr. Donovan C. Hutchens
Omaha Public Power District
444 South 16th Street Mall
Omaha, NE 68102-2247

RE: Ooperating Permit Licensing Renewal for the Fort Calhoun Nuclear Power Generating Facility

Dear Mr. Hutchens:

Thank you for inviting our comments on the impact of the above referenced project on protected species and rare natural communities.

Within the 6-mile radius of Fort Calhoun Station Unit 1, the Department has records for the piping plover (Charadrius melodus, Iowa listed endangered) and the least tern (Sterna antillarum, Iowa listed endangered) 1 ½ miles east in the Desoto Bend National Wildlife Area. Nearby Desoto Bend are the Nobles Lake Wildlife Management Area and the Wilson Island State Recreation Area. About 2 miles NNW of Unit 1 is Rand Bar, and 4 miles north is California Bend and the California Cut-off Revetment.

This letter is a record of review for protected species and rare natural communities in the project area. It does not constitute a permit and before proceeding with the project, you may need to obtain permits from the DNR or other state and federal agencies.

If you have any questions about this letter or if you require further information, please contact Keith Dohrmann at (515) 281-8967.

Sincerely,

ALLEN L. FARRIS
IOWA DEPARTMENT OF NATURAL RESOURCES

AF:kd

01-491L.doc

WALLACE STATE OFFICE BUILDING / DES MOINES, IOWA 50319
515-281-5918 TDD 515-242-5967 FAX 515-281-6794 WWW.STATE.IA.US/DNR

APPENDIX 4.0 CULTURAL RESOURCES CORRESPONDENCE

NSHS = Nebraska State Historical Society
OPPD = Omaha Public Power District

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

August 7, 2001
01-EA-240

Mr. L. Robert Puschendorf
State Historic Preservation Officer
Nebraska State Historical Society
P. O. Box 82554
Lincoln, NE 68501-2554

Subject: Fort Calhoun Station Unit 1
License Renewal Project
NRC Informal Consultation Preparation

Dear Mr. Puschendorf:

Omaha Public Power District (OPPD) is preparing an application to renew the operating licenses for Fort Calhoun Station Unit 1, and we intend the application to be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify impacts to cultural resources resulting from the renewal of the license. The NRC will request an informal consultation with your agency. There are no land disturbing operational or refurbishment activities planned for operations during the license renewal term. OPPD, therefore, believes there will be no cultural impacts from license renewal activities.

To assist you in your determination, please find enclosed a figure that depicts the Fort Calhoun Site and the associated transmission line corridors.

It is our intent that, by contacting you at this point in the process, we can identify any deficiencies, concerns, or data needed so that those areas identified can be addressed to ensure that the consultation process proceeds smoothly and efficiently.

After your review, we would greatly appreciate a letter confirming OPPD's conclusion that impacts to cultural resources will be minimal or no impact and that there is no need for mitigation.

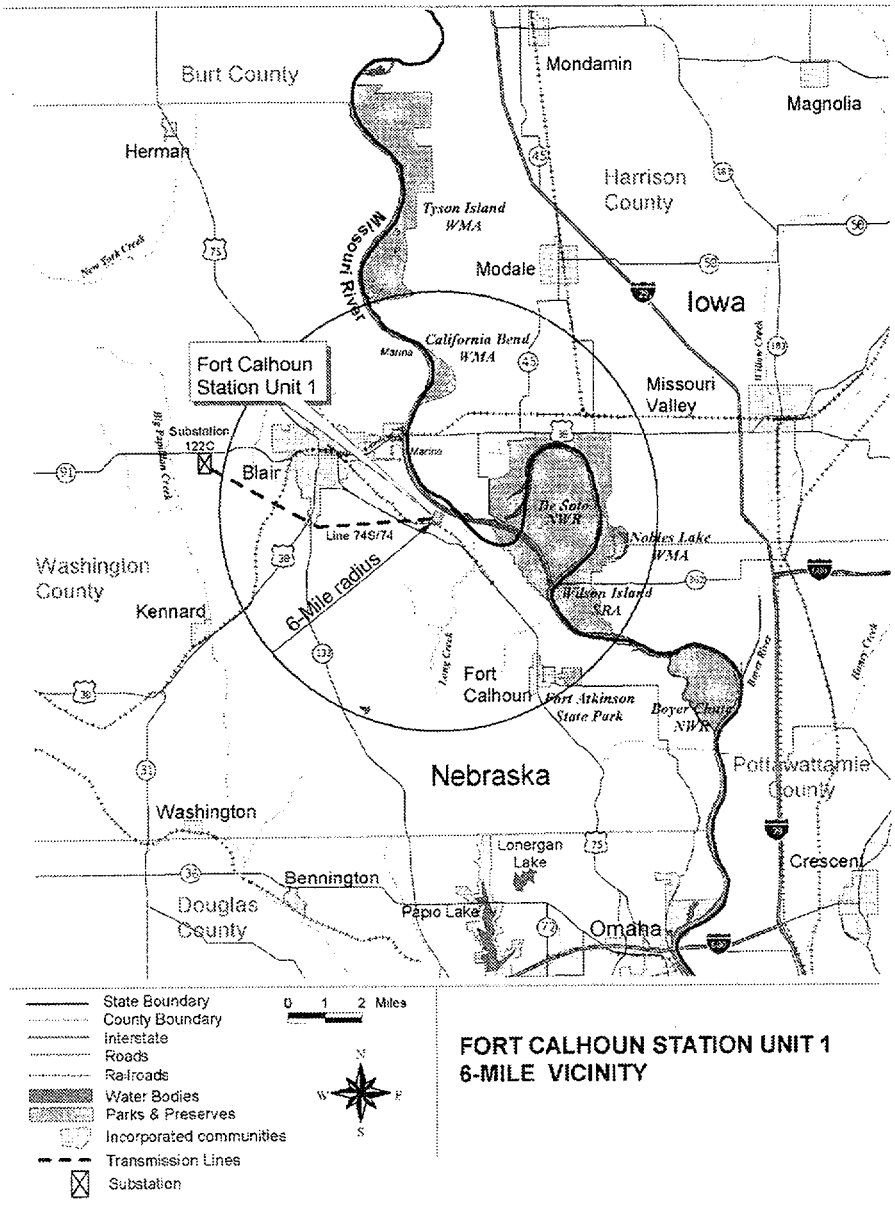
If you have any comments or questions, please contact me at (402) 636-2313.

Sincerely yours,

Donovan C. Hutchens
Manager – Environmental and Regulatory Affairs

Attachment

DCH/ses



FORT CALHOUN STATION UNIT 1
6-MILE VICINITY

NEBRASKA STATE HISTORICAL SOCIETY
1500 R STREET, P.O.BOX 82554, LINCOLN, NE 68501-2554
(402) 471-3270 Fax: (402) 471-3100 1-800-833-6747 www.nebraskahistory.org

21 August 2001

Donovan C. Hutchens
OPPD
444 South 16th Street Mall
Omaha, NE 68102-2247

Re: Fort Calhoun Station Unit 1
License Renewal
Washington Co.
H.P. #0108-051-01

Dear Mr. Hutchens:

A review of our files indicates that the referenced project does not contain recorded historic resources. It is our opinion that no survey for unrecorded cultural resources will be required. Your undertaking, in our opinion, will have no effect on an historic property.

There is, however, always the possibility that previously unsuspected archaeological remains may be uncovered during the process of project construction. We therefore request that this office be notified immediately under such circumstances so that an evaluation of the remains may be made, along with recommendations for future action.

Sincerely,

Terry Steinacher
H.P. Archaeologist

Concurrence:

L. Robert Puschendorf
Deputy NeSHPO

APPENDIX 5.0 SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS

Appendix 5 contains the following sections:

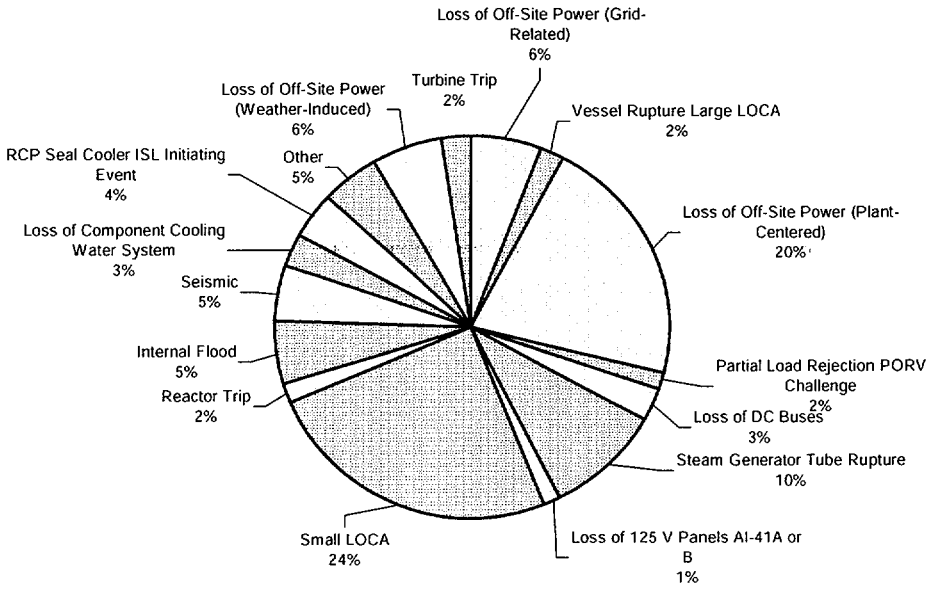
5.1 FCS PRA MODEL AND RISK PROFILE

5.1.1 BACKGROUND

In response to Generic Letter 88-20, "Individual Plant Examination of Severe Accident Vulnerabilities," and its supplements, Omaha Public Power District (OPPD) performed a Level 1, full-scale Level 2, and Level 3 probabilistic risk assessment (PRA) for Fort Calhoun Station Unit 1 (FCS). OPPD submitted its Individual Plant Examination (IPE) to the U.S. Nuclear Regulatory Commission (NRC) in December 1993. The IPE addressed internal initiating events and internal flooding events and indicated an estimated core damage frequency (CDF) of 1.36E-05 per reactor year (including internal flooding). OPPD submitted a complete assessment for external events for FCS in June 1995. The Individual Plant Examination for External Events (IPEEE) submittal covered seismic, fire, tornado, external flooding, transportation, and nearby facility accidents, as well as "other" external events. The submittal indicated that external events have a total CDF per reactor year of 3.13E-05, and that apart from seismic, 88 percent of the IPEEE CDF is dominated by fires. The Seismic Margins Analysis method was used and, thus, results were not quantified in terms of CDF.

Improvements identified through these analyses have been implemented. A peer review, conducted in 1999, confirmed the strengths of the FCS PRA model and identified some additional improvements that have either been implemented or were accounted for in the severe accident mitigation alternatives (SAMA) analysis.

OPPD maintains a "living" plant risk model, and the current total core damage frequency is 2.48E-05. The initiating events leading to core damage and their respective contributions to risk are depicted in Figure 5.3-3.



Note: Acronyms are defined in Appendix 5.6.

Figure 5.3-3: Contributors to FCS Core Damage Frequency

Several features incorporated into the FCS design have contributed to the low core damage frequency. Attention to the proper operation and maintenance of these features provides assurance that the risk of severe accidents at FCS remains low. FCS plant features that contribute to risk reduction are summarized below:

- **Large Pressurizer Capacity** – The capacity of the pressurizer is larger than required. This feature provides extra inventory for mitigating loss-of-coolant accidents (LOCAs).

- **Diesel Generators** – The emergency diesel generators are air cooled (radiator type) and do not rely on cooling water to perform their function. The non-reliance on cooling water enhances the reliability of the emergency diesel generators.

- **Heating, Ventilation, and Air Conditioning** – The openness of the Auxiliary Building and various rooms within the plant reduces the reliance on the Heating, Ventilation, and Air Conditioning (HVAC) System for equipment heat removal. It is unlikely that HVAC will be required to cool equipment.

- **Power-Operated Valves** – FCS is equipped with two large-capacity power-operated relief valves (PORVs). Either valve in conjunction with one of the

high-pressure safety injection (HPSI) pumps is capable of supporting once-through cooling in the unlikely event that steam generator cooling is lost.

- **Auxiliary Feedwater System Diversity**- FCS is equipped with three auxiliary feedwater pumps: one motor-driven, one turbine-driven, and one diesel-driven. The diesel-driven pump is equipped with its own sources of cooling and electric power. There are multiple paths available for supplying feedwater to the steam generators, thus making the auxiliary feedwater system diverse and reliable.

- **Emergency Core Cooling System (ECCS) Pump Cooling** – The seals/ bearings for the HPSI, low-pressure safety injection (LPSI), and containment spray pumps do not require cooling water to protect their integrity during the injection mode of operation. Cooling for the seals/bearings is required during the recirculation mode of operation.

- **Fire Water Backup** – A diesel-driven fire pump, independent of plant support systems, is available for long-term makeup to the Emergency Feedwater Storage Tank. This pump can also serve as backup to the Raw Water System, which provides cooling for the Component Cooling Water System.

- **Raw Water Backup** – In the unlikely event that the Component Cooling Water System becomes unavailable, the Raw Water System can be manually aligned to provide cooling to essential safety-related equipment including shutdown cooling heat exchangers, containment cooling units, coolers for the ECCS pump seals/bearings, and Control Room air conditioners.

- **Vital AC Power Backup** – If a vital inverter fails and 480 volts alternating current (VAC) power is available, the 120 VAC control power normally supplied by the affected inverter is automatically switched to an alternate bypass source. No operator actions are required and the switching from the preferred to the alternate source takes place while maintaining the function of the powered equipment.

5.1.2 FCS PRA MODEL PEER REVIEW

In March 1999, the FCS PRA model was peer reviewed by a team of PRA engineers from Westinghouse, four other utilities, and a PRA consultant. This peer review was conducted in accordance with the Combustion Engineering (CE) Owners Group version of the nuclear power industry peer review process documented in NEI-00-02 (Reference 5.1-1). The peer review team found the FCS PRA model to be effective for assessing planned plant maintenance and operations configurations and evaluating future plant design changes. The FCS PRA model was also found to be adequate for other applications where supported by deterministic insights and plant expert panel input.

5.1.3 PRA CONFIGURATION CONTROL

A key element of the PRA Configuration Control Program (PED-SEI-037) is the tracking of plant design, procedure, and operating changes that could potentially impact the FCS PRA. The PRA Configuration Control Form (CCF) is the primary vehicle for tracking plant changes that could potentially impact the FCS PRA and ensuring that such changes are incorporated as required. The CCFs are also used to track any errors detected in the PRA or associated documentation and to ensure that such errors are corrected as part of each update. The CCFs were used to track all of the peer review comments. A CCF is closed out once the requisite changes to the FCS PRA model or associated documentation have been completed.

In preparing this environmental report, the CCF database was reviewed to identify the outstanding FCS PRA issues and to evaluate their potential impacts on the SAMA analysis. Based upon the review of the FCS PRA issue database, OPPD concludes that the FCS PRA model is complete and correctly represents the as-built, as-operated plant.

5.1.4 CDF UNCERTAINTY

The SAMA analysis is based on bounding assessments of the benefits of each SAMA using mean values for CDF and cutset frequencies. Detailed uncertainty analyses for the latest version of the FCS PRA model indicate that the 95th percentile value of the CDF is 4.68E-05 per year. This is a factor of about 1.85 greater than the mean CDF value of about 2.5E-05 per year. External events are partially included in the baseline plant PRA through the inclusion of the dominant seismic sequences. The mean external event contribution resulting from weather-related factors (excluding external floods) is an order of magnitude lower than the plant baseline CDF and, therefore, will not impact SAMA assessments. Furthermore, these events do not introduce any new dominant sequences. External floods were explicitly considered as they impact core damage. While risk significant, the dominant sequences are focused on specific events and do not contribute to SAMA uncertainty. OPPD has not performed a fire PRA for FCS, but the plant fire risks were conservatively evaluated using a fire-induced vulnerability evaluation (FIVE) assessment. The results of this assessment were expressed in terms of CDF. However, it is expected that the FIVE CDF represents a fire-induced core damage frequency much greater than that of the actual plant fire CDF. The FIVE CDF for FCS is 2.78E-05 per year. This is approximately equal to the mean FCS internal events CDF. As with the external events assessment, no new risk-dominant sequences were noted. One can approximate an upper bound uncertainty factor by combining the 95th percentile baseline CDF and FIVE CDF and dividing by the mean baseline CDF. Performing the above operations, the estimated uncertainty factor for application to SAMA assessments should be approximately 3.

5.2 MELCOR ACCIDENT CONSEQUENCE CODE SYSTEM MODELING

This section of Appendix 5 describes the assumptions made and the results of modeling performed to assess the risks and consequences of severe accidents (U.S. Nuclear Regulatory Commission Class 9).

The Level 3 analysis was performed using the Melcor Accident Consequence Code System (MACCS) 2 code (Reference 5.2-1). MACCS2 simulates the impacts of severe accidents at nuclear power plants upon the surrounding environment. The principal phenomena considered in MACCS2 are atmospheric transport, mitigative actions based on dose projections, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs. Input for the Level 3 analysis includes the reactor core radionuclide inventory, source terms from the IPE (as applied to the FCS PRA model), site meteorological data, projected population distribution (within a 50-mile radius) for the year 2030, emergency response evacuation modeling, and economic data. These inputs are described in the following section.

5.2.1 INPUT DATA

The input data required by MACCS2 are outlined below.

5.2.1.1 CORE INVENTORY

The initial core inventory of radioisotopes was obtained from the OPPD alternative source term (AST) application submitted to the NRC in February 2001 (Reference 5.2-2). The core inventory was calculated using the ORIGEN-S computer code and provided in Table 4.1 of the AST application. To perform the analysis associated with this environmental report, the inventory was reduced to the isotopes with dose conversion factors, resulting in the 131 radioisotopes presented in Table 5.2-1. Previous versions of the MACCS model used a standard set of 60 radioisotopes, the computer code's limit. MACCS2, however, has the capability of using up to 150 isotopes.

TABLE 5.2-1
FCS CORE INVENTORY

Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction
H-3	2.12E+04	Ag-110	6.00E+06	Cs-135m	1.41E+06
Ga-72	6.69E+02	Ag-110m	1.43E+05	Cs-136	1.97E+06
As-76	7.58E+02	Ag-111	2.39E+06	Cs-137	4.80E+06
Ge-77	2.92E+04	Ag-112	1.10E+06	Cs-138	7.93E+07
Se-83	2.51E+06	In-115m	3.30E+05	Ba-137m	4.57E+06
Br-82	1.16E+05	Cd-115	3.30E+05	Ba-139	7.59E+07
Br-83	5.40E+06	Cd-115m	1.15E+04	Ba-140	7.59E+07
Kr-83m	5.43E+06	Sn-121	3.28E+05	Ba-142	6.62E+07
Kr-85	4.35E+05	Sn-123	2.58E+04	La-140	7.78E+07
Kr-85m	1.15E+07	Sn-125	2.02E+05	La-141	6.94E+07
Kr-87	2.32E+07	Sn-127	1.41E+06	La-142	6.84E+07
Kr-88	3.25E+07	Sb-122	3.58E+04	La-143	6.58E+07
Rb-86	6.31E+04	Sb-124	2.75E+04	Ce-141	7.00E+07
Rb-88	3.33E+07	Sb-125	3.30E+05	Ce-143	6.63E+07
Rb-89	4.37E+07	Sb-127	3.50E+06	Ce-144	5.24E+07
Sr-89	4.54E+07	Sb-129	1.31E+07	Pr-142	2.25E+06
Sr-90	3.82E+06	Sb-130	4.35E+06	Pr-143	6.48E+07
Sr-91	5.59E+07	Sb-131	3.25E+07	Pr-144	5.27E+07
Sr-92	5.84E+07	Te-127	3.44E+06	Nd-147	2.78E+07
Y-90	3.92E+06	Te-127m	5.66E+05	Pm-147	8.38E+06
Y-91	5.76E+07	Te-129	1.24E+07	Pm-148	6.73E+06
Y-91m	3.25E+07	Te-129m	2.51E+06	Pm-148m	1.31E+06
Y-92	5.88E+07	Te-131	3.44E+07	Pm-149	2.31E+07
Y-93	4.39E+07	Te-131m	8.06E+06	Pm-151	8.08E+06
Y-94	6.88E+07	Te-132	5.86E+07	Sm-153	1.71E+07
Y-95	7.08E+07	Te-133	4.65E+07	Eu-154	2.62E+05
Zr-95	7.32E+07	Te-133m	3.83E+07	Eu-155	1.16E+05

TABLE 5.2-1 (CONTINUED)
FCS CORE INVENTORY

Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction
Zr-97	6.78E+07	Te-134	7.75E+07	Eu-156	8.45E+06
Nb-95	7.34E+07	I-129	1.39E+00	Eu-157	9.40E+05
Nb-95m	8.38E+05	I-130	8.34E+05	Eu-158	3.40E+05
Nb-97	6.81E+07	I-131	4.08E+07	Gd-159	2.24E+05
Nb-97m	6.43E+07	I-132	5.97E+07	Tb-160	3.42E+04
Mo-99	7.70E+07	I-133	8.47E+07	Ho-166	2.61E+03
Mo-101	6.94E+07	I-134	9.47E+07	Th-228	1.19E-01
Tc-99m	6.81E+07	I-135	8.04E+07	Np-239	8.42E+08
Tc-101	6.94E+07	Xe-131m	5.35E+05	Pu-238	1.14E+05
Tc-104	5.23E+07	Xe-133	8.48E+07	Pu-239	1.67E+04
Ru-103	6.41E+07	Xe-133m	2.64E+06	Pu-240	2.14E+04
Ru-105	4.37E+07	Xe-135	3.08E+07	Pu-241	5.40E+06
Ru-106	2.15E+07	Xe-135m	1.75E+07	Pu-242	8.25E+01
Rh-103m	6.39E+07	Xe-138	7.38E+07	Am-241	5.86E+03
Rh-105	4.05E+07	Cs-132	1.39E+03	Cm-242	1.74E+06
Rh-106	2.37E+07	Cs-134	6.06E+06	Cm-244	1.37E+05
Pd-109	1.47E+07	Cs-134m	1.46E+06		

As described in the AST application, the equilibrium core inventory is calculated based on plant operation at 102 percent of the power level [1530 megawatts (thermal)], assuming an 18-month fuel cycle. The equilibrium core at the end of a fuel cycle is assumed to consist of fuel assemblies with three different burnups, i.e., approximately 1/3 of the core is subjected to one fuel cycle, 1/3 of the core to two fuel cycles, and 1/3 of the core to three fuel cycles. Minor variations in fuel irradiation times and duration of refueling outages will have a slight impact on the estimated inventory of long-lived isotopes in the core. However, these changes will have an insignificant impact on the radiological consequences of postulated accidents.

5.2.1.2 SOURCE TERMS

The atmospheric source terms used in the MACCS2 model were obtained from the latest Level 2 FCS PRA model analysis.

5.2.1.3 METEOROLOGICAL DATA

Site-specific meteorological data were used in the analysis. A full year (1988) of consecutive hourly meteorological data (wind speed, wind direction, stability class, and precipitation) were placed in MACCS2 format. Meteorological data for years 1994-1998 were used to demonstrate that the 1998 data set is representative.

5.2.1.4 POPULATION DISTRIBUTION

FCS is located on the west bank of the Missouri River approximately 20 miles from the Omaha Metropolitan Area. The 50-mile region includes the Omaha Metropolitan Area and 12 counties in Nebraska and 10 counties in Iowa that are completely, or partially within the 50-mile radius.

Population estimates within the 50-mile radius were performed using block-group resolution. The "block group" is one of several arial units used by the U.S. Bureau of the Census to aggregate data resulting from the decennial census. During the census conducted in 1990, the Census Bureau partitioned the U.S. into approximately 229,000 block groups nominally containing between 250 and 500 housing units per block group. Although the Census Bureau's block-group structure may have changed for the census performed in 2000, data at the block-group level of resolution are not scheduled for release until 2002. Thus, block-group boundaries from the 1990 census were used throughout this analysis.

A circle comprising a 50-mile radius centered at FCS defines the subject population distribution region. A total of 778 block groups are totally enclosed by the 50-mile circle centered at FCS (636 block groups in Nebraska and 142 block groups in Iowa). All residents in those block groups are included in the population estimate. However, 61 block groups are partially included within the circle (31 partially included block groups in Nebraska and 30 in Iowa). The precise location of residents within individual block groups is unknown. Estimates of the population for partially included block groups were obtained under the assumption that residents are uniformly distributed throughout each block group. Under this assumption, the fraction of the total block group population residing within 50 miles of FCS equals the fraction of the block group area that is enclosed by the 50-mile circle.

The 1990 census data were used to prepare population estimates for the region surrounding the plant. As described above, the 1990 population distribution by sector for the 50-mile region was prepared using population data extracted from the STF3A files released by the Census Bureau in 1992 (Reference 5.2-3). A commercially available Geographic Information System (GIS), Maptitude, developed by Caliper Corporation, was used to estimate the population within each of the 16 sectors. The total 1990 population residing in the 50-mile radius region was estimated to be 770,065 persons.

County-level data extracted from the year 2000 census data were used to estimate the year 2000 population distribution. Changes in population between 1990 and 2000 were calculated under the assumption that increase or decrease in the population for each census block group within a given county were the same as those for the county as a whole. A comparison of projected populations for potentially affected counties in Nebraska for the year 2000 to Census 2000 data for the same counties shows that the projected populations are approximately 2.4 percent less than the enumerated populations. This difference was determined not to be significant. The county population change factors were applied to the respective block groups to generate a population distribution for year 2000. The total year 2000 50-mile radius population estimate is 853,459 persons.

County-specific population estimates were used to extrapolate the year 2000 population estimate to year 2030. Projections of county populations for Iowa counties for the years 2010, 2020, and 2025 were obtained from Dr. Willis Gaudy, Census Services, Iowa State University (Reference 5.2-4). Projections of county populations for Nebraska counties for the years 2000, 2005, 2010, 2015, and 2020 were obtained from the Nebraska Databook and Economic Trends (Reference 5.2-5).

County population projections for the year 2030 were not available for the States of Iowa and Nebraska; therefore, straight-line projections to the year 2030 were made using available population projections for 2020 and 2025 (Iowa), or 2015 and 2020 (Nebraska). The county population change factors were then applied to the respective block groups. The year 2030 50-mile radius population total for the FCS region was estimated to be 1,055,770 persons.

5.2.1.5 EMERGENCY RESPONSE

The emergency response assumptions were obtained from the FCS MACCS analysis submitted with the IPE (Reference 5.2-6). That analysis used a 45-minute evacuation delay time and a 2.0 meters per second evacuation speed. The analysis assumed that 95 percent of the population surrounding the plant would evacuate in an emergency.

5.2.1.6 LAND FRACTIONS

Land fractions for a given sector refer to the fractions of the area of that sector within each potentially affected county. For example, sector R21N lies partly in Monona County, Iowa, and partly in Woodbury County, Iowa. The land fractions for R21N were identified from an overlay of the area of R21N with the area of each county. Sixty-one percent of R21N is in Monona County and the remaining 39 percent is in Woodbury. Areas with water features enclosed or partially enclosed by a sector do not contribute to a land fraction for that sector. Sectors for which the sum of land fractions over all counties is less than one are those that enclose or partially enclose water features.

5.2.1.7 DOSE CONVERSION FACTORS

Dose conversion factors (DCFs) issued by the U.S. Environmental Protection Agency in Federal Guidance Report (FGR) 11 and FGR 12 were used to determine the dose calculations and latent cancer effects in the FCS Level 3 analysis (Reference 5.2-7; Reference 5.2-8). These reports provide inhalation and ingestion DCFs for over 600 radionuclides, and cloudshine and groundshine DCFs for 825 radionuclides. The FGRs, however, do not provide the DCFs required for acute dose calculations. In order to determine early fatalities and injuries, DCFs were obtained from DOE/EH-0070, a 1988 DOE database (Reference 5.2-9). This database is limited to the original MACCS set of 60 radionuclides.

5.2.1.8 AGRICULTURAL DATA

Agricultural data required for MACCS2 include:

- the fraction of land devoted to farming;
- the farmland property values;
- the total annual farm sales; and
- the fraction of farm sales resulting from dairy production.

The land area for each county was taken from the 1997 Census of Agriculture (Reference 5.2-10) and the land area within each county from the 2000 U.S. Census (Reference 5.2-11). Farmland property values, on a county-by-county basis, used in the FCS analysis are the estimated market value for land and buildings ($ per acre) from the 1997 Census of Agriculture.

The total annual farm sales data for Iowa and Nebraska used in the FCS analysis were derived from the total annual farm sales values reported for each county in the 1997 Census of Agriculture. The fraction of farm sales resulting from dairy production in Iowa was derived from the following 1997 Census of Agriculture data :

- data for the total annual farm sales,
- the total value of all dairy products produced in Iowa, and
- the number of dairy cows for the State of Iowa and each county within 50 miles of FCS.

For each county in Nebraska, data as reported in the Nebraska Databook and Economic Trends was used to develop the value of the farm sales from dairy production in each county used for the FCS analysis. The available data include:

- the number of dairy cows in each county and agricultural district,
- the total milk production in each district, and
- the average milk price paid to Nebraska farmers.

The agricultural data are presented in Table 5.2-2.

TABLE 5.2-2
MACCS2 AGRICULTURAL DATA

County	Fraction of Land Devoted to Farming	Fraction of Farm Sales Resulting from Dairy Production	Total Annual Farm Sales ($/ hectare)	Farmland Property Values ($/hectare)
Nebraska				
Burt	0.928	0.0068	950.70	554.84
Butler	0.946	0.0129	716.19	476.74
Cass	0.840	0.0230	552.09	637.81
Colfax	0.871	0.0061	1915.75	573.46
Cuming	0.982	0.0047	3483.47	635.78
Dodge	0.945	0.0110	1079.14	669.37
Douglas	0.533	0.0188	967.31	915.03
Lancaster	0.784	0.0355	483.44	570.63
Sarpy	0.066	0.0096	1390.23	953.88
Saunders	0.903	0.0136	814.46	629.71
Thurston	0.750	0.0281	778.72	414.01
Washington	0.877	0.0356	1043.39	842.99
Iowa				
Cass	0.917	0.0071	701.70	533.39
Crawford	0.944	0.0086	818.52	607.05
Fremont	0.973	0.0000	684.46	523.28
Harrison	0.881	0.0014	710.89	610.29
Monona	0.829	0.0040	675.82	532.99
Montgomery	0.894	0.0055	841.16	496.57
Pottawattamie	0.879	0.0030	874.76	787.55
Shelby	0.905	0.0045	958.77	658.45
Woodbury	0.890	0.0013	751.98	539.06
Mills	0.830	0.0026	630.07	642.66

5.2.1.9 REGIONAL ECONOMIC DATA

Regional economic data (excluding the economic data associated with the farming industry, which are presented in the previous section) factored into the FCS risk analysis are limited to non-farm property values. As an estimate for the per capita property values one of two data sets was referenced. The median home value as reported in the 2000 US Census was used for each county in Iowa (Reference 5.2-11). The average single-family-home selling price as reported in the Nebraska Databook and Economic Trends was used for each county in Nebraska (Reference 5.2-15). The non-farm property values are presented in Table 5.2-3.

TABLE 5.2-3
NON-FARM PER CAPITA PROPERTY VALUES

County	Non-Farm Property Value ($/person)	County	Non-Farm Property Value ($/person)
Nebraska		*Iowa*	
Burt	42873	Cass	34700
Butler	40474	Crawford	33900
Cass	78143	Fremont	32000
Colfax	41424	Harrison	33600
Cuming	55857	Monona	27400
Dodge	68770	Montgomery	35200
Douglas	113154	Pottawattamie	46900
Lancaster	201780	Shelby	36400
Sarpy	117426	Woodbury	41000
Saunders	70839	Mills	47000
Thurston	46101		
Washington	109702		

5.2.1.10 FOOD PATHWAY ASSUMPTIONS

The MACCS2 ingestion model preprocessor, COMIDA2, was used to model the food pathway. COMIDA2 is a dynamic food-chain model that models the transfer of radionuclides into the edible portion of plants as a function of plant growth. COMIDA2 models transport through the human food chain and calculates the respective nuclide concentration in nine foodstuffs (grains, leafy vegetables, roots, fruits, legumes, milk, beef, poultry, and eggs), based on initial deposition.

After screening the radionuclide inventory it was found that 16 radionuclides sufficiently represented the ingestion effects for the FCS analysis. These radionuclides are Strontium-89, Strontium-90, Molybdenum-99, Ruthenium-103, Ruthenium-105, Tellurium-127m, Tellurium-129m, Tellurium-132, Iodine-129, Iodine-131, Iodine-133, Cesium-134, Cesium-137, Barium-140, Lanthanum-140, and Cerium-144.

5.2.1.11 DEPOSITION VELOCITIES

A deposition velocity value of 0.03 meters per second was used for the FCS analysis.

5.2.2 RESULTS

The result of the Level 3 model is a matrix of offsite exposure and offsite property costs associated with a postulated severe accident in each release category. This matrix was combined with the results of the Level 2 model to yield the probabilistic offsite dose and probabilistic offsite property damage resulting from the analyzed plant configuration. The base case offsite exposure risk for FCS is 10.15 person-rem per year. Table 5.2-4 provides the baseline exposures associated with each release category. The offsite exposure risk was calculated by multiplying the frequency of the release by the dose.

The base case offsite economic risk is $15,427 per year. Table 5.2-4 also provides the base case offsite economic costs associated with each release category. The economic risk for each release category was calculated by multiplying the frequency by the offsite dollar factor.

The final result of a Level 3 evaluation of a SAMA is a value of the cumulative dose expected to be received by offsite individuals and a value of the expected offsite property losses due to severe accidents given the plant configuration under evaluation.

TABLE 5.2-4
SUMMARY OF OFFSITE CONSEQUENCES

Release Category	Frequency	Offsite Dose (person-rem)	Offsite Dose Risk	Offsite Economic Costs ($)	Offsite Economic Risk ($)
1. Intact Containment (with / without Spray Scrubbing of Releases)	1.31E-05	1.52E+04	0.20	4.10E+05	5
3. Late Containment Failure (with / without Spray Scrubbing of Releases)	8.79E-06	1.59E+05	1.40	8.80E+07	774
4. Early Containment Failure (with / without Spray Scrubbing of Releases)	4.75E-07	3.16E+06	1.50	4.81E+09	2,285
5. Alpha Mode Containment Failure	1.65E-09	1.07E+06	0.00	1.52E+09	3
6. Isolation Failure (with / without Containment Cooling) / SGTR (with Open / Cycling SRV)	1.43E-06	2.34E+06	3.35	4.65E+09	6,650
7. Containment Bypass (Small / Large V-Sequence)	1.00E-06	3.70E+06	3.70	5.71E+09	5,710
Total	2.48E-05		10.15		15,427

SGTR = steam generator tube rupture
SRV = safety relief valve

5.2.3 SENSITIVITY ANALYSIS

Sensitivity analyses were performed for reduced evacuation speed, fission product release, and weather. Each sensitivity case is discussed below and results are presented in terms of impacts to latent cancer fatality (LCF) risk.

5.2.3.1 REDUCED EVACUATION SPEED

The analysis assumed that 95 percent of the population surrounding the plant would evacuate in an emergency. Analyses were performed for both 100 percent (full) and no evacuation of the surrounding population. The difference in LCF risk between full evacuation and no evacuation is approximately 6.1E-4 per year.

5.2.3.2 FISSION PRODUCT RELEASE

A sensitivity analysis was performed for a 10 percent increase in fission product release. The core inventory was increased by 10 percent while maintaining the release fractions. While short-term dose effects are proportional to the releases, the impact of long-term dose effects associated with groundshine, resuspension, and ingestion is limited by the use of MACCS2 interdiction triggers, which are based on U.S. Environmental Protection Agency Protective Action Guide dose limits. These triggers impact population relocation, ingestion, and long term land uses. As shown in the table below, a 10 percent increase in source term results in a 5.7 percent increase in population dose risk increase and a 6.2 percent increase in LCF.

Parameter	Nominal Release	10% Increase in Releases	Percent Change
Population Dose Risk (millirem/year)	4.32	4.56	5.7
LCF Risk (LCF/year)	2.41E-03	2.57E-03	6.2

5.2.3.3 WEATHER

Data from the years 1994 to 1998 were compared with the base 1988 meteorological year data used in the plant model for the FCS IPE. For the year studied, the mean LCF risk was 1.93E-03 per year. The 1988 meteorological data used in the base assessment conservatively bounded the results of the other five years given the impact was 25 percent greater than the sample mean.

5.3 SAMA IDENTIFICATION AND SCREENING

This section describes the generation of the initial list of potential severe accident mitigation alternatives (SAMAs) for Fort Calhoun Station Unit 1 (FCS), screening methods, and results.

5.3.1 SAMA LIST COMPILATION

Omaha Public Power District generated a list of candidate SAMAs by reviewing industry documents and considering plant-specific enhancements not considered in published industry documents. Industry documents reviewed include the following:

- The Watts Bar Nuclear Plant Unit 1 Individual Plant Examination (IPE) submittal (Reference 5.3-1);
- The Limerick Severe Accident Mitigation Design Alternative (SAMDA) cost estimate report (Reference 5.3-2);
- NUREG-1437 description of Limerick SAMDA (Reference 5.3-3);
- NUREG-1437 description of Comanche Peak SAMDA (Reference 5.3-4);
- Watts Bar Nuclear Plant SAMDA submittal (Reference 5.3-5);
- Tennessee Valley Authority (TVA) response to the U.S. Nuclear Regulatory Commission's (NRC's) Request for Additional Information on the Watts Bar Nuclear Plant SAMDA submittal (Reference 5.3-6);
- Westinghouse AP600 SAMDA (Reference 5.3-7);
- Safety Assessment Consulting presentation by Wolfgang Werner at the NUREG-1560 conference (Reference 5.3-8);
- NRC IPE Workshop – NUREG-1560 presentation (Reference 5.3-9);
- NUREG-0498, Supplement 1, Section 7 (Reference 5.3-10);
- NUREG/CR-5567, PWR Dry Containment Issue Characterization (Reference 5.3-11);
- NUREG-1560, Volume 2, NRC prospective on the IPE program (Reference 5.3-12);
- NUREG/CR-5630, PWR Dry Containment Parametric Studies (Reference 5.3-13);
- NUREG/CR-5575, Quantitative Analysis of Potential Performance Improvements for the Dry PWR Containment (Reference 5.3-14);
- Combustion Engineering (CE) System 80+ SAMDA submittal (Reference 5.3-15;
- NUREG-1462, NRC Review of the Asea Brown Boveri, Inc./CE System 80+ Submittal (Reference 5.3-16);
- An ICONE paper by C. W. Forsberg, et al., on a core melt source-reduction system (Reference 5.3-17);

- TVA's SAMDA evaluation for Watts Bar Nuclear Plant based on the updated IPE (Reference 5.3-18);
- Arkansas Nuclear One Unit 1 Probabilistic Risk Assessment Summary Report (Reference 5.3-19);
- The Arkansas Nuclear One, Unit 1 Individual Plant Examination of External Events (IPEEE) (Reference 5.3-20);
- Turkey Point, Applicant's Environmental Report, Operating License Renewal Stage, Attachment F (Reference 5.3-21);
- Oconee Nuclear Station, Applicant's Environmental Report, Operating License Renewal Stage, Attachment K (Reference 5.3-22);
- Edwin I. Hatch Nuclear Plant Application for Renewed Operating License (Reference 5.3-23);
- FCS IPE submittal (Reference 5.3-24); and
- Calvert Cliffs Nuclear Power Plant, Applicant's Environmental Report, Operating License Renewal Stage, Attachment 3 (Reference 5.3-25).

Although FCS has a CE-designed nuclear steam supply system, each of the above documents was reviewed for potential SAMAs even if they were not necessarily applicable to a CE plant. Those items not applicable to FCS were subsequently screened from this list. The containment performance improvement programs for boiling water reactors and for plants with ice condensers were not reviewed (and the NUREG-1560 portion of the containment performance improvements for these were not reviewed). Omaha Public Power District assumed that any issues from these documents have been included in the large, dry containment performance improvement program (NUREG/CR-5567). Conceptual enhancements for which no specific details were available (e.g., "improve diesel reliability" or "improve procedures for loss of support systems") were not included on the list unless they were considered as vulnerabilities in the FCS IPE.

5.3.2 QUALITATIVE SCREENING OF SAMAs

The resulting initial list of potential SAMAs is presented in Table 5.3-1. Table 5.3-1 also presents a qualitative screening of the initial list. Items were eliminated from further evaluation based on one of the following criteria:

- SAMA improvements that modify features not applicable to FCS;
- SAMA improvements that have already been implemented at FCS;

- SAMA improvements that could be consolidated with one or more other SAMA improvement(s);
- SAMA improvements that have previously been identified as costing greater than the maximum attainable benefit; or
- SAMA improvements that would provide minimal risk reduction.

Based on preliminary screening, 170 improvements were eliminated. Of these, 57 candidate SAMAs were not applicable, 8 were duplicates and combined into other SAMAs, 31 SAMAs were prohibitively expensive, 24 resulted in minimal risk reduction, and 50 were already implemented. The remaining 20 SAMAs were subject to further evaluation and final screening. The final screening and cost-benefit evaluation are presented in Section 4.16 of the main report.

TABLE 5.3-1
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
	Improvements related to reactor coolant pump seal loss-of-coolant accidents (loss of component cooling or service water)			
1	Cap piping downstream of normally closed component cooling drain and vent valves.	D	1, 13	Actions would not significantly impact loss-of-CCW events.
2	Improve saltwater, service water, and component cooling pump recovery (post-trip only).	D	2, 10, 13	Recoverable loss of these pumps would not significantly impact CDF or LERF.
3	Improve saltwater, service water, and component cooling pump recovery (pre-trip and post-trip).	D	2, 10, 13	Recoverable loss of these pumps would not significantly impact CDF or LERF.
4	Implement procedure and operator training enhancements for support-system failure sequences, with emphasis on anticipating problems and coping with events that could lead to loss of cooling to the RCP seals.	F	2, 13	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
5	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	B	2, 6, 11, 13	Cooling water does not cool charging pump seals.
6	Implement procedure changes to allow cross-connection of motor cooling for RHRSW pumps.	B	24	Motors are air cooled.
7	Perform enhancements to charging pump, such as increasing lube oil capacity, preventing flow diversion from relief valves, or adding a centrifugal pump.	D	2, 13, 22	Existing system is adequate and charging system poses minimal contribution to plant risk.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
8	Eliminate reactor coolant pump thermal barrier dependence on component cooling, such that loss of component cooling does not result directly in core damage.	C	2, 13	Without eliminating the impact for SBO events, the modifications would not provide a significant risk reduction. However, to address SBO a fix such as SAMA No. 11 would be required, which is cost prohibitive.
9	Install an additional service water pump.	F	5	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
10	Install the improved N 9000 reactor coolant pump seals.	F	11, 13	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
11	Create an independent reactor coolant pump seal injection system with or without a dedicated diesel.	C,D	6, 11, 13	Without a dedicated diesel, the impact of the modification on CDF and LERF would be negligible. With a dedicated diesel, the change would be cost prohibitive.
12	Use existing hydro test pump for reactor coolant pump seal injection.	B	7	Not applicable to FCS.
13	Eliminate Emergency Core Cooling System dependency on Component Cooling Water System by replacing ECCS pump motors with air-cooled motors or by providing self-cooled ECCS seals.	B	10, 13, 22	Motors are air cooled. FCS can function in injection and recirculation without seal cooling.
14	Install an additional CCW pump.	A	13	FCS already has three CCW pumps.
15	Change procedures to isolate reactor coolant pump seal letdown flow on loss of component cooling, and provide guidance on loss of injection during seal loss-of-coolant accident.	E	13	This SAMA is a subset/duplicate of SAMA No. 4 and will be evaluated as part of SAMA No. 4.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
16	Implement procedures to stagger high-pressure safety injection pump use after a loss-of-service water.	B	13	Not applicable to FCS.
17	Use Fire Protection System pumps as a backup for seal injection and high-pressure makeup.	B	13	Fire Protection System capabilities do not support makeup to RCS. Guidance to use fire pumps for SG cooling is included in the FCS SAMG.
18	Improve ability to cool residual heat removal heat exchangers.	A	12, 13	RW backs up CCW. Additional redundancy is not required.
	Improvements related to Heating, Ventilation, and Air Conditioning			
19	Stage backup fans in switchgear rooms.	A	1, 13	Equivalent procedures in place.
20	Provide a redundant train of ventilation to 480V switchboard rooms.	A	2, 13, 18	Air conditioners in rooms with fresh air backup.
21	Implement procedures for temporary heating, ventilation, and air conditioning.	A	11, 13	EOP-13 addresses this issue.
22	Add a switchgear room high-temperature alarm.	B	13	Some high-temperature alarms are available in the room. In addition, the long heatup times coupled with individual equipment alarms make this issue not applicable at FCS.
23	Create ability to switch fan power supply to direct current in a station blackout event.	D	13	FCS has electrical equipment located in large rooms; therefore, contribution from HVAC would be small.
	Improvements related to ex-vessel accident mitigation/containment phenomena			
24	Delay Containment Spray System actuation after large loss-of-coolant accident.	D	2, 6	Risk impact negligible.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
25	Install containment spray pump header automatic throttle valves.	E	11, 12, 13	The issues associated with this SAMA are related to SAMA No. 172. FCS is monitoring industry research and will address this issue as it relates to compliance with design criteria on an as-needed basis.
26	Install an independent method of suppression pool cooling.	B	3, 4	Not applicable to PWRs.
27	Develop an enhanced drywell spray system.	B	3, 4, 16, 17	Not applicable to PWRs.
28	Provide a dedicated existing drywell spray system.	B	3, 4	Not applicable to PWRs.
29	Install a containment vent large enough to remove anticipated transients without scram decay heat.	B	3, 4	Not applicable to PWRs.
30	Install a filtered containment vent to remove decay heat.	C	3, 4	CCNPP (Reference 5.3-25) estimated the cost of this enhancement as $5.7M, which exceeds the maximum attainable benefit.
31	Install an unfiltered, hardened containment vent.	A	3, 4, 9, 14	FCS can vent containment via a hydrogen purge line.
32	Install hydrogen recombiners.	D	24	Hydrogen recombiners have been determined to have limited value for mitigating large, dry PWR severe accident consequences.
33	Create/enhance hydrogen igniters with independent power supply or passive ignition system.	D	3, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17	Analyses of post-accident containment hydrogen threats were evaluated in the FCS PRA model and found to be a negligible contributor to containment failure.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
34	Create a molten core debris containment system with heat removal capabilities under the basemat or other enhancements to prevent melt-through, such as thicker basemat.	B	3, 4, 6, 8, 11, 16, 17, 19	FCS is designed with a passively flooded cavity. Any severe accident event that does not bypass the containment and fails the RV lower head will result in the quenching of debris. When the SIRWT contents are injected into the Containment, the RV can be flooded to the vessel beltline.
35	Provide modification for flooding of the drywell head.	B	4, 9	Not applicable to PWRs.
36	Enhance Fire Protection System and/or Standby Gas Treatment System hardware and procedures.	B	4	The Standby Gas Treatment System is not applicable to FCS. The Fire Protection System portion of this SAMA will be evaluated as part of SAMA No. 41.
37	Create a reactor cavity flooding system.	A	5, 6, 9, 11, 12, 13, 15, 16, 17	See response to SAMA No. 34.
38	Create other options for reactor cavity flooding.	A	7, 9, 13	See response to SAMA No. 34.
39	Enhance air return fans (ice condenser containment).	B	6, 11	SAMA is not applicable to FCS.
40	Provide containment inerting capability.	B	6, 9, 11, 14	SAMA is not applicable to FCS.
41	Use the Fire Protection System as a backup source for the Containment Spray System.	F	7, 9, 10, 12	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.

TABLE 5.3-1 (CONTINUED)

INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
42	Install a passive Containment Spray System.	C	8	FCS has redundant containment heat removal systems consisting of 2 CS and 2 CARC trains with multiple coolers per train. Benefit of passive containment heat removal is minimal and ability to perform such a backfit is unlikely.
43	Install secondary containment filtered ventilation.	B	8	SAMA is not applicable to FCS.
44	Increase containment design pressure.	C	8	Extensive reconstruction of the Containment Building would be needed for an existing plant.
45	Provide a reactor vessel exterior cooling system.	A	16, 17	See response to SAMA No. 34.
46	Construct a building, maintained at a vacuum, to be connected to the Containment.	C	17	Engineering judgement indicates that the implementation costs of this SAMA would greatly exceed the maximum attainable benefit. In addition, CE System 80+ judged this would not help to mitigate containment bypass.
47	Add ribbing to the containment shell.	B	17	SAMA is not applicable to FCS.
48	Install a Reactor Building liner protective barrier.	C	20	Engineering judgement indicates that the implementation costs of this SAMA would greatly exceed the maximum attainable benefit.
	Improvements related to improvement of alternating current/direct current power reliability/availability			
49	Train operations crew for response to inadvertent actuation signals.	B	1, 13	In general, procedures of this type are already in place. Specific procedure under consideration not applicable to FCS design.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
50	Proceduralize alignment of spare diesel to shutdown board after loss-of-offsite power and failure of the diesel normally supplying it.	B	2	SAMA is not applicable to FCS.
51	Provide an additional diesel generator.	C	5, 6, 10, 13, 16, 17	The cost of this enhancement exceeds the maximum attainable benefit . CCNPP (Reference 5.3-25) estimated the cost of this enhancement as greater than $20M.
52	Provide additional DC battery capacity.	F	5, 6, 13, 16, 17	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
53	Improve bus cross-tie ability.	A	10, 13	FCS has evaluated the applicability of this SAMA and significant issues associated with spurious actuation have been resolved previously. OI-EE-2B addresses the issue of bus cross tie.
54	Incorporate an alternate battery charging capability.	F	10, 11, 12, 13	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
55	Modify direct current bus A reliability.	D	24	Reliability is already high. No benefit expected.
56	Increase/improve direct current busload shedding.	F	10, 11, 12, 13	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
57	Replace batteries with a more reliable model.	A	10	Batteries are of acceptably high reliability.
58	Create alternating current power cross-tie capability across units at a multi-unit site.	B	11, 12, 13	FCS is a single-unit site.
59	Create a cross-unit tie for diesel fuel oil.	B	13	FCS is a single-unit site.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
60	Develop procedures to repair or replace failed 4- kV breakers.	F	13	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
61	Emphasize steps in recovery of offsite power after a station blackout.	A	13	FCS Station Blackout EOP has been recently upgraded and has adequate detail.
62	Develop a severe weather conditions procedure.	A	13	Severe weather procedures are already in place.
63	Develop procedures for replenishing diesel fuel oil.	A	13	FCS has a seven-day diesel fuel oil supply and refill procedures are included in EPIPs.
64	Install gas turbine generators.	C	13	CCNPP (Reference 5.3-25) estimated the cost of this enhancement at $3.3M, which exceeds the maximum attainable benefit.
65	Install gas turbine generators with tornado protection.	C	16, 17	See response to SAMA No. 64.
66	Create a backup source for diesel cooling.	B	13	FCS diesels are air cooled.
67	Provide a connection to an alternate offsite power source.	C	13	CCNPP (Reference 5.3-25) estimated the cost of this enhancement as greater than $25M. The FCS supply grid has been recently upgraded.
68	Implement underground offsite power lines.	C	13	CCNPP (Reference 5.3-25) estimated the cost of this enhancement as greater than $25M, which exceeds the maximum attainable benefit.
69	Replace anchor bolts on diesel generator oil cooler.	A	13	Walkdown done as part of SQUG Program has been completed. Any seismic enhancements addressed through SQUG .

TABLE 5.3-1 (CONTINUED)

INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
70	Change undervoltage, auxiliary feedwater actuation signal block, and high pressurizer pressure actuation signals to 3-out-of-4 logic, instead of 2-out-of-4.	B	18	FCS trip signals utilize 2-out-of-4 logic.
71	Add an automatic bus transfer feature to allow the automatic transfer of the 120V vital AC bus from the on-line unit to the standby unit.	B	18	Feature not available at FCS.
72	Add disconnects at the junction box on the roof of the Auxiliary Building where 4 kV power from the 0C diesel generator branches to all four switchgears. The disconnects would allow the recovery of the 0C diesel generator following the loss of any switchgear.	B	18	SAMA refers to third EDG. Equivalent equipment not available at FCS.
	Improvements in identifying/coping with containment bypass			
73	Create/enhance Reactor Coolant System depressurization ability.	E	1, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17	Feed-and-bleed can be successfully accomplished with one PORV. See SAMA No. 183 for evaluation.
74	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture.	D	16, 17	Sufficient means of plant cooldown exist. Action has minimal benefit.
75	Improve/add additional steam generator tube rupture coping abilities.	D	7, 8, 9, 10, 13, 14, 16, 17	Thermal-hydraulic analyses suggest SIRWT inventory is sufficient to accommodate a SGTR event for more than 24 hours. Additional coping capabilities not necessary.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
76	Increase secondary-side pressure capacity such that a steam generator tube rupture would not cause the relief valves to lift.	C	8, 17	For an existing plant, increasing the secondary-side pressure capacity is not feasible, as it would require an entirely new secondary system.
77	Replace steam generators with new design.	C	13	CCNPP (Reference 5.3-25) estimated the cost of this enhancement at more than $100M.
78	Revise emergency operating procedures to direct that a faulted steam generator be isolated	A	13	Guidance already addressed in FCS EOPs.
79	Direct steam generator flooding after a steam generator tube rupture, prior to core damange.	A	14, 15	The action described in this SAMA is already recommended in the FCS SAMG.
80	Implement a maintenance practice that inspects 100 percent of the tubes in a steam generator.	C	16, 17	CCNPP (Reference 5.3-25) estimated the cost of this enhancement at $8M per year.
81	Locate residual heat removal inside of the Containment.	C	8	For an existing plant, relocating the RHR System inside the Containment is not feasible, as it would require an entirely new RHR system.
82	Install self-actuating containment isolation valves.	B	8	Vast majority of penetrations are AOVs that fail closed on loss of power or loss of IA.
83	Install additional instrumentation for inter-system loss-of-coolant accidents.	A	5, 6, 11, 13	Maintenance and testing procedures already cover this. Power is removed from SDC MOVs.
84	Increase frequency of valve leak testing.	D	12	Impact negligible based on CIV RRW.
85	Improve operator training on inter-system loss-of-coolant accident coping.	A	12, 13	ISLOCAs identified in the FCS PRA model are included in the biennial operator requalification training cycle.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
86	Install relief valves in the Component Cooling Water System.	A	13	Issue addressed by adjusting positioning of associated CIV.
87	Revise emergency operating procedures to improve inter-system loss-of-coolant accident identification.	E	13	This SAMA duplicates SAMA No. 85.
88	Ensure all interfacing system loss-of-coolant accident releases are scrubbed.	F	14, 15	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
89	Add redundant and diverse limit switch to each containment isolation valve.	D	16, 17	This involves a hardware change with minimal risk reduction.
90	Keep low-pressure injection/decay heat removal and reactor building spray pump drains closed.	B	20	Each room has its own sump.
91	Verify valve position.	A	20	Procedures for checking valve position are in place.
92	Conserve/makeup Borated Water Storage Tank inventory post accident.	F	20	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
93	Remove and flange the hydrogen purge valves.	B	20	FCS credits use of hydrogen purge in SAMG actions.
	Improvements in reducing internal flooding frequency			
94	Modify swing direction of doors separating Turbine Building basement from areas containing safeguards equipment.	B	13	FCS has different design. Basement does not communicate with any safeguards compartments.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
95	Improve inspection of rubber expansion joints on main condenser.	A	13	FCS has rubber expansion joints that are replaced on a preventive maintenance schedule. In addition, a flood like this is not a credible serious risk for FCS.
96	Implement internal flood prevention and mitigation enhancements.	A	13	Enhancements already included following plant internal flooding study.
	Improvements related to feedwater/feed-and-bleed reliability/availability			
97	Install a digital feedwater upgrade.	D	1, 13	Performance of main FW regulation valves is not risk-significant and FCS has motor-driven MFW pumps.
98	Perform surveillance on manual valves used for backup auxiliary feedwater pump suction.	A	1, 13	SO-0-37 requires periodic verification of AFW alignment.
99	Install manual isolation valves around auxiliary feedwater turbine-driven steam admission valves.	D	1, 13	Risk reduction worth of existing TAV is small. No benefit expected.
100	Install accumulators for turbine-driven auxiliary feedwater pump flow control valves (control valves).	B	11	Accumulators good for 3 cycles. Valves may then be hand jacked. No action required.
101	Install separate accumulators for the auxiliary feedwater cross-connect and block valves.	A	18	Cross-tied MOV and AOV have separate accumulators.
102	Install a new Condensate Storage Tank.	C	13, 16, 17	CCNPP (Reference 5.3-25) estimated the cost of this enhancement at $1M. Costs at FCS would be similar and the benefit would be small.
103	Provide cooling of steam-driven auxiliary feedwater pump in a station blackout event.	B	13	Pump is self-cooled.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
104	Proceduralize local manual operation of auxiliary feedwater when control power is lost.	A	13	OI-AFW-4 addresses manual operation.
105	Provide portable generators, to be hooked into the turbine-driven auxiliary feedwater pump after battery depletion.	B	16, 17	TD pump does not need electrical power once it starts.
106	Add a motor train of auxiliary feedwater to the steam trains.	A	13	FW-6 is in place.
107	Create ability for emergency connections of existing or alternate water sources to feedwater/condensate.	A	12, 18	Installed cross-tie between Fire Water and FW systems. (See FCS EOP-20.)
108	Use Fire Protection System as a backup for steam generator inventory.	A	13	FCS EOP-20 provides for FP System backup source for steam generator inventory.
109	Procure a portable diesel pump for isolation condenser makeup.	B	13	Not an FCS component.
110	Install an independent diesel generator for the Condensate Storage Tank makeup pumps.	D	13	There are four ways to refill the CST; two with power and two without power. Existing CST can accommodate 24 hrs + of post-accident operation.
111	Change failure position of condenser makeup valve.	A	13	LCV-1190 was modified by adding an accumulator and a manual isolation valve.
112	Create passive secondary-side coolers.	C	17	For an existing plant, design and installation of this SAMA is not considered feasible, as it would involve major changes in plant structures.
113	Reduce the support system requirements for low-pressure feed.	B	18	Equivalent systems not available at FCS.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
114	Replace current power-operated relief valves with larger ones such that only one is required for successful feed-and-bleed.	A	18	Only one PORV is required for feed-and-bleed.
115	Install an emergency feedwater pump common discharge valve.	B	20	No common discharge at FCS.
	Improvements in core cooling systems			
116	Provide capability for diesel-driven, low-pressure vessel makeup.	C	4, 13, 15	Engineering judgment indicates that the implementation costs of this SAMA would greatly exceed the maximum attainable benefit because a complete new system would be required.
117	Provide an additional high-pressure safety injection pump with independent diesel.	C	6, 16, 17	CCNPP (Reference 5.3-25) estimated the cost of this enhancement at between $5M and $10M, which exceeds the maximum attainable benefit.
118	Install independent alternating current High-Pressure Safety Injection System.	C	11	CCNPP (Reference 5.3-25) estimated the cost of this enhancement at between $5M and $10M, which exceeds the maximum attainable benefit.
119	Create the ability to manually align Emergency Core Cooling System recirculation.	A	12	Capability exists via remote operation.
120	Implement a Refueling Water Tank makeup procedure.	E	12, 13	See SAMA No. 92.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
121	Stop low-pressure safety injection pumps earlier in medium or large loss-of-coolant accidents/ emphasize timely recirculation swapover in operator training.	D	13	The benefits for this SAMA are minimal, as estimated by CCNPP (Reference 5.3-25). FCS has automatic recirculation actuation. The costs associated with revising calculations, accident analyses, and procedures would exceed the minimal benefits.
122	Upgrade Chemical and Volume Control System to mitigate small loss-of-coolant accidents.	C	8	Larger charging pumps could reduce ISLOCA CDF; however, cost would be very expensive.
123	Install an active High-Pressure Safety Injection System.	B	8	SAMA intended for passive plant assessment. FCS has active HPSI System.
124	Change "in-containment" Refueling Water Tank suction from 4 check valves to 2 check and 2 air-operated valves.	B	8	SAMA intended for passive plant assessment. FCS has active HPSI System.
125	Replace two of the four safety injection pumps with diesel-powered pumps.	C	16, 17	Engineering judgment indicates that the implementation costs of this SAMA would greatly exceed the maximum attainable benefit.
126	Align low-pressure core injection or core spray to Condensate Storage Tank on loss of suppression pool cooling.	B	10, 13	BWR issue.
127	Raise high-pressure core injection/reactor core isolation cooling backpressure trip setpoints.	B	13	BWR issue.
128	Improve the reliability of the automatic depressurization system.	B	4	BWR issue.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
129	Disallow automatic vessel depressurization in non-anticipated transients without scram scenarios.	B	13	BWR issue.
130	Create automatic swapover to recirculation on Refueling Water Tank depletion.	A	5, 6, 11	Included in original plant design.
	Instrument air/gas improvements			
131	Modify emergency operating procedures for ability to align diesel power automatically to air compressors.	A	13	EOP Attachments 12 and 13 provide procedures for charging the EDG air start banks with the diesel-driven compressors.
	Improvements in anticipated transient without scram coping			
132	Replace old air compressors with more reliable ones.	D	13	The compressors installed at FCS are highly reliable.
133	Install nitrogen bottles as backup gas supply for safety relief valves.	E	13	Duplicate of SAMA No. 186.
134	Install motor-generator set trip breakers in Control Room.	B	11	FCS does not have motor-generator sets.
135	Add capability to remove power from the bus powering the control rods.	A	13	This is part of the original FCS plant design.
136	Create cross-connect ability for standby liquid control trains.	A	13	FCS has capability to cross-tie boric acid pumps or boric acid gravity feed.
137	Create an alternate boron injection capability (backup to standby liquid control).	A	13	FCS has capability to cross-tie boric acid pumps or boric acid gravity feed.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
138	Remove or allow override of low-pressure core injection during anticipated transients without scram.	B	13	LPSI provides no benefit during ATWS scenarios.
139	Install a system of relief valves that prevents any equipment damage from a pressure spike during anticipated transients without scram event.	D	16, 17	Minimal benefit since ATWS is a small contributor to CDF and LERF.
140	Create a boron injection system to back up the mechanical control rods.	A	16, 17	Boron injection system is available at FCS.
141	Provide an additional instrument system for anticipated transients without scram mitigation (e.g., anticipated transients without scram mitigation scram actuation circuitry).	A	16, 17	Plants trips on "Hi-Hi" pressurizer pressure.
		Other improvements		
142	Provide capability for remote operation of secondary-side relief valves in station blackout.	E	2	Duplicates SAMA No. 186.
143	Defeat 100 percent load rejection capability.	B	13	FCS does not have the ability to reject load; therefore, there is no way to defeat this ability.
144	Change control rod drive flow control valve failure position.	B	13	Not applicable to PWR plants.
145	Install secondary-side guard pipes up to the main steam isolation valves.	C	16, 17	Engineering judgment indicates that the implementation costs of this SAMA would greatly exceed the maximum attainable benefit.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
146	Install digital large break loss-of-coolant accident protection.	C	17	Engineering judgment indicates that the implementation costs of this SAMA would greatly exceed the maximum attainable benefit.
147	Increase seismic capacity of the plant to a high confidence, low-pressure failure of twice the safe shutdown earthquake.	A	17	Seismic analysis done in response to GL 88-20 included identification of cost-beneficial seismic. These are being addressed within the SQUG.
148	Enhance the reliability of the demineralized water makeup system through the addition of diesel-backed power to one or both of the demineralized water makeup pumps.	A	18	FCS already has four sources of makeup water for long-term decay heat removal.
149	Proceduralize intermittent operation of high-pressure coolant injection.	A	24	This is part of the HPSI stop and throttle strategy included in the FCS EOPs.
150	Increase the reliability of safety relief valves (adding electrical signal to open automatically).	B	24	Does not apply to PWRs.
151	Install motor-driven feedwater pump.	A	24	FCS has three motor-driven FW pumps.
152	Implement procedure to instruct operators to trip unneeded residual heat removal/CS pumps on loss of room ventilation.	B	24	FCS does not have an HVAC dependency for RHR/CS pumps.
153	Increase available NPSH for the injection pumps.	A	24	Analyses have verified existence of adequate NPSH.
154	Increase the safety relief valve reseat reliability.	D	24	Stuck open SRV is not a significant contributor to CDF and LERF.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
155	Reduce direct current dependency between high-pressure injection system and automatic depressurization system.	B	24	Item refers to BWR systems.
156	Modify RWCU for use as a decay heat removal system and proceduralize use.	B	24	Item refers to BWR systems.
157	Use control rod device for alternate boron injection.	B	24	Item refers to BWR systems.
158	Allow cross-connection of uninterruptible compressed air supply to opposite unit.	B	24	Not applicable to a single-unit site.
159	Ensure that motor control centers are adequately secured per seismic or other requirements.	A	21	Seismic analysis done in response to GL 88-20 included identification of cost-beneficial seismic modifications. These are being addressed within the SQUG.
160	Ensure that control cabinets are adequately secured per seismic or other requirements.	A	21	Seismic analysis done in response to GL 88-20 included identification of cost-beneficial seismic modifications. These are being addressed within the SQUG.
161	Ensure that compressed gas, gas, propane, or tanks containing other flammable/ combustible fluids are adequately secured per seismic or other requirements.	A	21	Seismic analysis done in response to GL 88-20 included identification of cost-beneficial seismic modifications. These are being addressed within the SQUG.
162	The angle frame around the cover plate for valves CV-2233, CV-2234, CV-2214 must be widened to accommodate more movement.	B	21	Specific to ANO-1; therefore, not applicable to FCS.
163	Adequate clearance for motor-operated valve CV-3851 must be verified.	B	21	Specific to ANO-1; therefore, not applicable to FCS.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
164	Additional flexibility in the power cable for CV-3850 must be provided.	B	21	Specific to ANO-1; therefore, not applicable to FCS.
165	Further investigate the calculated value for high confidence of low probability of failure (<0.3f) for the Emergency Diesel Fuel Tanks (T-57A and T-57B).	A	21	Seismic analysis done in response to GL 88-20 included identification of cost-beneficial seismic modifications. These are being addressed within the SQUG.
166	Add scuppers to the parapet walls of the roof structures to limit the amount of water that can build up.	A	21	Compliance with the design basis of the plant provides sufficiently low risk.
167	Separate non-vital buses from vital buses.	C	22	Negligible risk reduction and large anticipated cost.
168	Make component cooling water trains separate.	C	22	Negligible risk reduction and large anticipated cost.
169	Make intermediate cooling water trains separate.	C	22	Negligible risk reduction and large anticipated cost.
170	Provide a motor-operated auxiliary feedwater pump.	E	22	See SAMA No. 151.
171	Provide containment isolation design per General Design Criteria and Standard Review Plan.	C	22	Addressed through design basis; further improvements determined to be cost prohibitive.
172	Improve residual heat removal sump reliability.	D	22	Minimal risk reduction.
173	Provide Auxiliary Building Vent/Seal structure.	C	22	Iodine retention in AB considered in plant-specific FCS fixes. Sealing AB at FCS considered not cost beneficial.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
174	Add charcoal filters on Auxiliary Building exhaust.	B	22	FCS does not have a secondary containment.
175	Add penetration valve leakage control system.	D	22	Penetration leakage is not a significant contributor to LERF.
176	Enhance screen wash.	D	22	Wash does not significantly reduce CDF or LERF.
177	Enhance training for important operator actions.	D	22	Operator actions have been highlighted in FCS PRA model-associated training; therefore, operator actions are not likely to measurably reduce the probabilities of failure.
178	Enhance tornado protection for tanks, pumps, switchgear, or other equipment/rooms that may not have protection or that may be susceptible to tornadoes in category F2.	A	23	Most equipment important to severe accident risk is located inside buildings. The CST and HVAC units have been evaluated for severe weather vulnerability.
179	Man safe shutdown valve continuously to align Coolant Makeup System for reactor coolant pump seal cooling.	B	23	Equivalent component not available at FCS.
180	Replace reactor vessel with stronger vessel.	C	23	RV failure probability is low (less than 10E-07 per year). RV replacement would be very costly.
	Ft. Calhoun Station Unit 1-specific SAMAs			
181	Add accumulators or implement training on SIRWT bubblers and recirculation valves.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
182	Add capability for steam generator level indication during an SBO.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition
183	Add 480 VAC power supply to open the PORV.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
184	Add capability to flash the field on the EDG to enhance SBO recovery.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
185	Remove SI-2C from auto-start.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
186	Add manual steam relief capability and associated procedures.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
187	Enhance operation of FW-54.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
188	Enhance external flood procedures.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
189	Add TSP into Auxiliary Building.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.
190	Enhance EOPs to provide guidance to operators to better avert TI-SGTR.	F	FCS	Considered in cost-benefit evaluation. See Section 4.16 of the main report and Appendix Section 5.4.

TABLE 5.3-1 (CONTINUED)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE FCS SAMA ANALYSIS[a]

SAMA No.	Potential Enhancement	Screening Criterion[b]	Reference Source	Disposition

a. Acronyms used in Table 5.3-1 are defined in Section 5.6. Numbers provided as reference sources correspond to references listed for Section 5.3 in the reference list presented in Section 5.5.

b. Screening Criteria:
A – Already Implemented
B – Does Not Apply
C – Excess Cost
D – Minimal Risk Reduction
E – Duplicate
F – Further Evaluation

5.4 SAMA EVALUATION SUMMARIES

This section includes an evaluation summary for each of the 20 Severe Accident Mitigation Alternatives (SAMAs) Omaha Public Power District (OPPD) evaluated in the cost-benefit analysis. Each summary includes a Fort Calhoun Station Unit 1-(FCS-) specific description of the candidate SAMA, a discussion of the potential benefits, a summary of the evaluation and resulting benefits, and discussion of the associated costs.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 4
CATEGORY: Improvements Related to the Mitigation of RCP Seal LOCA
TITLE: Implement procedure and operator training enhancements for support-system failure sequences, with emphasis on anticipating problems and coping with events that could lead to loss of cooling to the RCP seals

Description:
This SAMA would provide procedural changes and associated operator training for coping with events that could lead to loss of cooling to reactor coolant pump (RCP) seals. Operator actions to be added potentially include: (1) directions for operators to control reactor coolant system (RCS) cooling on the reactor cold leg to >50 deg F; and (2) directions for operators to fully isolate controlled bleed off (CBO) (including potential excess flow relief valves) following events that could lead to loss of RCP seal cooling.

SAMA Benefits:
This SAMA potentially improves the ability of the operator to minimize the probability of incurring a loss of seal cooling. Byron Jackson (BJ) pump seals have a greater probability of failure when subcooling in the seal stages is decreased. The ability to control subcooling will minimize seal stage heatup, increase pressure, and subsequently increase subcooling of downstream seal stages.

Evaluation:
The impact of this SAMA was evaluated by assuming that all core damage events associated with loss of component cooling water (LOCCW) initiators and those associated with station blackouts (SBOs) with induced RCP seal failures will be eliminated from the plant core damage frequency (CDF). Using the Rev. 3 CDF as a basis, the CDF would decrease by 1.10E-06 per year. The population dose would decrease by 0.24 person-rem per year.

Cost of Implementation:
Analysis would need to be performed to provide the bases for the procedure changes. Procedure changes to the Emergency Operating Procedures (EOPs) would need to be made and training for the operators would be required. After initial training on the procedures, the operators would be trained in the existing training regime. The cost of this alternative is expected to be less than $30K. OPPD will continue to monitor industry developments.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 9
CATEGORY: Improvements Related to the Mitigation of RCP Seal LOCA
TITLE: Install an additional service water pump

Description:
The Raw Water (RW) System and Component Cooling Water (CCW) System are subsystems within the FCS Service Water System. This SAMA assumes that a swing pump will be installed in the FCS RW System. To increase the pump's capabilities and reliability, the pump will be procured such that no common-cause failure link exits between the new and existing RW pumps. The RW pump will be designed such that the swing pump will automatically align to the service water header without an operating pump.

SAMA Benefits:
The addition of an independent RW pump will increase the reliability of RW System backup in the event of an LOCCW event. Consequently, availability of the RW System will limit the potential impact of LOCCW events.

Evaluation:
The impact of this SAMA change was optimistically evaluated by assuming that all core damage events associated with an LOCCW can be eliminated. Elimination of LOCCW events would decrease the plant CDF by 7.0E-07 per year. This would result in a reduction in population dose exposure of 0.145 person-rem per year.

Cost of Implementation:
Addition of a swing pump to the RW System is a major project. The cost of a safety-related (SR) RW pump, volute, and 400 horsepower (hp) Westinghouse motor at Calvert Cliffs Nuclear Power Plant (CCNPP) is about $460K. In addition, each header would have to be modified to accept the swing pump piping, system piping, valves, supports, SR power supply to the motor with diesel back-up capability, and pump and valve control logic and circuitry. The estimated costs are expected to exceed $460K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 10
CATEGORY: Improvements Related to the Mitigation of RCP Seal LOCA
TITLE: Install the improved N 9000 reactor coolant pump seals

Description:
This SAMA will replace the current BJ RCP seal with a newer version ("N") seal. The replacement seal is an enhanced RCP seal design that is more resistant to temperature-induced RCP seal failures. This improved performance is a result of the replacement of the Nitril "U" cup with an ethylene propylene rubber seal of an improved hydrodynamic design.

SAMA Benefits:
The "N" seal will improve seal performance during normal operation, as well as, during plant upsets. The "N" seal has been specially tested under plant SBO conditions (including effects of shaft motion) for a period of 8 hours.

Evaluation:
The risk benefits are bounded by the risk benefits of SAMA No. 4. That is, the "N" seal is assumed to reduce CDF (due to decreased probability of induced RCP seal failures) by 1.10E-06 per year and decrease population dose by 0.24 person-rem per year.

Cost of Implementation:
One replacement BJ N 9000 RCP seal costs $400K. Material costs alone exceed $2M.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 41
CATEGORY: Improvements Related to the Mitigation of RCP Seal LOCA
TITLE: Use FP System as back-up source for the CS System

Description:
This SAMA involves upgrading the Fire Protection (FP) System and constructing a hard-pipe connection to the Containment Spray (CS) System. The FP System utilizes a diesel-powered pump and will, therefore, be available during SBO events. Procedures for implementation would be included in the FCS Severe Accident Mitigation Guidelines (SAMG).

SAMA Benefits:
This upgrade would add additional redundancy for achieving Containment Heat Removal (CHR) during a severe accident. Currently, CHR is supported by containment sprays or containment air recirculation coolers.

Evaluation:
Availability of the FP System for CHR is assumed to reduce all late containment failures to zero. There is no associated impact on the CDF, and the population dose would decrease by 0.86 person-rem per year.

Cost of Implementation:
This alternative would require a piping modification and design evaluation, including analysis of the pipe layout and seismic supports. System operating characteristics would also be closely reviewed. Procedure changes would be needed, as well as training. Assuming a minimum cost of $70K for a hardware modification, implementation costs would greatly exceed the benefit.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 52
CATEGORY: Improvements in Identifying/Coping with Containment Bypass
TITLE: Provide additional DC battery capacity

Description:
Install additional batteries to extend 125 volts direct current (VDC) battery life to 24 hours.

SAMA Benefits:
This upgrade would increase the capability of the plant to cope with SBO events. By extending the battery life to 24 hours, the opportunity for power recovery is increased and alternative coping strategies can be established.

Evaluation:
The evaluation of longer battery life calculates the post-SAMA CDFs by eliminating core damage due to long-term battery depletion. This assumes all late SBOs are fully recoverable (full recovery). This results in a 20 percent reduction in CDF (change in CDF of 4.2E-06 per year). Assuming the release classes would be divided into containment bypass and late containment failures (10 percent bypass and 90 percent late), bypass events are assumed to result from a thermally induced steam generator tube rupture (TI-SGTR). The resulting population dose reduction would be 1.22 person-rem per year.

Cost of Implementation:
The scope of this modification includes the purchase of new battery strings at a cost of approximately $100K for a string of 12 yielding 120 amps. Modifications to the storage racks and potential modification to the battery room would cost an additional $60K per string. Design analysis costs for installation of an additional string would be minor, on the order of $50K. To triple the life of the battery by expansion would require a new structure to house the additional batteries, driving the cost to the $8M level. The batteries alone would cost over $2M. CCNPP estimated $3.5M to double the batteries, changing the configuration from a 4-hour to an 8-hour design. The estimated cost well exceeds the benefit.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 54
CATEGORY: Improvements in Identifying/Coping with Containment Bypass
TITLE: Incorporate an alternate battery charging capability

Description:
Add independent power supply (20-kilowatt DC source) to charge batteries.

SAMA Benefits:
This upgrade would increase the capability of the plant to cope with SBO events. By extending the battery life to 24 hours the opportunity for power recovery is increased and alternative coping strategies can be established.

Evaluation:
The evaluation of longer battery life calculates the post-SAMA CDFs by eliminating core damage due to long-term battery depletion. This assumes all late SBOs are fully recoverable (full recovery). This results in a 20 percent reduction in CDF (change in CDF of 4.2E-06 per year). Assuming the release classes will be divided into containment bypass and late containment failures (10 percent bypass and 90 percent late), bypass events are assumed to result from a TI-SGTR. The resulting population dose reduction would be 1.22 person-rem per year.

Cost of Implementation:
The scope of this modification includes the purchase of a dedicated 20-kilowatt diesel power supply. Associated housing, fuel supply, and monitoring equipment would also have to be acquired. Implementation would require revisions to existing plant operating and maintenance procedures and operator training. OPPD estimates the cost of implementation to exceed $150K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 56
CATEGORY: Improvements in Identifying/Coping with Containment Bypass
TITLE: Increase/improve DC busload shedding

Description:
Improve 125 VDC busload management to allow the 125 VDC batteries to last for 24 hours.

SAMA Benefits:
This upgrade would increase the capability of the plant to cope with SBO events. By extending the battery life to 24 hours the opportunity for power recovery is increased and alternative coping strategies can be established.

Evaluation:
The evaluation of longer battery life calculates the post-SAMA CDFs by eliminating core damage due to long-term battery depletion. This assumes all late SBOs are fully recoverable (full recovery). This results in a 20 percent reduction in CDF (change in CDF of 4.2E-06 per year). Assuming the release classes will be divided into containment bypass and late containment failures (10 percent bypass and 90 percent late), bypass events are assumed to result from a TI-SGTR. The resulting population dose reduction would be 1.22 person-rem per year.

Cost of Implementation:
FCS is an 8-hour plant for battery life during an SBO. It is estimated to take 1,500 to 2,000 man-hours of design work to review the DC loads and the SBO calculations and load requirements, perform battery sizing calculation reviews, and determine the impact of shedding loads to extend the battery life to 24 hours (approximately $160,000). Revisions to the EOPs and associated operator training would have to be performed to allow the operator to manually shed loads during an SBO. The likelihood of being able to manage the battery load for 24 hours is very small. When the probability of success is applied to the estimated benefit, the implementation costs are expected to well exceed the benefit.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 60
CATEGORY: Improvements in Identifying/Coping with Containment Bypass
TITLE: Develop procedures to repair or replace failed 4 kV breakers

Description:
This SAMA includes the enhancement of procedures for recovery of a failed 4 kiloVolt (kV) transfer breaker and associated operator training. The enhancement can improve the reliability of offsite power to equipment or the associated bus.

SAMA Benefits:
This SAMA would offer a recovery path from a failure of breakers that perform transfer of 4.16 kV non-emergency buses from unit station service transformers to system station service transformers, leading to loss of emergency alternating current (AC) power (i.e., in conjunction with failures of the diesel generators).

Evaluation:
The evaluation assumed setting Basic Events ECBD1A11, ECBD1A31, ECBD1A22, and ECBD1A42 at zero. No changes in CDF or population dose were noted.

Cost of Implementation:
No benefit is associated with implementation; therefore, associated cost was not evaluated.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 88
CATEGORY: Improvements in Identifying/Coping with Containment Bypass
TITLE: Ensure all ISLOCA releases are scrubbed

Description:
Develop procedures and install systems such that every possible interfacing system loss-of-coolant accident (ISLOCA) path would undergo scrubbing.

SAMA Benefits:
ISLOCA events can potentially release large quantities of fission products directly to the environment. This SAMA would provide systems and/or procedures to ensure that all bypass releases due to ISLOCAs would be reduced.

Evaluation:
The evaluation assumed all ISLOCA sequences are scrubbed, reducing the associated releases by a factor of 5. As the progression of the ISLOCA event is unaltered, no change in CDF would result. The evaluation indicates that a reduction in the population dose of 1.30 person-rem per year could be obtained.

Cost of Implementation:
To ensure every leak path is scrubbed, multiple systems would have to be custom designed for the individual location of each vent. It is estimated that to determine the best design for each individual situation and to modify the system would cost $500K for each potential vent path. Significant effort would have to be expended to scope these modifications.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 92
CATEGORY: Improvements in Identifying/Coping with Containment Bypass
TITLE: Conserve/makeup Borated Water Storage Tank inventory post accident

Description:
Modify procedures to conserve or prolong the inventory in the Borated Water Storage Tank (Safety Injection Refueling Water Storage Tank, or SIRWT) during SGTRs. At FCS this SAMA would be implemented by providing procedures to refill the SIRWT with borated water and ensuring that the necessary boration and water sources are available.

SAMA Benefits:
An increased supply of borated water would reduce the potential for a SGTR to result in core damage. Revision 3 of the FCS probabilistic risk assessment (PRA) model conservatively assumes that once the initial SIRWT inventory is depleted the event will progress to core damage.

Evaluation:
The evaluation assumed procedures and additional sources of borated water would eliminate failures associated with depletion of the SIRWT inventory during ISLOCAs and SGTRs. The resulting improvement in plant CDF would be a reduction of approximately 5.8E-06 per year, and the resulting population dose reduction would be 1.66 person-rem per year.

Cost of Implementation:
With the assumption that no hardware modifications would be required, enhancing the guidance to replenish the tank and providing the associated training is expected to cost less than $30K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 181 (page 1 of 2)
CATEGORY: FCS-Specific SAMAs
TITLE: Add accumulators or implement training on SIRWT bubblers and recirculation valves

Description:
This SAMA would involve adding the capability to prevent an early Recirculation Actuation Signal (RAS) following the loss of instrument air. Depletion of the SIRWT bubblers will result in a low-level indication in the SIRWT and cause a premature RAS. This may cause the Emergency Core Cooling System (ECCS) and spray pumps to take suction from a sump with inadequate net positive suction head (NPSH). Pump damage and failure are possible.

The options considered by this SAMA are: (1) procurement and installation of additional accumulators to extend the instrument measurement time; (2) replacement of the existing accumulators with larger ones; or (3) implementation of procedural guidance (and the associated engineering analyses and training) to support operator actions to avert and/or recover from the premature RAS.

SAMA Benefits:
This SAMA would significantly reduce the potential for a premature RAS resulting from the depletion of the SIRWT level indication air bubblers. Currently the bubblers will last 13 hours. Several events, such as SGTRs and smaller LOCAs, may require extended feeding from the SIRWT. Extending the capability of the bubblers and/or increasing the guidance documents (EOPs /AOPs) to alert the operator to the potential inadvertent RAS will reduce the potential for or mitigate the consequences of premature RAS.

Evaluation:
The impact of this SAMA was modeled by assuming that the air supply to the bubblers will always be available. This resulted in a CDF reduction of 4.2E-06 per year. Assuming that these events will all result in late containment failures, the estimated reduction in the population dose would be 0.36 person-rem per year.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 181 (page 2 of 2)
CATEGORY: FCS-Specific SAMAs
TITLE: Add accumulators or implement training on SIRWT bubblers and recirculation valves

Cost of Implementation:
SR Instrument Air (IA) System consumption and capacity calculations would be performed as part of the modification package. A design modification to install a larger accumulator would be required, assuming the larger accumulator and regulator would fit in the same footprint as the original. If custom equipment is necessary, procurement of a larger SR accumulator and regulator to fit the location may be an added expense. Changing operator actions and the supporting design analysis to avert and recover from a premature RAS would cost about $40K and should be analyzed separate from the larger accumulator changeout option. The accumulator modification would cost about $120K. Economies in the design and analysis costs could be realized between the procedure changes and the modification. Estimated costs are expected to exceed $150K.

As an alternative, enhancing the guidance to alert operators on available time before onset of a premature RAS would involve minimal costs. OPPD estimates these costs to be less than $30K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 182
CATEGORY: FCS-Specific SAMAs
TITLE: Add capability for SG level indication during an SBO

Description:
This SAMA is intended to increase the capability of a plant to cope with an SBO event by extending the steam generator (SG) level indication. Inadequate level indication may cause SG overfeed, which can potentially drive liquid into FW-10 [the turbine-driven auxiliary feedwater (AFW) pump]. Other plants have used portable 120-volt AC (VAC) generators with manual clamps to provide the power supply to the level instrumentation.

SAMA Benefits:
Reliable feeding of the SG following an SBO will enable the plant to keep inventory in the SG, increase the reliability of the turbine-driven AFW pump, and, consequently reduce the likelihood of SG dryout.

Evaluation:
This SAMA was evaluated by assuming all SBOs that were not predicted to have induced RCP seal failure would be eliminated. This results in a CDF reduction of approximately 4.1E-06 per year. The resulting reduction in population dose was calculated to be 0.37 person-rem per year.

Cost of Implementation:
A power supply could be provided on a "crash cart" that could be used in various applications beyond that described above. A design modification package would need to be prepared. The equipment required would include a 120 VAC generator, inverters, and cables. Equipment modification may also be required to facilitate quick installation. EOPs would have to be changed and operators trained to respond to this contingency. Estimated hardware and procedure changes are expected to cost less than $30K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 183
CATEGORY: FCS-Specific SAMAs
TITLE: Add 480 VAC power supply to open the PORV

Description:
This SAMA would provide a portable power source, inverter, associated implementing cables, and necessary operating and implementation instructions for use as a backup power supply for opening the power-operated relief valve(s) [PORV(s)]. Guidance for use of this backup supply will be provided in the FCS SAMG.

SAMA Benefits:
This SAMA is primarily directed at mitigating severe accident releases following a core damage event with RCS release paths (or potential release paths) to the environment. These events include ISLOCAs and some SGTRs. Opening a PORV during a core damage event would reduce the potential for a TI-SGTR, lower RCS pressure while potentially averting a high-pressure melt ejection challenge to the Containment, and retain RCS fission products within the Containment.

Evaluation:
As this is intended for post-core damage implementation, no credit was taken for the use of the PORV in averting core damage. The post-core damage impact was assessed by assuming that all SGTRs that resulted in direct releases to the environment (due to loss of secondary-side isolation) were assumed to go to zero. This results in no change to the CDF, and a population dose reduction of 0.79 person-rem per year.

Cost of Implementation:
The equipment associated with this SAMA would not be SR. Procedure changes and training to implement this modification would also have to be developed. The estimated costs for both the hardware and procedure changes are expected to be less than $25K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 184
CATEGORY: FCS-Specific SAMAs
TITLE: Add capability to flash the field on the EDG to enhance SBO recovery

Description:
This SAMA is intended to increase the capability of FCS to cope with an SBO event when one or more emergency diesel generator (EDG) fails to start or an EDG failure occurs and restart is required after battery depletion. This SAMA would require hardware modification and operational changes. The hardware modification includes the addition of a power supply to flash the field. Operational changes include the development of procedures for restoring the affected EDGs to operability and the associated operator training.

SAMA Benefits:
This SAMA enhances EDG recovery for SBO accident sequences involving the unavailability of one or more EDG following a loss of offsite power event. This SAMA will enhance safety by reducing the probability of core damage due to certain SBO events.

Evaluation:
This SAMA was assessed by assuming that (1) 20 percent of the mechanical failures of the EDGs would be recoverable, and (2) 15 percent of the battery-related failures (which prevented the EDG startup) would be recoverable. The resulting CDF reduction was estimated to be approximately 6.4E-06 per year. The population dose reduction was 0.544 person-rem per year.

Cost of Implementation:
Similar to SAMA No. 182, a power supply could be provided on a "crash cart" that could be used in various applications beyond that described above. A design modification package would need to be prepared. The equipment required would include a power supply and cables. Equipment modification may also be required to facilitate quick installation. EOPs would have to be changed and operators trained to respond to this contingency. Estimated hardware and procedure changes are expected to cost less than $30K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 185
CATEGORY: FCS-Specific SAMAs
TITLE: Remove SI-2C from auto-start

Description:
This SAMA involves making the necessary electrical changes (including appropriate documentation) to remove the auto-start capability for SI-2C. This modification will probably require alarm changes to prevent a control board alarm with the pump in "pull-to-lock." It will also require EOP changes and associated operator training.

SAMA Benefits:
SI-2C is the designation for the station's spare high pressure safety injection (HPSI) pump. Currently SI-2C will initiate pumping action upon receipt of a safety injection actuation signal (SIAS). In the event of RAS failures, all safety injection (SI) pumps may fail simultaneously. Removing SI-2C from auto-start enhances safety by reducing the probability of an accident that could cause radiation exposure to the public. This is accomplished by removing the common-cause coupling between the pumps that occurs due to challenges like inadvertent RAS failures.

Evaluation:
This SAMA was assessed by removing the RAS dependency on SI-2C. The CDF was reduced by 2.4E-06 per year. The population dose reduction was calculated to be 0.20 person-rem per year.

The risk reduction is dominated by preventing accidents that could fail all HPSI pumps (e.g., RAS occurring at the wrong time; heating, ventilation, and air-conditioning (HVAC) problems, flooding issues). Operation of fewer HPSI pumps also improves pressurized thermal shock (PTS) concerns and reduces the severity of overcooling transients.

Cost of Implementation:
This modification will require design input to identify the wiring changes and control panel modifications. The hardware modifications are estimated to cost less than $50K. In addition to modification cost, licensing activities would also be associated with this modification. Implementation of this SAMA would require a Technical Specification change, given all three pumps are required to be operable. EOP changes and associated operator training would also need to be performed. OPPD estimates the cost of this project is to be approximately $90K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 186
CATEGORY: FCS-Specific SAMAs
TITLE: Add manual steam relief capability and associated procedures

Description:
This SAMA involves performing specific procedural and/or hardware changes to give the plant the alternate capability to increase heat removal from the RCS and accelerate RCS cooldown. Introducing an alternate cooldown pathway will increase the capability of the plant to cope with ISLOCAs, SGTRs, and long-term SBOs.

This modification is designed to facilitate reducing RCS temperature and pressure to mitigate ISLOCAs and RCS SGTRs. ISLOCAs are often complicated by equipment failures due to flooding in the AB, which preclude normal cool down methods such as HCV-1040 or steam dump and bypass. This modification may involve nitrogen backup to open the Main Steam (MS) valves, MS-291 and -292 (and leave them open) while continuing to feed both steam generators. This would also facilitate rapid RCS temperature reduction to preclude RCP seal LOCAs during prolonged SBO.

SAMA Benefits:
These changes would both avert core damage and reduce potentially high releases of radioactivity by extending the time until core uncovery following an SBO-induced RCP seal LOCA. Efficient depressurization of the RCS to below 200 pounds per square inch atmospheric (psia) may terminate the small ISLOCA. RCS heatups that result from SGTRs may also be cooled down more quickly, allowing the potential for reaching safe shutdown cooling (SDC).

Evaluation:
The evaluation assumed a 20 percent reduction in SGTR core damage frequency and elimination of the small ISLOCA sequences. The net reduction in CDF was 6.0E-07 with a population dose reduction of 1.28 person-rem per year.

Cost of Implementation:
A number of low-cost modifications could be implemented to achieve the stated benefit. For the purposes of this analysis, implementation would involve minor hardware costs associated with nitrogen backup. Procedure changes and training would also have to be performed. OPPD estimates the implementation costs to be less than $40K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 187
CATEGORY: FCS-Specific SAMAs
TITLE: Enhance operation of FW-54

Description:
This SAMA is intended to enhance the operability of the diesel-driven AFW, FW-54. There are two low-cost opportunities for improving the operation of FW-54. The first is to increase the Day Tank low-level alarm setpoint to increase the time between receipt of the low-level alarm and emptying of the tank. The second is to devise the optimum strategy for use of the diesel protection bypass switch. A determination should be made whether it is better to leave the protective trips bypassed during normal operation or enabled during normal operation. Procedural changes are also included for enhancing the operability of FW-54. These changes involve the development of provisions and procedures for refilling the Day Tank and restarting FW-54 when the Day Tank is replenished.

SAMA Benefits:
This SAMA enhances the reliability of FW-54. Consequently, the probability of accidents involving the loss of secondary heat removal, which could cause releases to the public, is reduced. The reduction in risk is shown below.

Evaluation:
The evaluation assumes FW-54 will never fail. The core damage sequences averted typically result in late containment failures. The CDF reduction is 6.0E-07 per year with a reduction in population dose of 0.05 person-rem per year.

Cost of Implementation:
The first part of the modification is to change the setpoint on the Day Tank low-level alarm. It will cost about $10K to provide the engineering justification, paper work changes, and implementation tasks associated with this change. Determining a strategy for the use of the diesel protection bypass switch and implementing the associated procedure changes will exceed the $30K minimum cost of procedure changes. With these considerations, the implementation cost is expected to exceed $40K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 188
CATEGORY: FCS-Specific SAMAs
TITLE: Enhance external flood procedures

Description:
This SAMA includes hardware or procedural changes to enhance the plant response to external flooding. The hardware enhancements involve: (1) provisions for adding a redundant portable pump to feed the SGs; and (2) upgrading the existing portable pumps to account for equipment diversity and increased pumping capacity, with supporting analysis. The consideration of strategies to utilize the pumps for long-term mitigation is included. A strategy for filling the Containment basement with water to assist in the scrubbing of fission products is also included in this SAMA. The associated procedure revisions and operator training for utilizing the portable pumps to feed the SGs on a long-term basis are also included as part of the enhancement.

SAMA Benefits:
By making the hardware addition and/or enhancing the external flooding procedures, the CDF due to external flooding is expected to be reduced by a factor of two or more.

Evaluation:
The CDF for external floods could be reduced by 50 percent, from the current value of 1.3E-06 per year to 6.5E-07 per year. The population dose reduction would be less than 0.01 person-rem per year.

Cost of Implementation:
Assuming the minimum cost is $70K for a hardware modification, implementation costs are expected to well exceed the benefit.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 189
CATEGORY: FCS-Specific SAMAs
TITLE: Add TSP into Auxiliary Building

Description:
Trisodium Phosphate (TSP) is utilized in containment sumps to maintain the sump water pH above 7. pH control will provide for long-term retention of dissolved iodine in the sump water. The intent of this SAMA is to procure and store extra TSP for use in the Auxiliary Building (AB) in the event of an ISLOCA. The TSP will be placed in the vicinity of the ISLOCA locations so that evolution of iodines from the AB sump water will be reduced.

SAMA Benefits:
By retaining a greater portion of iodines in the sump water post-accident, airborne releases would be reduced.

Evaluation:
Placement of TSP has no impact on CDF. It was assumed that ISLOCA releases from the small ISLOCA events would be reduced by a factor of 5. This results in a reduction in population dose of 0.65 person-rem per year.

Cost of Implementation:
In the mid-1990s, three baskets of TSP were installed in the Containment at CCNPP utilizing a modification to an existing design and at a cost of $150K. In this case, new design work would have to be performed; therefore, estimated costs are expected to exceed $200K.

SEVERE ACCIDENT ALTERNATIVE ASSESSMENT SHEET

SAMA No. 190
CATEGORY: FCS-Specific SAMAs
TITLE: Enhance EOPs to provide guidance to operators to better avert TI-SGTR

Description:
Combustion Engineering, Inc. (CE), designed pressurized water reactors (PWRs) have an increased susceptibility to TI-SGTRs. This SAMA would provide additional guidance to the plant operator on averting a TI-SGTR . Changes are to be included in the EOPs. These changes include guidance to not allow complete dryout of the SG and procedures to depressurize the RCS. Such procedures have been implemented by operators at other CE PWRs. Owner's group implementation of changes into CEN-152 is possible.

SAMA Benefits:
Guidance will minimize the likelihood of TI-SGTR. Reduction of these events is significant since they progress to potential core damage events with loss of isolation capability.

Evaluation:
This was evaluated by assuming all SGTR event loss of isolation releases go to zero. No change in CDF is expected. The reduction in population dose is estimated to be 0.24 person-rem per year.

Cost of Implementation:
Estimated costs associated with this SAMA are expected to be at least $30K.

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5.6 LIST OF ACRONYMS USED IN APPENDIX 5

AB	Auxiliary Building
AC	Alternating Current
AFW	Auxiliary Feedwater
ANO-1	Arkansas Nuclear One, Unit 1
AOP	Abnormal Operating Procedure
AOV	Air-Operated Valve
AST	Alternative Source Term
ATWS	Anticipated Transients Without Scram
BJ	Byron Jackson
BWR	Boiling Water Reactor
CARC	Containment Air Recirculation Cooler
CBO	Controlled Bleed Off
CCF	[PRA] Configuration Control Form
CCNPP	Calvert Cliffs Nuclear Power Plant
CCW	Component Cooling Water
CDF	Core Damage Frequency
CE	Combustion Engineering, Inc.
CHR	Containment Heat Removal
CIV	Containment Isolation Valve
COE	Cost of Enhancement
CS	Containment Spray
CST	Condensate Storage Tank
DC	Direct Current
DCF	Dose Conversion Factor
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedure
EP	Emergency Plan
EPIP	Emergency Plan Implementing Procedure

5.6 LIST OF ACRONYMS USED IN APPENDIX 5 (Continued)

FCS	Fort Calhoun Station Unit 1
FGR	Federal Guidance Report
FIVE	Fire-Induced Vulnerability Evaluation
FP	Fire Protection
FW	Feedwater
GIS	Geographic Information System
GL	Generic Letter (NRC)
HP	Horsepower
HPSI	High-Pressure Safety Injection
HVAC	Heating, Ventilation, and Air Conditioning
IA	Instrument Air
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination of External Events
ISLOCA	Interfacing System Loss-Of-Coolant Accident
K	Thousand
KV	Kilovolt
LCF	Latent Cancer Fatality
LERF	Large Early Release Frequency
LOCA	Loss-Of-Coolant Accident
LOCCW	Loss of Component Cooling Water
LPSI	Low-Pressure Safety Injection
M	Million
MACCS	Melcor Accident Consequence Code System
MFW	Main Feedwater
MOV	Motor-Operated Valve
MS	Main Steam
MSSV	Main Steam Safety Valve
MW(t)	Megawatts (thermal)
NPSH	Net Positive Suction Head

5.6 LIST OF ACRONYMS USED IN APPENDIX 5 (Continued)

NRC	U.S. Nuclear Regulatory Commission
OI	Operating Instruction
OPPD	Omaha Public Power District
PORV	Power-Operated Relief Valve
PRA	Probabilistic Risk Assessment
PSIA	Pounds per square inch atmospheric
PTS	Pressurized Thermal Shock
PWR	Pressurized-Water Reactor
RAS	Recirculation Actuation Signal
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RHRSW	Residual Heat Removal Service Water
RRW	Risk Reduction Worth
RV	Reactor Vessel
RW	Raw Water
RWCU	Raw Water Cooling Unit
SAMA	Severe Accident Mitigation Alternative
SAMDA	Severe Accident Mitigation Design Alternative
SAMG	Severe Accident Mitigation Guidelines
SBO	Station Blackout
SDC	(Safe) Shutdown Cooling
SG	Steam Generator
SGTR	Steam Generator Tube Rupture
SI	Safety Injection
SIAS	Safety Injection Actuation Signal
SIRWT	Safety Injection Refueling Water Tank
SO	Standing Order
SQUG	Seismic Qualification Users Group

5.6 LIST OF ACRONYMS USED IN APPENDIX 5 (Continued)

SR	Safety Related
SRV	Safety Relief Valve
TAV	Turbine-Steam Admission Valve
TD	Turbine Driven
TI-SGTR	Thermally Induced Steam Generator Tube Rupture
TSP	Trisodium Phosphate
TVA	Tennessee Valley Authority
V	Volt
VAC	Volt AC
VDC	Volt DC

APPENDIX 6.0 OTHER AGENCY CORRESPONDENCE

DPH = Department of Public Health
NDHHS = Nebraska Department of Health and Human Services
OPPD = Omaha Public Power District

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

August 7, 2001
01-EA-244

Mr. Richard P. Nelson
Director
Nebraska Department of Health and Human Services
P.O. Box 95007
301 Centennial Mall South
Lincoln, NE 68509-5007

SUBJECT: Fort Calhoun Station Unit 1
License Renewal Project

Dear Mr. Nelson:

Omaha Public Power District (OPPD) is preparing an application to renew the operating license for its Fort Calhoun Station Unit 1 (FCS) and we intend the application to be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts that might be associated with the continued operation of, or refurbishment to, a facility. If discharges are to a small river with an average annual flow rate of less than 3.15×10^{12} cubic feet per year, impact of the proposed action on public health from thermophilic organisms in the affected water is required. FSC discharges cooling water into the Missouri River, which has an average flow of 9.1×10^{11} cubic feet per year in the vicinity of FCS. NRC considers it a small river and so this issue is applicable.

Omaha Public Power District has reviewed this matter and concluded that the Missouri River near Fort Calhoun Station Unit 1 provides poor conditions for supporting populations of pathogenic organisms. Ambient water temperatures vary from 30°F in the winter to 85°F in the summer. Though discharge temperatures at the outfall are at their highest in the summer, averaging 101°F in July and 103°F in August, the rapid mixing characteristics of the Missouri River would result in organisms being exposed to these temperatures in an area limited to within 500 feet of the plant. Any organisms entrained in the condenser cooling water would be subjected to a rapid temperature rise through the condenser followed by cooling as the thermal plume rapidly mixes with the ambient river water. With river flow averaging approximately 5 feet per second, residence time in areas of the plume with temperatures of 95°F or greater would be short and so create an adverse environment for thermal bacteria. In addition, no pathway for significant human exposure exists, considering there is no mechanism for inhalation exposure from aerosol production (such as spray nozzles or cooling towers), and the likelihood of swimming and fishing occurring in the immediate vicinity of the discharge stream preclude both direct contact and ingestion routes.

After your review, we would greatly appreciate a letter concurring with OPPD's conclusions. You are welcome to visit the site. A copy of your response will be submitted to the NRC as part of the license renewal application.

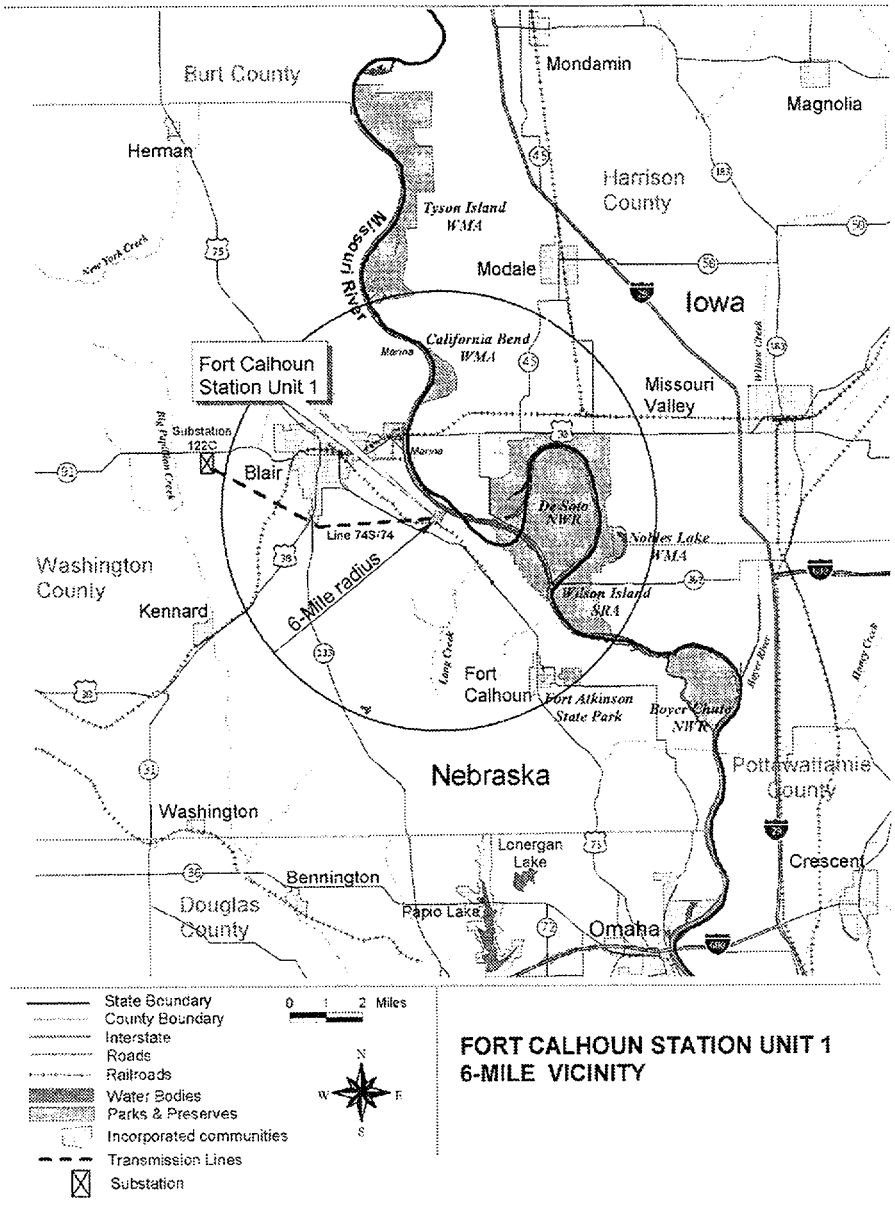
If you have any comments or questions, please contact me at (402) 636-2313.

Sincerely yours,

Donovan C. Hutchens
Manager – Environmental and Regulatory Affairs

Attachment

DCH/ses



FORT CALHOUN STATION UNIT 1
6-MILE VICINITY

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

August 7, 2001
01-EA-243

Mr. Steve Quirk
Division Director Environmental Health
Iowa Department of Public Health
321 East 12 Street
Des Moines, IA 50319

SUBJECT: Fort Calhoun Station Unit 1
License Renewal Project

Dear Mr. Quirk.

Omaha Public Power District (OPPD) is preparing an application to renew the operating license for its Fort Calhoun Station Unit 1 (FCS) and we intend the application to be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts that might be associated with the continued operation of, or refurbishment to, a facility. If discharges are to a small river with an average annual flow rate of less than 3.15×10^{12} cubic feet per year, impact of the proposed action on public health from thermophilic organisms in the affected water is required. FSC discharges cooling water into the Missouri River, which has an average flow of 9.1×10^{11} cubic feet per year in the vicinity of FCS. NRC considers it a small river and so this issue is applicable.

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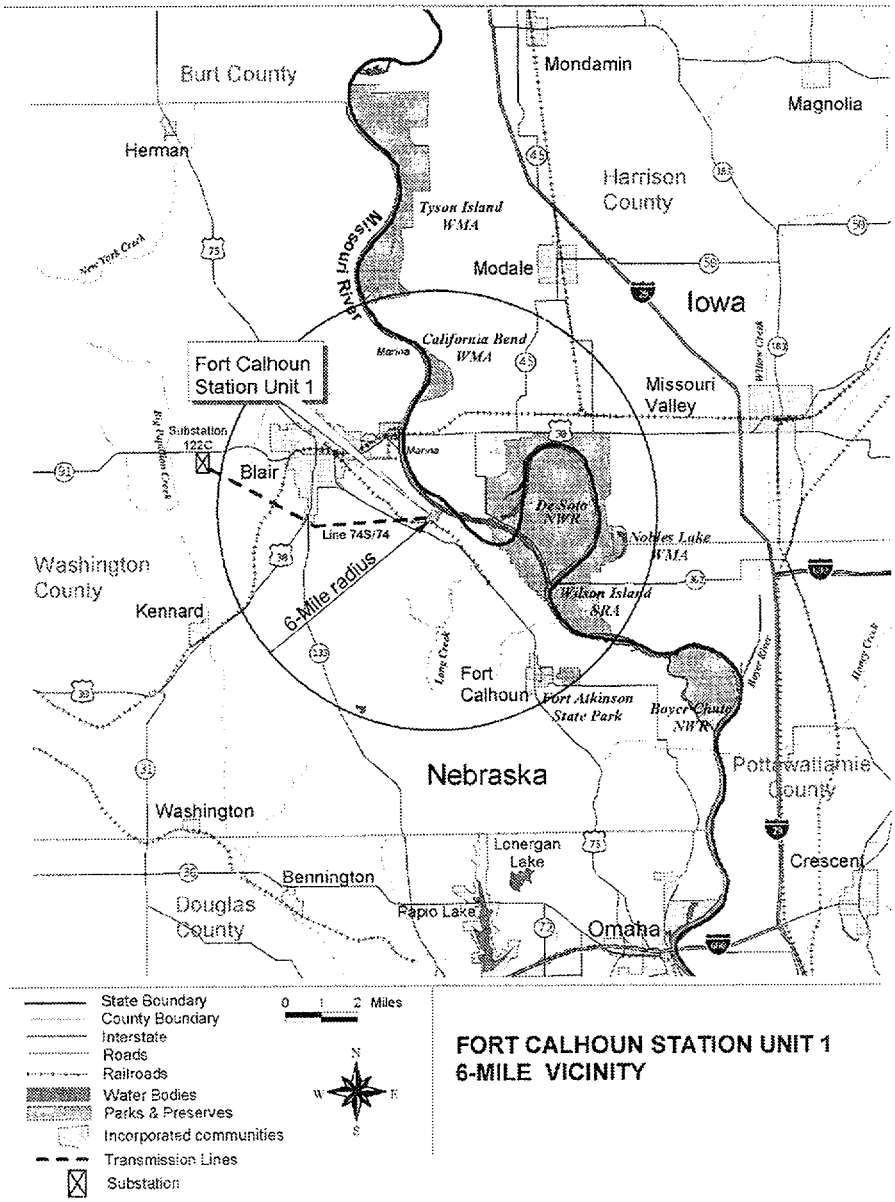
Manager – Environmental and Regulatory Affairs

Attachment

DCH/ses



FORT CALHOUN STATION UNIT 1
6-MILE VICINITY