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NUREG-1437
Supplement 41

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 41

Regarding Cooper Nuclear Station, Unit 1

Draft Report for Comment

Office of Nuclear Reactor Regulation

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Draft Report for Comment

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Office of Nuclear Reactor Regulation

Proposed Action	Issuance of renewed operating license DPR-46 for Cooper Nuclear Station, Unit 1, in the city of Brownville, Nemaha County, Nebraska.
Type of Statement	Draft Supplemental Environmental Impact Statement
Agency Contact	Bennett Brady U.S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation Mail Stop O-11F1 Washington, D.C. 20555-0001 Phone: 301-415-2981 Email: Bennett.Brady@nrc.gov
Comments	Any interested party may submit comments on this supplemental environmental impact statement. Please specify NUREG-1437, Supplement 41, draft, in your comments. Comments must be received by April 6, 2010. Comments received after the expiration of the comment period will be considered if it is practical to do so, but assurance of consideration of late comments will not be given. Comments may be emailed to CooperEIS@nrc.gov or mailed to: Chief, Rulemaking, Directives, and Editing Branch U.S. Nuclear Regulatory Commission Mail Stop T6-D59 Washington, D.C. 20555-0001 Please be aware that any comments that you submit to the NRC will be considered a public record and entered into the Agencywide Documents Access and Management System (ADAMS). Do not provide information you would not want to be publicly available.

ABSTRACT

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by Nebraska Public Power District (NPPD) to renew the operating license for Cooper Nuclear Station, Unit 1, for an additional 20 years.

This draft SEIS includes the preliminary analysis that evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include replacement power from new supercritical coal-fired generation; natural gas combined-cycle generation; a combination of alternatives that include natural gas combined-cycle generation, energy conservation, and wind; and not renewing the license (the no-action alternative).

The preliminary recommendation is that the U.S. Nuclear Regulatory Commission (NRC) determines that the adverse environmental impacts of license renewal for Cooper Nuclear Station, Unit 1, are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable.

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EXECUTIVE SUMMARY

BACKGROUND

By letter dated September 24, 2008, Nebraska Public Power District (NPPD) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue a renewed operating license for Cooper Nuclear Station, Unit 1 (CNS-1), for an additional 20-year period.

Pursuant to 10 CFR 51.20(b)(2), the Commission indicates that a renewal of a power reactor operating license requires preparation of an environmental impact statement (EIS) or a supplement to an existing EIS. In addition, 10 CFR 51.95(c) states that the Commission shall prepare an environmental impact statement, which is a supplement to the Commission's NUREG–1437, "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (May 1996), (NRC, 1996).

Upon acceptance of NPPD's application, the NRC staff began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare a supplemental EIS and conduct scoping. In preparation of this SEIS for CNS-1, the NRC staff performed the following:

- Conducted public scoping meetings on February 25, 2009, in Brownville and Auburn, NE
- Conducted a site audit at the plant in late March 2009
- Reviewed NPPD's environmental report (ER) and compared it to the GEIS
- Consulted with other agencies
- Conducted a review of the issues following the guidance set forth in NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal (NRC, 2000)
- Considered public comments received during the scoping process.

PROPOSED ACTION

NPPD initiated the proposed Federal action—issuing a renewed power reactor operating license—by submitting an application for license renewal of CNS-1, for which the existing license DPR-46 will expire on January 18, 2014. The NRC's Federal action is the decision whether or not to renew the license for an additional 20 years.

PURPOSE AND NEED FOR ACTION

The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for power generation capability beyond the term of the current nuclear power plant operating license, and to meet future system generating needs, as determined by State, utility, and, where authorized, Federal (other than NRC) decision makers. This definition of purpose and need for action reflects the recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954 (AEA) or findings in the NEPA environmental analysis that would lead to the rejection of a license renewal application, the NRC does not have a role in the energy-planning decisions of State regulators and utility officials as to whether a particular nuclear power plant should continue to operate.

If the operating license is not renewed, then the facility must be shut down on or before the expiration date of the current operating license, January 18, 2014.

ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL

The SEIS evaluates the potential environmental impacts of the proposed action. The environmental impacts from the proposed action are designated as SMALL, MODERATE, or LARGE. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue is determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts, except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.

(3) Mitigation of adverse impacts associated with the issue is considered in the analysis and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For Category 1 issues, no additional site-specific analysis is required in this draft SEIS unless new and significant information is identified. Chapter 4 of this report presents the process for identifying new and significant information. Site-specific issues (Category 2) are those that do not meet one or more of the criterion for Category 1 issues; therefore, an additional site-specific review for these nongeneric issues is required, and the results are documented in the SEIS. The NRC staff has reviewed NPPD’s established process for identifying and evaluating the significance of any new and significant information on the environmental impacts of license renewal of CNS-1. Neither NPPD nor NRC identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the NRC staff has identified any new issue applicable to CNS-1 that has a significant environmental impact. The NRC staff, therefore, relies upon the conclusions of the GEIS for all Category 1 issues applicable to CNS-1.

LAND USE

SMALL. The NRC staff did not identify any Category 2 issues for land use, nor did the staff identify any new and significant information during the environmental review. Therefore, there would be no impacts beyond those discussed in the GEIS. As stated in the GEIS, the impacts associated with these Category 1 issues were determined to be SMALL, and plant-specific mitigation measures are not sufficiently beneficial to be warranted.

AIR QUALITY

SMALL. The NRC did not identify any Category 2 issues for air quality impacts, nor did the staff identify any new or significant information during the environmental review. Therefore, for plant operation during the license renewal term, there are no impacts beyond those discussed in the GEIS.

GROUND WATER USE AND QUALITY

SMALL. The staff did not identify any new and significant information in regard to Category 1 or generic ground water issues. Ground water use conflicts: potable and service water—plants using greater than 100 gallons per minute (gpm) is a Category 2 issue related to license renewal at CNS-1. Because of the limited radius of influence of CNS-1 wells in the unconfined aquifer, no public ground water supplies are close enough to CNS-1 to be impacted by ground water use at the station. There are no well-head protection areas or Environmental Protection Agency (EPA) designated sole source aquifers in the vicinity of CNS-1. Therefore, the impact of ground water use by CNS-1 is SMALL.

SURFACE WATER USE AND QUALITY

SMALL. The staff did not identify any new information and issues during its review. Therefore, no Category 2 surface water issues were identified for the CNS-1 license renewal term. The surface water issues related to CNS-1 are Category 1. Therefore, no impacts are related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff concludes in the GEIS that the impacts are SMALL.

AQUATIC RESOURCES

SMALL. With regard to operation of CNS-1 during the license renewal term, the NRC staff identified the following Category 2 issues for aquatic resources: entrainment and impingement of fish and shellfish, and heat shock. The NRC staff reviewed the available information and concludes that the weight of evidence indicates a SMALL level of impact on aquatic resources due to impingement and entrainment at CNS-1. NPPD has implemented some impingement mitigation measures and plans to implement others. After reviewing the available information, the NRC staff concludes that the level of thermal impact on the aquatic community by renewing CNS-1's operating license is SMALL.

In addition to the impact on aquatic resources due to entrainment and impingement of fish and shellfish and heat shock, the NRC staff reviewed field studies on the total impact of CNS-1's cooling water system operation on aquatic resources. The NRC staff concludes that the level of impact on aquatic resources due to all aspects of CNS-1's cooling system operation is SMALL.

TERRESTRIAL RESOURCES

SMALL. The NRC staff identified no Category 2 issues related to terrestrial resources for license renewal. The NRC staff did not identify any additional new and significant information during review of the NPPD's ER, the site audit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there are no additional impacts related to these issues beyond those discussed in the GEIS. The GEIS further concludes that since the impacts are SMALL, additional site-specific mitigation measures are not likely to be sufficiently beneficial to implement.

THREATENED AND ENDANGERED SPECIES

SMALL. Impact to threatened and endangered species during the period of extended operation includes one Category 2 issue, the conservation of pallid sturgeon. NPPD has been involved with several organizations in a conservation agreement regarding pallid sturgeon, which could have a positive impact on the pallid sturgeon population. Operation of the CNS-1 site and its associated transmission lines has not been known, nor is expected, to adversely affect any threatened or endangered species during the license renewal term. The NRC staff, therefore, concludes that adverse impacts to threatened or endangered species during the license renewal term would be SMALL.

HUMAN HEALTH

SMALL. The NRC staff's review of the historical radioactive releases from CNS-1 and the resultant dose calculation demonstrate that CNS-1 is operating in compliance with Federal radiation protection standards. Continued compliance with regulatory requirements is expected during the license renewal term. Therefore, the impacts from radioactive effluents are not expected to change during the license renewal term.

The NRC staff did not identify any new and significant information during its review. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC's conclusion in the GEIS was that the impacts are SMALL and additional site-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Microbiological organisms (public health) and electromagnetic fields— acute effects (electric shock) are Category 2 human health issues. The NRC staff reviewed all documents applicable to the microbiological organisms issue and concludes that thermophilic microbiological organisms are not likely to present a public health hazard as a result of CNS-1 discharges to the Missouri River. The NRC staff concludes that impacts on public health from thermophilic microbiological organisms from continued operation of CNS-1 in the license renewal period are SMALL.

The NRC staff has reviewed the available information, including the applicant's evaluation and computational results. Based on this information, the NRC staff evaluated the potential impacts for electric shock resulting from operation of CNS-1 and its associated transmission lines. The staff concludes that the potential impacts from electric shock during the renewal period are SMALL.

SOCIOECONOMICS

SMALL. For Category 1 issues (public services and aesthetic impacts), the NRC staff identified no new and significant information during the environmental review. Therefore, there would be no impacts beyond those discussed in the GEIS. Category 2 socioeconomic impacts include housing impacts, public services (public utilities), offsite land use, public services (public transportation), and historic and archaeological resources.

Since NPPD has no plans to add additional employees during the license renewal period except during outages, employment levels at CNS-1 would remain relatively constant with no additional demand for permanent housing during the license renewal term. Based on this information, there would be no impact on housing during the license renewal term beyond what has already been experienced.

For the same reason, demand for public water services will remain relatively unchanged with no additional demand. Public water systems in the region would be adequate to meet the demands of residential and industrial customers in the area. Therefore, there would be no additional impact to public water services during the license renewal term beyond what is currently being experienced.

Since non-outage employment levels at CNS-1 would remain relatively constant during the license renewal period, there would be no land use impacts related to population or tax revenues, and no transportation impacts. Therefore, offsite land use and transportation issues would remain relatively unchanged.

No impacts to known historic and archaeological resources are expected from the continued operation of CNS-1 during the license renewal term. The CNS-1 site is situated in an area where historic and archaeological resources could be located several feet beneath the ground surface. NPPD has instituted a stop work order within its Cultural Resource Protection Plan to ensure that proper notification is taken to protect these resources should they be discovered. Based on review of Nebraska State Historical Society (NSHS) files (archaeological surveys, assessments, and other information), the potential impacts of continued operations and maintenance on historic and archaeological resources at CNS-1 would be SMALL.

In reviewing potential social environmental justice impacts(i.e., potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations), an analysis of minority and low-income populations residing within a 50-mile (80-km) radius of CNS-1 indicated there would be no disproportionately high and adverse impacts to these populations from the continued operation of CNS-1 during the license renewal period. Based on recent monitoring results, concentrations of contaminants in native leafy vegetation, soils and sediments, surface water, and fish in areas surrounding CNS-1 have been low (at or near the threshold of detection) and seldom above background levels. Consequently, no disproportionately high and adverse human health impacts are expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

SEVERE ACCIDENT MITIGATION ALTERNATIVES

Since CNS-1 had not previously considered alternatives to reduce the likelihood or potential consequences of a variety of highly uncommon but potentially serious accidents, NRC regulation 10 CFR 51.53(c)(3)(ii)(L) requires that CNS-1 evaluate Severe Accident Mitigation Alternatives (SAMAs) in the course of the license renewal review. SAMAs are potential ways to reduce the risk or potential impacts of uncommon but potentially severe accidents, and may include changes to plant components, systems, procedures, and training.

NRC staff reviewed the ER's evaluation of potential SAMAs. Subsequent to the ER, a problem with the process used to numerically average the site-specific meteorological data was identified. NPPD performed a re-analysis of the population dose risk and offsite economic cost risk using corrected meteorological data, and found that the population dose and offsite economic cost values for each of the release categories would be slightly less than reported in the ER, and that the conclusions of the SAMA remain valid.

NRC staff reviewed NPPD's re-analysis and the methods used by NPPD as submitted by NPPD and agrees that the error was conservative relative to the average population dose and offsite economic cost and that no SAMAs were inappropriately excluded from consideration in the LRA as a result of the error.

Based on the staff's review and the supplemental information provided by NPPD, the NRC staff concluded that none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

ALTERNATIVES

The NRC staff considered the environmental impacts associated with alternatives to license renewal. These alternatives include other methods of power generation and not renewing the CNS-1 operating license (the no-action alternative). Replacement power options considered were supercritical coal-fired generation, natural gas combined-cycle generation, and a combination alternative that includes a portion of the combined-cycle gas-fired capacity, a conservation capacity component, and a wind power component. The NRC staff initially considered a number of additional alternatives for analysis as alternatives to license renewal of CNS-1; these were later dismissed due to technical, resource availability, or commercial limitations that currently exist and that the NRC staff believes are likely to continue to exist when the existing CNS-1 license expires. The no-action alternative by the NRC staff and the effects it would have were also considered.

Where possible, the NRC staff evaluated potential environmental impacts for these alternatives located both at the CNS-1 site and at some other unspecified alternate location. Energy conservation and energy efficiency; purchased power, and a combination alternative, which included natural gas combined-cycle generation, energy conservation and wind power were also considered. The NRC staff evaluated each alternative using the same impact areas that were used in evaluating impacts from license renewal. The results of this evaluation are summarized in the table on the following page.

COMPARISON OF ALTERNATIVES

The coal-fired alternative is the least environmentally favorable alternative, due to its impacts to air quality from nitrogen oxides (NOx), sulfur oxides (SOx), particulate matter (PM), polycyclic aromatic hydrocarbons (PAHs), carbon monoxide (CO), carbon dioxide (CO_2), and mercury—and the corresponding human health impacts; construction impacts to aquatic, terrestrial, and potentially historic and archaeological resources are also factors that make the coal-fired alternative the least environmentally favorable alternative.

The gas-fired alternative would have slightly lower air emissions, and impacts to aquatic, terrestrial, historic, and archaeological resources would vary depending upon location of the plant. Purchased power would likely have operational impacts that would include aspects of coal-fired, gas-fired, and existing nuclear generation.

All other alternatives capable of meeting the energy needs currently served by CNS-1 entail potentially greater impacts than the proposed action of license renewal of CNS-1. The no-action alternative does not meet the needs currently served by CNS-1. However, if the no-action alternative was selected and this was to trigger the energy conservation and energy efficiency action to replace the capacity currently supplied by CNS-1, it could result in an overall SMALL impact.

Summary of Environmental Impacts of Proposed Action and Alternatives.

Alternative	Impact Area						
	Air Quality	**Ground Water**	**Surface Water**	**Aquatic and Terrestrial Resources**	**Human Health**	**Socioeconomics**	**Waste Management**
License renewal	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Supercritical coal-fired alternative at the CNS-1 site	MODERATE	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to LARGE	MODERATE
Gas-fired alternative at the CNS-1 site	SMALL TO MODERATE	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Combination of alternatives	SMALL TO MODERATE	SMALL	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL
No-action alternative	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL

RECOMMENDATION

Our preliminary recommendation is that the Commission determines that the adverse environmental impacts of license renewal for CNS-1 are not so great that preserving the option of license renewal for energy planning decision makers would be unreasonable. This recommendation is based on:

(1) the analysis and findings in the GEIS

(2) information submitted in the NPPD's ER

(3) consultation with other Federal, State, and local agencies

(4) review of other pertinent studies and reports

(5) consideration of public comments received during the scoping process.

ABBREVIATIONS AND ACRONYMS

AADT	average annual daily traffic
ACC	averted cleanup and decontamination costs
ADV	atmospheric dump valve
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AEO	Annual Energy Outlook
ALARA	as low as reasonably achievable
AMSL	above mean sea level
APE	area of potential effect
BA	biological assessment
BACT	best available control technology
Btu/kWh	British thermal units/kilowatt hours
BWR	boiling water reactor
BWST	borated water storage tank
CAA	Clean Air Act
CAFTA	cutest and fault tree analysis
CAMR	Clean Air Mercury Rule
CDC	Center for Disease Control
CDF	core damage frequency
CDM	Clean Development Mechanism
CENRAP	Central Regional Air Planning Association
CEQ	Council on Environmental Quality
CESQG	Conditionally Exempt Small Quantity Generator
CET	containment event tree
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
CH_4	methane
CNS-1	Cooper Nuclear Station, Unit 1
CO	carbon monoxide
CO_2	carbon dioxide
CRA	Conestoga Rover Associates

CRT	cathode ray tube
CWA	Clean Water Act
CWERCLA	Comprehensive Environmental Response, Compensation, and Liability
DBA	design-basis accident
DDE	insecticide, dichlorodiphenyldichloroethylene
DDT	insecticide, dichlorodiphenyltrichloroethane
DHCCW	decay heat closed cooling water
DHHS	Department of Health and Human Services
DHR	decay heat removal
DHRW	decay heat river water system
DNR	Department of Natural Resources
DOE	Department of Energy
DOT	Department of Transportation
DPR	demonstration power reactor
DPS	Department of Public Safety
DSEIS	draft supplemental environmental impact statement
DSM	demand-side management
EDG	emergency diesel generator
EFW	emergency feedwater
EIA	Energy Information Administration
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EMF	electromagnetic fields
EMS	environmental management system
E.O.	Executive Order
ER	environmental report
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ESA	Endangered Species Act
ESAS	engineered safeguards actuation signal

ESRP	Environmental Standard Review Plan
F&O	fact and observation
FCS	Fort Calhoun Station
FES	final environmental statement
FIVE	fire-induced vulnerability evaluation
FR	*Federal Register*
FSAR	final safety analysis report
g C_{eq}/kWh	grams of CO_2 equivalents per kilowatt-hour
GEIS	generic environmental impact statement
GHG	greenhouse gas
gpm	gallons per minute
HAP	hazardous air pollutant
HCLPF	high confidence in low probability of failure
HFC	hydrofluorocarbons
HFE	hydrofluorinated ethers
HID	high intensity discharge (light)
HLW	high-level waste
HPI	high-pressure injection
HRA	human reliability analysis
ICCW	immediate closed cooling water
IEEE	Institute of Electrical and Electronics Engineers
IGCC	integrated gasification combined-cycle
Inc.	incorporated
IPCC	Intergovernmental Panel on Climate Change
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing-systems loss-of-coolant accident
J	joule
JHEP	joint human error probability

LERF	large early release frequency
LLC	limited liability corporation
LLMW	low level mixed waste
LLNL	Lawrence Livermore National Laboratory
LLW	low-level radioactive waste
LOCA	loss of coolant accident
LOOP	loss of offsite power
LPI	low pressure injection
LQG	Large Quantity Generator
MAAP	modular accident analysis program
MACCS2	MELCOR Accident Consequence Code System 2
MCR	main control room
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MOV	motor operated valve
mrad	milliradiation absorbed dose
mrem	milliroentgen equivalent man (mrem)
MSA	Magnuson-Stevens Fishery Conservation and Management Act of 1996
msl	mean sea level
MT	metric tonnes
MW	megawatt
MWd/MTU	megawatt-days per metric ton uranium
MWe	megawatt-electric
MWt	megawatt-thermal
N_2O	nitrous oxide
NA	not applicable
NAAQS	National Ambient Air Quality Standards
NAC	Nebraska Administrative Code
NAQR	Nebraska Air Quality Regulations
NAS	National Academy of Sciences
NCDC	National Climatic Data Center

NDED	Nebraska Department of Education
NDEQ	Nebraska Department of Environmental Quality
NDOR	Nebraska Department of Roads
NDNR	Nebraska Department of Natural Resources
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
NF_3	nitrogen triflouride
ng	nanograms
NGPC	Nebraska Game and Parks Commission
NHHS	Nebraska Department of Health and Human Services
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NNRD	Nemaha Natural Resources District
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NPPD	Nebraska Public Power District
NRC	U.S. Nuclear Regulatory Commission
NRCC	National Research Council
NRHP	National Register of Historic Places
NSCCW	nuclear service closed cooling water
NSHS	Nebraska State Historical Society
NSR	New Source Review
NWPCC	Nebraska Water Pollution Control Council
NWS	National Weather Service
ODAM	Offsite Dose Assessment Manual
ODCM	Offsite Dose Calculation Manual
ODNR	Ohio Department of Natural Resources
OMB	Office of Management and Budget
OPPD	Omaha Public Power District
PAH	polycyclic aromatic hydrocarbon

PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PDS	plant damage state
PFC	perfluorocarbons
PILOT	payments in lieu of taxes
PM	particulate matter
$PM_{2.5}$	particulate matter, 2.5 microns or less in diameter
PM_{10}	particulate matter, 10 microns or less in diameter
PMF	probably maximum flood
PRA	probabilistic risk assessment
PWR	pressurized water reactor
RAI	request for additional information
RBEC	reactor building emergency cooling
RBWMD	Rainwater Basin Wetland Management District
RCP	reactor coolant pump
RCRA	Resource Conservation and Recovery Act
RCS	reactor coolant system
REMP	radiological environmental monitoring program
RKm	river kilometer
RM	river mile
rms	root mean square
ROI	region of influence
ROW(s)	right-of-way(s)
RPMA	recovery priority management area
RPO	regional planning organization
RPV	reactor pressure vessel
RRW	risk reduction worth
RWD	Rural Water District
SAMA	Severe Accident Mitigation Alternative
SAR	safety analysis report
SBO	station blackout
SC	species of concern
SCDHEC	South Carolina Department of Health and Environmental Control

SCR	selective catalytic reduction
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SF_6	sulfur hexafluoride
SGTR	steam generator tube rupture
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SO_x	sulfur oxide(s)
SPDES	State Pollutant Discharge Elimination System
SQG	Small Quantity Generator
Sv	sievert
TDEC	Tennessee Department of Environment and Conservation
TSP	total suspended particles
TSS	total suspended solids
U	Uranium
UDEQ	Utah Department of Environmental Quality
UNL	University of Nebraska-Lincoln
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USACE	United States Army Corps of Engineers
U.S.C.	*United States Code*
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGCRP	United States Global Change Research Program
USGS	U.S. Geological Survey
USI	unresolved safety issue
VOC	volatile organic compound
WGA	Western Governors Association
WHO	World Health Organization

1.0 PURPOSE AND NEED FOR ACTION

Issuance of a renewal of a nuclear power plant operating license requires the preparation of a supplemental environmental impact statement (SEIS) under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," of the *Code of Federal Regulations* (10 CFR Part 51.20).

The Atomic Energy Act of 1954 (AEA) originally specified that licenses for commercial power reactors be granted for up to 40 years, but permitted license renewal. The 40-year licensing period was based on economic and antitrust considerations rather than on technical limitations of the nuclear facility.

The decision to seek a license renewal rests with the nuclear power facility owners and typically is based on the facility's economic viability and the investment necessary to continue to meet NRC safety and environmental requirements. The NRC grants or denies a license renewal application based on whether or not the applicant demonstrates that agency regulations for environmental and safety requirements can be met during the period of extended operation.

1.1 PROPOSED FEDERAL ACTION

Nebraska Public Power District (NPPD) initiated the proposed Federal action by submitting an application for license renewal of the Cooper Nuclear Station, Unit 1 (CNS-1), for which the existing license, DPR-46, expires January 18, 2014. The NRC's Federal action is the proposed decision to renew the license for an additional 20 years.

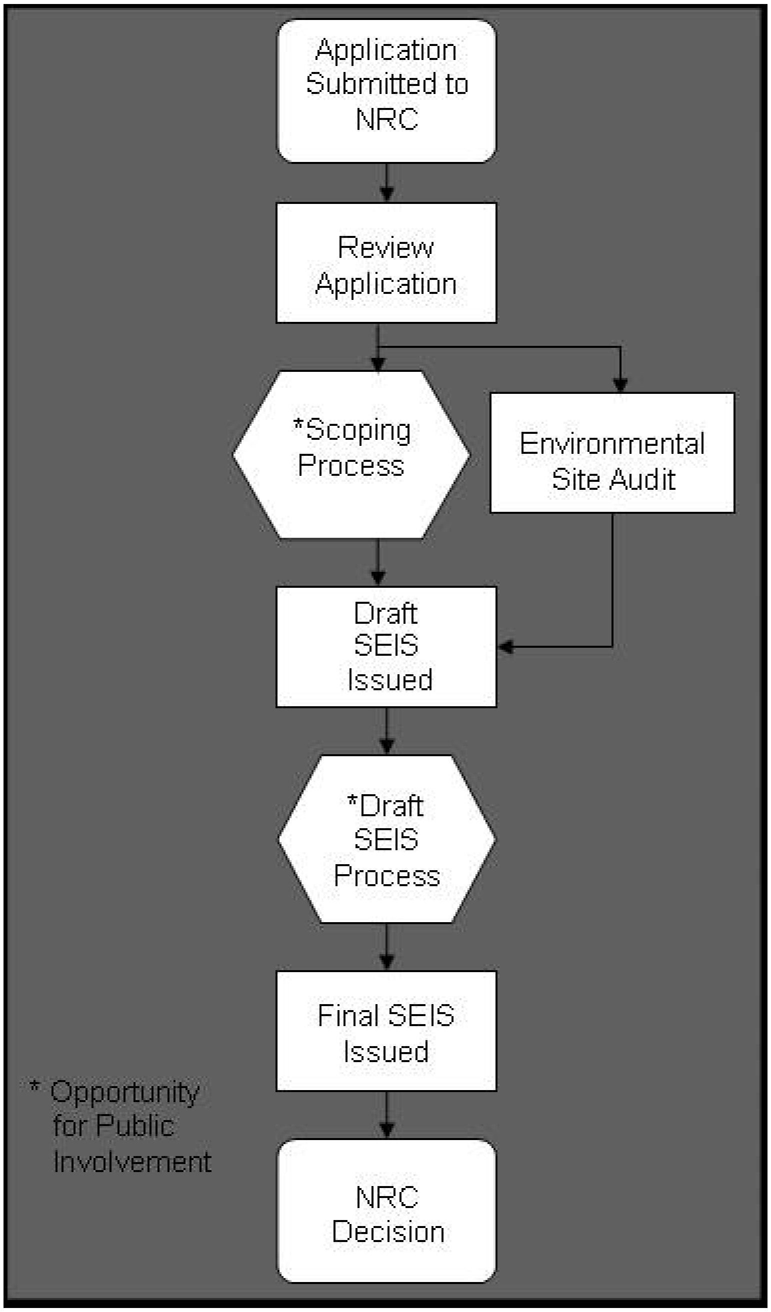
1.2 PURPOSE AND NEED FOR THE PROPOSED FEDERAL ACTION

The purpose and need for the proposed Federal action (i.e., the issuance of a renewed license) is to provide an option that allows for power generation capability, beyond the term of a current nuclear power plant operating license, to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal decisionmakers (other than NRC). This definition of purpose and need for the proposed Federal action reflects the NRC's recognition that, unless there are findings in the safety review required by the AEA or findings in the National Environmental Policy Act (NEPA) environmental analysis that would lead the NRC not to issue a renewal, the NRC does not have a role in the energy-planning decisions of State regulators and utility officials as to whether or not a particular nuclear power plant should continue to operate.

If the NRC renews the operating license, State regulatory agencies and NPPD decide whether or not the plant will continue to operate based on factors such as the need for power within the State's jurisdiction or the purview of the owners. If the NRC does not renew CNS-1's DPR-46 operating license, the facility must be shut down on or before the expiration date of the current operating license, January 18, 2014.

1 ## 1.3 MAJOR ENVIRONMENTAL REVIEW MILESTONES

Figure 1-1. Environmental Review Process. *The environmental review process provides opportunities for public involvement.*



NPPD submitted an environmental report (ER) as part of its license renewal application (NPPD, 2008a) in September 2008. After reviewing the application and the ER for sufficiency, the NRC staff published a Notice of Acceptability and Opportunity for Hearing on December 30, 2008, in the *Federal Register* (73 FR 79921). On January 26, 2009, the NRC published another notice in the *Federal Register* (74 FR 4476) on its intent to conduct scoping, thereby beginning the 60-day scoping period.

The agency held two public scoping meetings on February 25, 2009, in Brownville, Nebraska, and Auburn, Nebraska. The NRC report entitled "Environmental Impact Statement Scoping Process Summary Report for Cooper Nuclear Station, Unit 1," dated May 29, 2009, presents the comments received during the scoping process in their entirety (NRC, 2009a). Appendix A to this SEIS presents the comments considered to be within the scope of the environmental license renewal review and the associated NRC responses.

To independently verify information provided in the ER, the NRC staff conducted a site audit at CNS-1 from March 30 through April 3, 2009. During the site audit, staff met with plant personnel, reviewed specific documentation, toured the facility, and met with interested Federal, State, and local agencies. The agency published a summary of that site audit and a list of the attendees in a report entitled, "Summary of Site Audit Related to the Review of the License Renewal Application for Cooper Nuclear Station, Unit 1," dated April 30, 2009 (NRC, 2009b).

Figure 1-1 shows the major milestones in the public review of the EIS. Upon completion of the scoping period and site audit, the staff compiled its findings in this draft SEIS, which is being made available for public comment for 75 days. During this comment period, NRC staff will host public meetings and collect public comments. Based on the information gathered, the staff will amend the draft SEIS findings as necessary, and publish a final SEIS.

The NRC has established a license renewal process that can be completed in a reasonable period of time with clear requirements to ensure safe plant operations for up to an additional 20 years of plant life. The safety review is conducted simultaneously with the environmental review. The staff documents the findings of the safety review in a safety evaluation report (SER). The Commission considers the findings in both the SEIS and the SER in its decision to either grant or deny the issuance of a new license.

1.4 GENERIC ENVIRONMENTAL IMPACT STATEMENT

The NRC performed a generic assessment of the environmental impacts associated with license renewal to improve the efficiency of the license renewal. NUREG-1437, Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants,[1] documents the results of the NRC staff's systematic approach to evaluating the environmental consequences of renewing licenses of individual nuclear power plants and operating them for an additional 20 years (NRC 1996, 1999). The NRC staff analyzed and dispositioned those environmental issues that could be dispositioned generically in the GEIS.

The GEIS includes a determination of whether or not the analysis of the environmental issue could be applied to all plants and if additional mitigation measures are warranted (Figure 1-2).

[1] NUREG-1437, "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants," Volume 1 and 2, May 1996, Washington, D.C.

Issues are assigned a designation: a Category 1 (generic to all plants) or a Category 2 (not generic to all plants). As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue is determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts, except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.

(3) Mitigation of adverse impacts associated with the issue is considered in the analysis and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For Category 1 issues, no additional site-specific analysis is required in this draft SEIS unless new and significant information is identified. Chapter 4 of this report presents the process for identifying new and significant information. Site-specific issues (Category 2) are those that do not meet one or more of the criterion for Category 1 issues; therefore, an additional site-specific review for these nongeneric issues is required, and the results are documented in the SEIS.

The GEIS establishes 92 issues for the NRC staff to independently verify. Of these 92, the staff determined that 69 are Category 1, while 21 issues do not lend themselves to generic consideration (Category 2). Two other issues remained uncategorized and must be evaluated on a site-specific basis: environmental justice and the chronic effects of electromagnetic fields. Refer to Appendix B of this draft SEIS for a list of all 92 issues.

For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect for both beneficial and adverse effects, (5) determines whether or not the results of the analysis apply to all plants, and (6) considers whether or not additional mitigation measures are warranted for impacts that would have the same significance level for all plants.

Significance indicates the importance of likely environmental impacts and is determined by considering two variables: **context** and **intensity**.
Context is the geographic, biophysical, and social context in which the effects will occur.
Intensity refers to the severity of the impact, in whatever context it occurs.

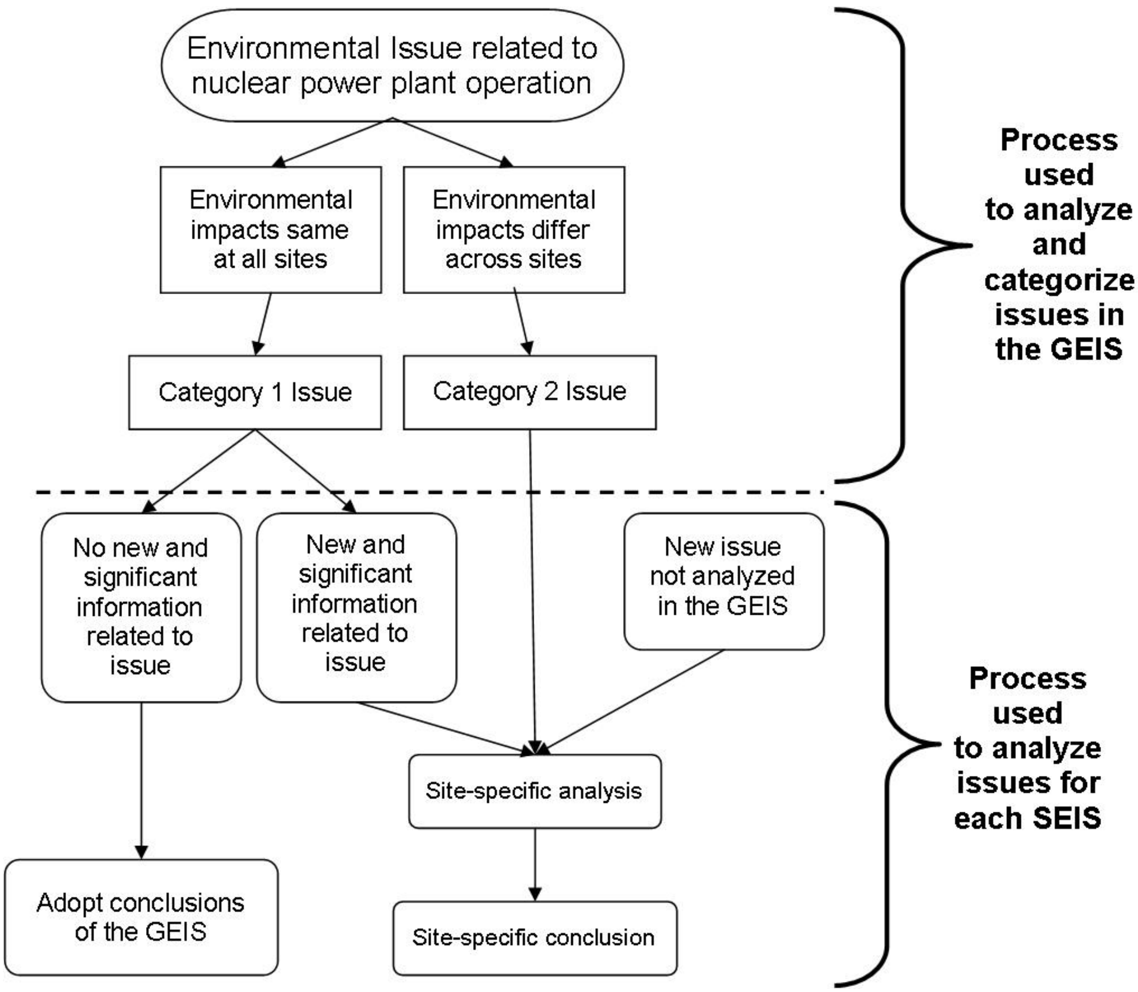
The NRC's standard of significance for impacts was established using the Council on Environmental Quality (CEQ) terminology for "significant." The NRC established three levels of significance for potential impacts—SMALL, MODERATE, and LARGE, as defined below:

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, important attributes of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Figure 1-2. Environmental Issues Evaluated During License Renewal. *Ninety-two issues were evaluated in the GEIS. A site-specific analysis is required for 23 of those 92 issues.*



1.5 SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

The SEIS presents an analysis that considers the environmental effects of the continued operation of CNS-1, alternatives to license renewal, and mitigation measures for minimizing adverse environmental impacts. Chapters 5, 6, and 7 analyze the environmental impact of postulated accidents, the uranium fuel cycle and greenhouse gas emissions, and decommissioning, respectively. Chapter 8 analyzes and compares the potential environmental impacts from alternatives, and Chapter 9 presents the preliminary recommendation to the Commission as to whether or not the environmental impacts of license renewal are so great that preserving the option of license renewal would be unreasonable. The recommendation will be made after consideration of the draft SEIS.

In preparation of this draft SEIS for CNS-1, the staff undertook the following activities:

- reviewed information provided in the NPPD ER
- consulted with other Federal, State, and local agencies
- conducted an independent review of the issues during site audit
- considered public comments received during the scoping process

New information can be identified from a number of sources, including the applicant, the NRC, other agencies, or public comments. If a new issue is revealed, then it is first analyzed to determine whether it is within the scope of the license renewal evaluation. If the issue is not addressed in the GEIS, then the NRC determines its significance and documents its analysis in the SEIS.

> **New and significant information** either: (1) identifies a significant environmental issue not covered in the GEIS, or (2) was not considered in the analysis in the GEIS and leads to an impact finding that is different from the finding presented in the GEIS.

1.6 COOPERATING AGENCIES

During the scoping process, no Federal, State, or local agencies were identified as cooperating agencies in the preparation of this SEIS.

1.7 CONSULTATIONS

The Endangered Species Act of 1973, as amended; the Magnuson-Stevens Fisheries Conservation and Management Act of 1996, as amended; and the National Historic Preservation Act of 1966, require that Federal agencies consult with applicable State and Federal agencies and groups before taking action that may affect endangered species, fisheries, or historic and archaeological resources, respectively. Below are the agencies and groups with whom the NRC consulted; Appendix D to this report includes copies of consultation documents.

Advisory Council on Historic Preservation

Department of Health and Human Services

Iowa Tribe of Kansas and Nebraska

Iowa Tribe of Oklahoma

Kickapoo Tribe in Kansas

Nebraska Game and Parks Commission

Nebraska Department of Natural Resources

Nebraska State Historic Society

Missouri State Historic Society

Omaha Tribe of Nebraska

- Otoe-Missouria Tribe of Indians
- Prairie Band of Potawatomi Indians
- Sac and Fox Nation of Missouri
- Sac and Fox Tribe of the Mississippi in Iowa
- Sac and Fox Nation of Oklahoma
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service, Grand Island, NE Field Office

1.8 CORRESPONDENCE

During the course of the environmental review, the NRC staff contacted the following Federal, State, regional, local, and tribal agencies. Appendix E to this report contains a chronological list of all documents sent and received during the environmental review.

- Advisory Council on Historic Preservation
- Department of Health and Human Services
- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma
- Kickapoo Tribe in Kansas
- Nebraska Game and Parks Commission
- Nebraska Department of Health and Human Services
- Nebraska Department of Natural Resources
- Nebraska State Historic Preservation Office
- Missouri State Historic Preservation Office
- Omaha Tribe of Nebraska
- Otoe-Missouria Tribe of Indians
- Prairie Band of Potawatomi Indians
- Sac and Fox Nation of Missouri
- Sac and Fox Tribe of the Mississippi in Iowa
- Sac and Fox Nation of Oklahoma
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency, Kansas City, KS Field Office
- U.S. Fish and Wildlife Service, Grand Island, NE Field Office

A list of persons who received a copy of this draft SEIS is provided below:

Mr. Ronald D. Asche President and Chief Executive Officer Nebraska Public Power District 1414 15th Street Columbus, NE 68601	Mr. Gene Mace Nuclear Asset Manager Nebraska Public Power District P.O. Box 98 Brownville, NE 68321	Mr. John C. McClure Vice President and General Counsel Nebraska Public Power District P.O. Box 499 Columbus, NE 68602-0499
Mr. David Van Der Kamp Licensing Manager Nebraska Public Power District P.O. Box 98 Brownville, NE 68321	Mr. Michael J. Linder, Director Nebraska Department of Environmental Quality P.O. Box 98922 Lincoln, NE 68509-8922	Chairman Nemaha County Board of Commissioners Nemaha County Courthouse 1824 N Street Auburn, NE 68305
Mr. Stewart B. Minahan Vice President Nuclear and Chief Nuclear Officer Cooper Nuclear Station 72676 – 648A Avenue Brownville, NE 68321	Ms. Julia Schmitt, Manager Radiation Control Program Nebraska Health & Human Services R&L Public Health Assurance 301 Centennial Mall, South P.O. Box 95007 Lincoln, NE 68509-5007	Deputy Director for Policy Missouri Department of Natural Resources P.O. Box 176 Jefferson City, MO 65102-0176
Senior Resident Inspector U.S. Nuclear Regulatory Commission P.O. Box 218 Brownville, NE 68321	Regional Administrator, Region IV U.S. Nuclear Regulatory Commission 612 E. Lamar Blvd, Suite 400 Arlington, TX 76011-4125	Director, Missouri State Emergency Management Agency P.O. Box 116 Jefferson City, MO 65102-0116
Chief, Radiation and Asbestos Control Section Kansas Department of Health and Environment Bureau of Air and Radiation 1000 SW Jackson, Suite 310 Topeka, KS 66612-1366	Ms. Melanie Rasmussen Radiation Control Program Director Bureau of Radiological Health Iowa Department of Public Health Lucas State Office Building, 5th Floor 321 East 12th Street Des Moines, IA 50319	Mr. Keith G. Henke, Planner Division of Community and Public Health Office of Emergency Coordination 930 Wildwood Drive P.O. Box 570 Jefferson City, MO 65102
Mr. Art Zaremba, Director of Nuclear Safety Assurance Nebraska Public Power District P.O. Box 98 Brownville, NE 68321	Mr. John F. McCann, Director Licensing, Entergy Nuclear Northeast Entergy Nuclear Operations, Inc. 440 Hamilton Avenue White Plains, NY 10601-1813	Mr. Mike Boyce Cooper Strategic Initiatives Manager Cooper Nuclear Station 72676 – 648A Avenue Brownville, NE 68321
Mr. Garry Young License Renewal Manager Entergy Nuclear 1448 S.R. 333, N-GSB-45 Russellville, AR 72802	Mr. Alan Cox License Renewal Technical Manager Entergy Nuclear 1448 S.R. 333, N-GSB-45 Russellville, AR 72802	Mr. Dave Lach LRP Entergy Project Manager Entergy Nuclear 1448 S.R. 333, N-GSB-45 Russellville, AR 72802
Mr. Jerry Perry 500 S. Main Street Rock Port, MO 64482	Ms. Yolanda Peck 1008 Central Avenue Auburn, NE 68305	Ms. Kendall Neiman 830 Central Avenue Auburn, NE 68305
Ms. Annie Thomas 1522 I Street Auburn, NE 8305	Mr. John Chaney 1101 17th Street Auburn, NE 68305	Mr. Darrell Kruse 2415 McConnell Avenue Auburn, NE 68305

Ms. Daryl J. Obermeyer 64381 727A Road Brownville, NE 68321	Ms. Sherry Black, Director Auburn Memorial Library 1810 Courthouse Avenue Auburn, NE 68305	Board of Brownville, NE Attn: Chairman Marty Hayes P.O. Box 67 223 Main Street Brownville, NE 68321
Mr. Bob Engles Mayor of Auburn, NE 1101 J Street Auburn, NE 68305	Ms. Jo Stevens Mayor of Rock Port, MO 500 S. Main Street Rock Port, MO 64482	Mr. John Cochnar U.S. Fish and Wildlife Service Ecological Services Nebraska Field Office 203 West Second Street Grand Island, NE 68801
Mr. John Askew Regional Administrator U.S. EPA Region 7 901 N. 5th Street Kansas City, KS 66101	Ms. Joann Scheafer, Director Nebraska Department of Health & Human Services 301 Centennial Mall South Lincoln, NE 68509	Mr. Doyle Childers, Director Missouri Department of Natural Resources P.O. Box 176 Jefferson City, MO 65102
Mr. Mark Miles State Historic Preservation Officer Department of Natural Resources P.O. Box 176 Jefferson City, MO 65102	Mr. Michael J. Smith State Historic Preservation Officer Nebraska State Historical Society P.O. Box 82554 Lincoln, NE 68501	Mr. Robert Puschendorf Nebraska State Historical Society 1500 R Street P.O. Box 82554 Lincoln, NE 68501-2554
Mr. Seth Greenburg Environment, Planning, and Infrastructure Research Assistant ICF International 9300 Lee Highway Fairfax, VA 22031	Mr. Matthew Leaf KTNC/KLZA Radio 1602 Stone St Falls City, NE 68335	Mr. Daryl J. Obermeyer ADC 64381 727A Road Brownville, NE 68321
Mr. Ron Asche NPPD 1414 15th St. Columbus, NC 68601	Ms. Carla Mason ADC 820 Central Avenue Auburn, NE 68305	Mr. Jim Thomas Enercon 5100 E. Skelton Street, 450 Tulsa, OK 74135

1.9 STATUS OF COMPLIANCE

NPPD is responsible for complying with all NRC regulations and other applicable Federal, State, and local requirements. Appendix H to the GEIS describes some of the major Federal statutes. Table 1-1 on the following page lists the numerous permits and licenses issued by Federal, State, and local authorities for activities at CNS-1.

1 **Table 1-1. Licenses and Permits**. *Existing environmental authorizations for CNS-1 operations.*

Permit	Number	Dates	Responsible Agency
Operating License	DPR-46	Issued: 1/18/1974 Expires: 1/18/2014	NRC
National Pollutant Discharge Elimination System (NPDES) Permit	NE0001244	Expires: 6/30/2012	Nebraska Department of Environmental Quality (NDEQ)
General NPDES Permit	NER000059	Expires: 9/17/2012	NDEQ
Permit to Construct an Air Contaminant Source	Not Applicable (NA)	NA	NDEQ
Hazardous Waste Generator Identification	NED1055071064-2	NA	NDEQ
Class V Well Underground Injection	NE0208256	Expires: 11/16/2010	NDEQ
Well Registration	G-030088	NA	Nebraska Department of Natural Resources (NDNR)
Well Registration	G-030089	NA	NDNR
Well Registration	G-040718	NA	NDNR
Well Registration	G-100339	NA	NDNR
Well Registration	G-100340	NA	NDNR
Well Registration	G-149001A	NA	NDNR
Well Registration	G-149001B	NA	NDNR
Well Registration	G-149001C	NA	NDNR
Well Registration	G-149001D	NA	NDNR
Well Registration	G-149001E	NA	NDNR
Well Registration	G-149001F	NA	NDNR
Well Registration	G-149001G	NA	NDNR
Well Registration	G-149001H	NA	NDNR
Well Registration	G-149001I	NA	NDNR
Well Registration	G-149001J	NA	NDNR
Well Registration	G-149001K	NA	NDNR
Water withdrawal permit	D-1071	NA	NDNR
Class III Public Water Supply System Permit	NE3150505	NA	Nebraska Health and Human Services (NHHS) System
401 Certification	NA	NA	Nebraska Water Pollution Control Council (NWPCC)
CNS-1 Radioactive Waste Transport Permit	0218-26-08-X	12/31/2008	South Carolina Department of Health and Environmental Control (SCDHEC)

Permit	Number	Dates	Responsible Agency
CNS-1 Radioactive Waste License for Delivery	T-NE002-L08	12/31/2008	Tennessee Department of Environment and Conservation (TDEC), Division of Radiological Health
Generator Site Access Permit	0111000042	1/3/2009	Utah Department of Environmental Quality (UDEQ), Division of Radiological Health

1.10 REFERENCES

10 CFR Part 51. *Code of Federal Regulations,* Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

Atomic Energy Act of 1954 (AEA). 42 U.S.C. 2011, et seq.

Endangered Species Act of 1973 (ESA). 16 U.S.C. 1531, et seq.

Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996. 16 U.S.C. 1855, et seq.

National Environmental Policy Act of 1969 (NEPA). 42 U.S.C. 4321, et seq.

National Historic Preservation Act (NHPA). 16 U.S.C. 470, et seq.

Nebraska Public Power District (NPPD). 2008. *License Renewal Application, Cooper Nuclear Station*, "Appendix E, Applicant's Environmental Report, Operating License Renewal Stage." ADAMS Accession No. ML083030246.

Nebraska Public Power District (NPPD). 2008a. *Cooper Nuclear Station, License Renewal Application.* ADAMS Accession No. ML083030227.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C. . ADAMS Accession Nos. ML040690705 and ML040690738.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C. ADAMS Accession No. ML0400690720.

U.S. Nuclear Regulatory Commission (NRC). 2009a. "Environmental Impact Statement, Scoping Process, Summary Report, Cooper Nuclear Station, Unit 1." Brownville, Nebraska. ADAMS Accession No. ML091200017.

U.S. Nuclear Regulatory Commission (NRC). 2009b. "Summary of Site Audit Related to the Review of the License Renewal Application for Cooper Nuclear Station, Unit 1 (TAC NOS. MD9763 and MD9737)." ADAMS Accession No. ML090970414.

2.0 AFFECTED ENVIRONMENT

Cooper Nuclear Station, Unit 1 (CNS-1) is located in Nemaha County, Nebraska, 2.25 miles southeast of Brownville, Nebraska, approximately 60 miles southeast of Lincoln, Nebraska and 65 miles south of Omaha, Nebraska. CNS-1 is bounded on the east by the Missouri River and by non-Nebraska Public Power District (NPPD) owned property on the north, south, and west. Figure 2.1-1 shows a map of a 50-mile radius around CNS-1. Figure 2.2-2 shows the area within a six-mile radius of CNS-1. The site is owned and operated by NPPD. The site structures for CNS-1 span approximately 55 acres of the site's total area of approximately 1,359 acres, including 239 acres on the opposite bank (east) of the Missouri River in Atchison County, Missouri. Over 99 percent of the acreage in Nemaha County is used for agriculture and farming. A significant portion of NPPD property at CNS-1, 234 acres in Missouri and 715 acres in Nebraska, is currently leased for agricultural activities such as farming and raising livestock.

2.1 FACILITY DESCRIPTION

The principal structures at CNS-1 consist of the reactor building, turbine building (including service area appendages), control building, controlled corridor, radwaste building, augmented radwaste building, intake structure, off-gas filter building, elevated release point, diesel generator building, multi-purpose facility, railroad airlock, drywell and suppression chamber, miscellaneous circulating water system structures (e.g., circulating water conduits, seal well), optimum water chemistry gas generator building, and office building. Predominant features are the 290-foot tall reactor building, the 325-foot tall elevated release point, and the 328.8-foot tall meteorological tower.

The reactor and nuclear steam supply systems for the site, along with the mechanical and electrical systems required for the safe operation of CNS-1, are primarily located in the containment structure. These vital components of the station are located in a protected area that is completely enclosed by a security fence, with access to the station controlled at a security gate. A plant security system monitors the protected area, as well as the buildings within the station. Normal access to the site is by a paved entrance road built across the site from Nemaha County Road 648A Avenue, located on the west side of the property. No residences are permitted within the CNS-1 exclusion area boundary.

2.1.1 Reactor and Containment Systems

CNS-1 is a single-unit boiling-water reactor (BWR) plant with a nuclear steam supply system supplied by General Electric Company and a turbine generator set supplied by Westinghouse Electric Corporation. CNS-1 achieved commercial operation in 1974 with an initial licensed core thermal power of 2,381 megawatt-thermal (MWt). In 2008, with U.S Nuclear Regulatory Commission (NRC) approval, the applicant performed a measurement uncertainty recapture uprate that increased the core thermal power by 1.62 percent to its current level of 2,419 MWt and 830 megawatt-electric (Mwe) (NPPD, 2008). Figure 2.1-3 shows the general layout of the buildings at CNS-1.

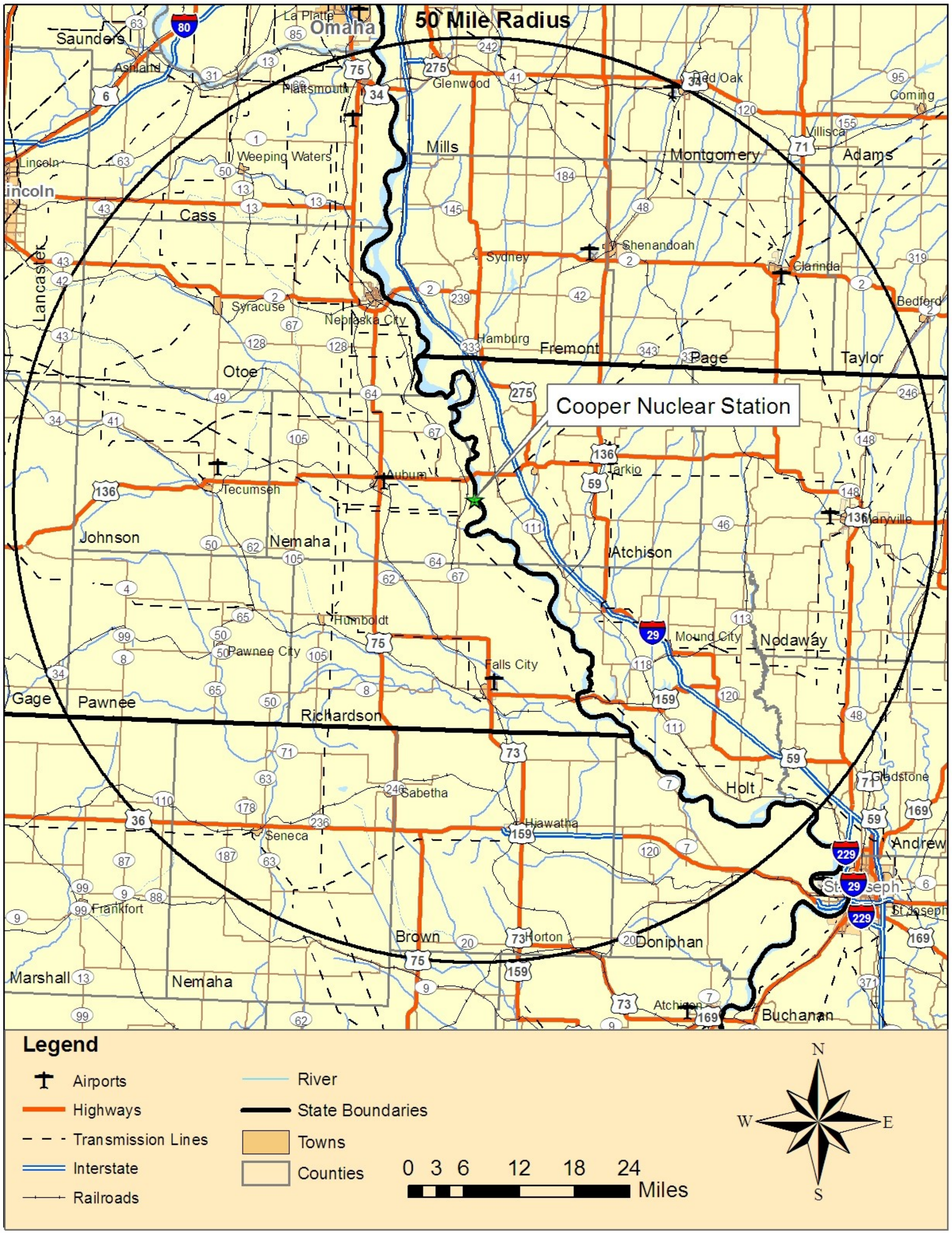


Figure 2.1-1. Location of Cooper Nuclear Station, Unit 1, 50-mile (80-kilometer) Region
(Source: NPPD, 2008)

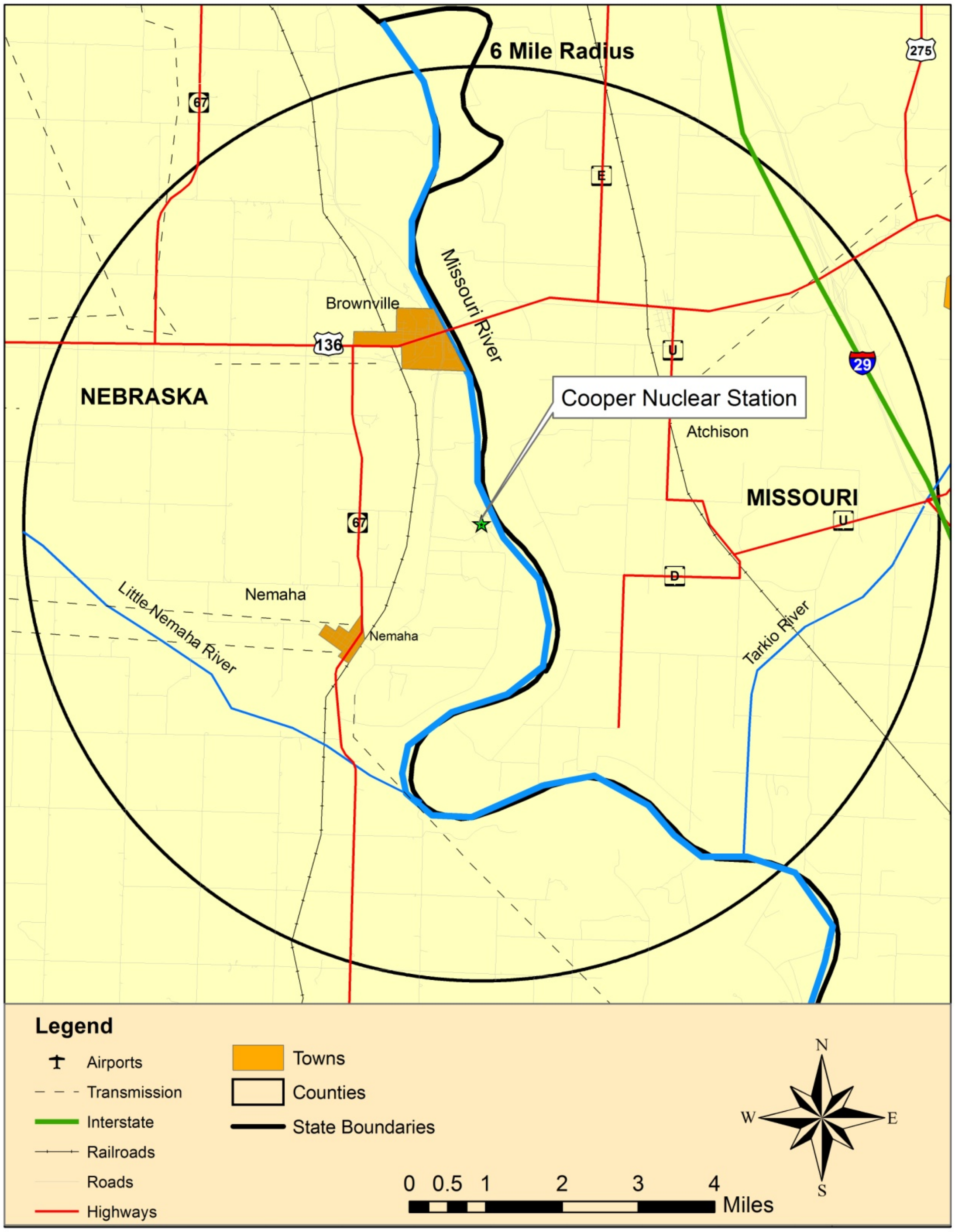


Figure 2.1-2. Location of Cooper Nuclear Station, Unit 1, 6-mile (10-kilometer) Region
(Source: NPPD, 2008)

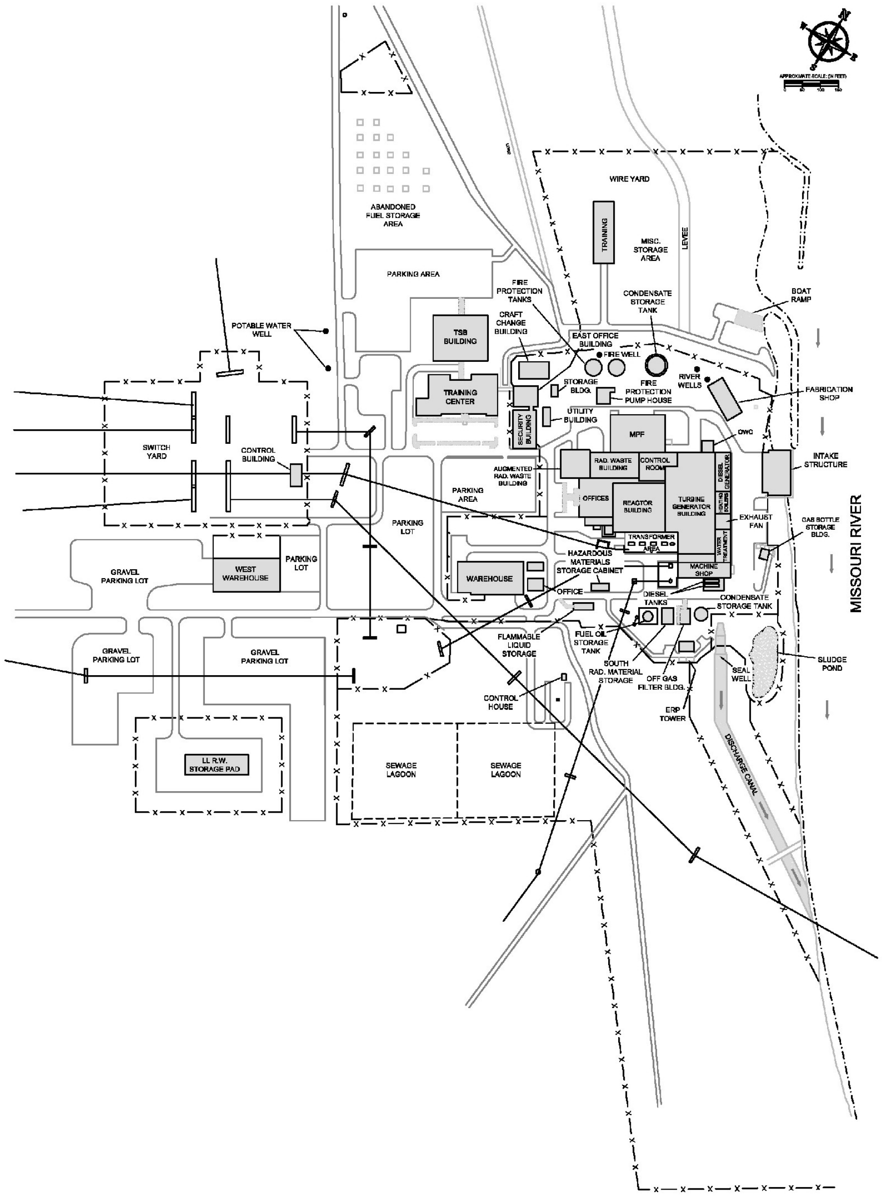


Figure 2.1-3. Cooper Nuclear Station, Unit 1, General Site Layout *(Source: NPPD, 2008)*

The reactor fuel is low-enriched high density ceramic uranium dioxide fuel pellets stacked within a Zircaloy-2 cladding tube, which is evacuated, back-filled with helium, and sealed by welding Zircaloy plugs in each end. NPPD currently operates CNS-1 with an individual rod average burnup of not more than 62,000 megawatt-days per metric ton uranium (MWd/MTU) (NPPD, 2008).

The CNS-1 containment system utilizes a multibarrier concept consisting of two systems, a primary containment, which is a pressure suppression system, and a secondary containment, which minimizes the release of radioactive materials.

The primary containment houses the reactor pressure vessel, the reactor coolant recirculation system, and other branch connections of the reactor coolant system. Primary containment is a pressure suppression system consisting of a drywell, a suppression chamber which stores a large volume of water, a connecting vent system between the drywell and suppression pool, isolation valves, portions of the emergency core cooling system, and other service equipment. The drywell is a steel pressure vessel in the shape of an inverted light bulb, and the suppression chamber is a torus-shaped steel pressure vessel, often referred to as the torus, located below and encircling the drywell.

Secondary containment encloses the primary containment system, refueling and reactor servicing areas, new and spent fuel storage facilities, and other reactor auxiliary systems. Secondary containment serves as the primary containment, when required, during reactor refueling and maintenance operations, when primary containment is inoperable and as an additional barrier when primary containment is operable (NPPD, 2008).

2.1.2 Radioactive Waste Management

The radioactive waste system for CNS-1 collects, treats, and disposes of radioactive and potentially radioactive wastes that are byproducts of plant operations. The byproducts are activation products resulting from the irradiation of reactor water and impurities therein (principally metallic corrosion products) and fission products resulting from defective fuel cladding or uranium contamination within the reactor coolant system. Operating procedures for the radioactive waste system ensure that radioactive wastes are safely processed and discharged from the plant within the limits set forth in Title 10 of the *Code of Federal Regulations* (CFR) Part 20, "Standards for Protection against Radiation," 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," the plant's technical specifications, and the CNS-1 offsite dose assessment manual (ODAM) (NPPD, 2008).

Radioactive wastes resulting from plant operations are classified as liquid, gaseous, or solid. Radioactive liquid wastes are generated from liquids received directly from portions of the reactor coolant system or were contaminated by contact with liquids from the reactor coolant system. Radioactive gaseous wastes are generated from gases or airborne particulates vented from reactor and turbine equipment containing radioactive material. Radioactive solid wastes are solids from the reactor coolant system, solids that come into contact with reactor coolant system liquids or gases, or solids used in the reactor coolant system or steam and power conversion system operation or maintenance (NPPD, 2008).

Reactor fuel that has exhausted a certain percentage of its fissile uranium content is referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced with fresh fuel assemblies during routine refueling outages. Spent fuel assemblies are stored in the spent fuel pool in the reactor building. In addition to the spent fuel pool, spent nuclear fuel is expected to be stored in dry casks during the license renewal term.

The CNS-1 ODAM contains the methodology and parameters used to calculate offsite doses resulting from radioactive gaseous and liquid effluents, and the gaseous and liquid effluent monitoring alarm and trip setpoints used to verify that the radioactive material being discharged meets regulatory limits. The ODAM also contains the radioactive effluent controls and radiological environmental monitoring activities and descriptions of the information that is included in the annual radiological environmental operating report and annual radioactive effluent release report (NPPD, 2008).

2.1.2.1 *Radioactive Liquid Waste*

The CNS-1 liquid waste disposal system collects, holds, treats, processes, and monitors all liquid radioactive wastes for reuse or disposal. The function of the radioactive waste system is to reclaim the liquid phase of the wet solid wastes for reuse within the station and to prepare the solid waste for offsite shipment while minimizing radiation exposure to the workers. Prior to offsite shipment to a licensed burial ground, solid wastes may be stored on site in shielded areas. The solid waste processing systems are located in the radioactive waste building and augmented radioactive waste building. Liquid radioactive waste is collected in sumps and drainage tanks and transferred to the appropriate subsystem collection tanks for treatment, disposal, or recycle. The waste processing selectively removes the radioactive material from the liquid. The processing methods used include filtration and/or demineralization. The system can also handle effluent streams that typically do not contain radioactive material, but may on occasion, be radioactive. The applicant limits, to the extent possible, the amount of liquid radioactive wastes discharged to the Missouri River. For example, there were no liquid radioactive discharges from CNS-1 into the Missouri River in 2007. Liquid discharges are made only after the radioactive material has been analyzed and the projected dose to members of the public has been calculated to be within the values specified in the ODAM, 10 CFR Part 20; and Appendix I to 10 CFR Part 50 (NPPD, 2008).

The NRC staff reviewed the CNS-1 radioactive effluent release reports for 2003 through 2007 for liquid effluents (NPPD 2004, 2005, 2006, 2007, 2008b). Based on the liquid waste processing system’s performance from 2003 through 2007, the liquid discharges for 2007 are consistent with the radioactive liquid effluents discharged from 2003 through 2006. Variations on the amount of radioactive effluents released from year to year are expected, based on the overall performance of the plant and the number and scope of outages and maintenance activities. The radioactive liquid wastes reported by CNS-1 are reasonable and no unusual trends were noted.

2.1.2.2 *Radioactive Gaseous Waste*

The CNS-1 gaseous waste disposal system processes and disposes of radioactive gaseous effluent to the atmosphere. The off-gas system (non-augmented) includes subsystems that process and dispose of the gases from the main condenser air ejectors, the startup mechanical vacuum pumps, and the gland steam condensers. The processed gases are routed to the elevated release point for dilution and release to the atmosphere. Radiation monitors monitor the gaseous discharges (NPPD, 2008).

CNS-1 discharges gaseous waste in accordance with the procedures and methodology described in the ODAM. The radioactive gaseous waste system is used to reduce radioactive materials in gaseous effluents before discharge to meet the dose limits in 10 CFR Part 20 and the dose design objectives in Appendix I to 10 CFR Part 50.

The NRC staff reviewed the CNS-1 radioactive effluent release reports for 2003 through 2007 for gaseous effluents (NPPD 2004, 2005, 2006, 2007, 2008b). Based on the gaseous waste processing system’s performance from 2003 through 2007, the gaseous discharges for 2007 are consistent with the effluents discharged from 2003 through 2006. Variations on the amount of radioactive effluents released from year to year are expected, based on the overall performance of the plant and the number and scope of outages and maintenance activities. The radioactive gaseous wastes reported by CNS-1 are reasonable and no unusual trends were noted.

2.1.2.3 *Radioactive Solid Waste*

The CNS-1 radioactive solid waste disposal system collects, stores, and processes wet and dry solid waste for packaging and shipment offsite. The system consists of a wet process, which collects, processes, dewaters, and solidifies wet solid wastes, and a dry process, which collects and packages dry solid wastes. Wet solid wastes include spent resins, filter cartridges, and filter crud. Dry solid wastes include contaminated rags, clothing, paper, outage equipment, and other radioactively contaminated equipment. CNS-1 uses a combination of onsite processing and an offsite vendor to process radioactive wastes for disposal. Transportation of the radioactive solid waste is conducted in accordance with NRC and U.S. Department of Transportation (DOT) regulations as specified in 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Wastes," and 10 CFR Part 71, "Packaging and Transportation of Radioactive Material" (NPPD, 2008).

The State of South Carolina's licensed low-level radioactive waste (LLW) disposal facility, located in Barnwell, has limited the access from radioactive waste generators located in States that are not part of the Atlantic Low-Level Waste Compact. Nebraska is not a member of the Atlantic Low-Level Waste Compact. This has had a minimal affect on CNS-1's ability to dispose of its solid LLW. It uses the licensed LLW disposal site operated by Envirocare in Clive, Utah for its Class A waste. The applicant has onsite storage capacity to store its Class B and C radioactive waste during the license renewal term.

In 2007, preparation work began for the construction of an independent spent fuel storage installation (ISFSI) located on the north end of the CNS-1 site in an area that was previously disturbed. The ISFSI will provide storage space for spent fuel storage casks. The ISFSI, in combination with the existing spent fuel pool, will store spent fuel assemblies generated during the license renewal term. Operation of the ISFSI will be in accordance with NRC regulations to ensure the spent fuel is stored safely and that worker and public radiation exposures are controlled in accordance with the dose limits specified in 10 CFR Part 20, as well as the Environmental Protection Agency's (EPA) radiation standards in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations" (NPPD, 2008).

The NRC staff reviewed the CNS-1 LLW reports for 2003 through 2007 (NPPD 2004, 2005, 2006, 2007, 2008b). The solid waste volumes and radioactivity amounts generated in 2007 are typical of previous annual waste shipments made by CNS-1. Variations in the amount of solid radioactive waste generated and shipped from year to year are expected, based on the overall performance of the plant and the number and scope of outages and maintenance activities. The volume and activity of solid radioactive wastes reported by CNS-1 are reasonable and no unusual trends were noted.

No plant refurbishment activities were identified by the applicant as necessary for the continued operation of CNS-1 through the license renewal term. Routine plant operational and maintenance activities currently performed will continue during the license renewal term. Based on the past performance of the radioactive waste system, and the lack of any planned refurbishment activities, similar amounts of radioactive solid waste are expected to be generated during the license renewal term.

2.1.3 Nonradiological Waste Management

CNS-1 generates nonradioactive wastes as part of routine plant maintenance, cleaning activities, and plant operations. Resource Conservation and Recovery Act (RCRA) governs the disposal of solid and hazardous waste. RCRA regulations are contained in Title 40, “Protection of the Environment,” Parts 239 through 299 (40 CFR 239, et seq.), of the CFR. Parts 239 through 259 of Title 40 contain regulations for solid (nonhazardous) waste, and Parts 260 through 279 contains regulations for hazardous waste. RCRA Subtitle C establishes a system for controlling hazardous waste from “cradle to grave,” and RCRA Subtitle D encourages States to develop comprehensive plans to manage nonhazardous solid waste and mandates minimum technological standards for municipal solid waste landfills. Nebraska State RCRA regulations are administered by the Nebraska Department of Environmental Quality (NDEQ) and address the identification, generation, minimization, transportation, and final treatment, storage, or disposal of hazardous and nonhazardous waste.

2.1.3.1 *Nonradioactive Waste Steams*

CNS-1 generates solid waste, defined by RCRA, as part of routine plant maintenance, cleaning activities, and plant operations. Nebraska is a part of EPA Region 7 and its Solid Waste program. In 1985, the EPA authorized NDEQ to administer portions of the RCRA program in the State of Nebraska that are incorporated in Title 128 (Nebraska Hazardous Waste Regulations) of Nebraska Administrative Code (NAC). NAC Title 128 was updated in 2004 to keep current with Federal RCRA regulations.

The EPA classifies certain nonradioactive wastes as hazardous based on characteristics including ignitability, corrosivity, reactivity, or toxicity (identification and listing of hazardous waste is available in 40 CFR Part 261). State-level regulators may add wastes to the EPA’s list of hazardous wastes. RCRA provides standards for the treatment, storage, and disposal of hazardous waste for hazardous waste generators (regulations are available in 40 CFR Part 262).

The EPA recognizes three main types of the hazardous waste generators (40 CFR 260.10) based on the quantity of the hazardous waste produced: Large Quantity Generators (LQGs), that generate 2,200 pounds (1,000 kg) per month or more of hazardous waste, more than 2.2 pounds (1 kg) per month of acutely hazardous waste, or more than 220 pounds (100 kg) per month of acute spill residue or soil; Small Quantity Generators (SQGs) that generate more than 220 pounds (100 kg), but less than 2,200 pounds (1,000 kg) of hazardous waste per month; and, Conditionally Exempt Small Quantity Generators (CESQGs) that generate 220 pounds (100 kg) or less per month of hazardous waste, or 2.2 pounds (1 kg) or less per month of acutely hazardous waste, or less than 220 pounds (100 kg) per month of acute spill residue or soil. State of Nebraska has incorporated the EPA’s regulations regarding hazardous wastes and recognizes CNS-1 as a conditionally exempt small quantity generator of hazardous wastes under Title 128, Chapter 8 of NDEQ Administrative Code. CNS-1 generates small amounts of hazardous wastes including spent and expired chemicals, laboratory chemical wastes, and occasional project-specific wastes. As reported in the NPPD environmental report (ER), CNS-1 produced no hazardous waste in 2003, 1,112 pounds (504 kg) in 2004, 4,285 pounds (1,944 kg) in 2005, 5,317 pounds (2,412 kg) in 2006, and 308 pounds (140 kg) in 2007 (NPPD, 2008). The increase in quantity of the hazardous waste produced by CNS-1 in 2005–2006 was due to large volumes of paint used during outages, as was confirmed by the NRC staff during the site audit. Used oil, produced during operation of CNS-1, is sent offsite to the EPA-approved hazardous waste disposal facility (NPPD, 2009c).

The EPA classifies several hazardous wastes as universal wastes; these include batteries, pesticides, mercury-containing items, and fluorescent lamps. NDEQ has incorporated the EPA's regulations (40 CFR Part 273) regarding universal wastes in Chapter 25 of Title 128 of the NAC. NDEQ defines used batteries, pesticides, mercury-containing items, spent non-TCLP fluorescent and HID lamps, cathode ray tubes (CRTs) and electronics as universal waste and such wastes make up the majority of the hazardous wastes produced by CNS-1. The NPPD ER reports that in 2007 CNS-1 produced 20,860 pounds (9,462 kg) of electronic waste, 6,190 pounds (2,808 kg) of lamps and 25,200 pounds (11,431 kg) of batteries (NPPD, 2008).

CNS-1 does not routinely chlorinate circulating water systems; however the periodic use of chlorine/bromine in the circulating water system and cooling water system is allowed in CNS-1 National Pollutant Discharge Elimination System (NPDES) permit No. NE0001244 (NPPD, 2008). Radioactive liquid waste is addressed in Section 2.1.2. Section 2.1.7.3 provides more information on CNS-1 NPDES permit and permitted discharges.

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires applicable facilities to provide information on hazardous and toxic chemicals to local emergency planning authorities and the EPA (Title 42, Section 11001, of the *United States Code* (42 USC 11001)). On October 17, 2008, the EPA finalized several changes to the Emergency Planning (Section 302), Emergency Release Notification (Section 304) and Hazardous Chemical Reporting (Sections 311 and 312) regulations that were proposed on June 8, 1998 (63 FR 31268). CNS-1 is subject to Federal EPCRA reporting requirements, and thus submits an annual Section 312 (Tier II) report on hazardous substances to local emergency agencies.

Low-level mixed wastes (LLMW) are wastes that contain both LLW and RCRA hazardous waste (40 CFR 266.210). The EPA (or any authorized State agency) regulates the hazardous component of the mixed waste through RCRA, and the NRC regulates radioactive waste subject to the Atomic Energy Act (AEA). CNS-1, as a conditionally exempt small quantity generator under RCRA Subtitle C, periodically produces small amounts of LLMW, mainly from the use of liquid cleaners, and sends it offsite for disposal to an approved disposal facility.

2.1.3.2 *Pollution Prevention and Waste Minimization*

NPPD established company-wide recycle programs at its major and minor facilities, with a growing Green Team, that focuses on pollution prevention, waste minimization, and education of personnel. CNS-1 implements this program and participates in Green Team activities. NPPD compiles an annual recycling report that summarizes recycling efforts at various locations including CNS-1. As a result of the CNS-1 recycling efforts 51.2 tons (46 metric tonnes (MT) of the office paper, 6,800 pounds (3.1 MT) of batteries, 8,500 pounds (3.9 MT) of electronic waste and 2,675 pounds (1.2 MT) of fluorescent lamps were recycled in 2008 as stated in *Nebraska Public Power District 2008 Recycling Report* (NPPD, 2008).

In support of nonradiological waste minimization efforts, the EPA's Office of Prevention and Toxics has established a clearinghouse that provides information regarding waste management and technical and operational approaches to pollution prevention (EPA, 2009a). The EPA's clearinghouse can be used as a source for additional opportunities for waste minimization and pollution prevention at CNS-1, as appropriate.

The EPA also encourages the use of Environmental Management Systems (EMSs) for organizations to assess and manage the environmental impact associated with their activities, products, and services in an efficient and cost-effective manner. The EPA defines an EMS as "a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency." EMSs help organizations fully integrate a wide range of environmental initiatives, establish environmental goals, and create a continuous monitoring process to help meet those goals. The EPA Office of Solid Waste especially advocates the use of EMSs at RCRA-regulated facilities to improve environmental performance, compliance, and pollution prevention (EPA, 2009).

2.1.4 Plant Operation and Maintenance

Maintenance activities conducted at CNS-1 include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. Various programs and activities currently exist at CNS-1 to maintain, inspect, test, and monitor the performance of facility equipment. These maintenance activities include inspection requirements for reactor vessel materials, boiler and pressure vessel in-service inspection and testing, maintenance structures monitoring program, and maintenance of water chemistry.

Additional programs include those implemented to meet technical specification surveillance requirements, those implemented in response to the NRC generic communications, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during the operation of the unit, while others are performed during scheduled refueling outages. Nuclear power plants must periodically discontinue the production of electricity for refueling, periodic in-service inspection, and scheduled maintenance. CNS-1 refuels on an 18-month interval.

2.1.5 Power Transmission System

The NPPD notes in their ER that four transmission lines, owned and operated by NPPD, are considered in scope for license renewal. Three of these four lines are numbered and connect CNS-1 to the regional grid via 345-kilovolt (kV) transmission lines, and total approximately 148 miles (238 km). Two of these numbered lines, NPPD TL301 and NPPD TL3502, form a transmission line corridor extending 145 miles (233 km) west-northwest from CNS-1 in Nemaha County and ending within 4 miles (6 km) east of Grand Island in Merrick County. Line NPPD TL3501 originates at CNS-1 and extends approximately 64 miles (103 km) west-northwest to the Mark T. Moore substation, located 1.5 miles (2.4 km) north of Hallam, Nebraska. Line NPPD TL3502 extends approximately 83 miles (134 km) west-northwest from the Moore substation and ends east of Grand Island, crossing the Platte River within one mile of the Grand Island substation (Figure 2.1.5-1). This transmission line right-of-way (ROW) originating from the CNS-1 switchyard spans Nemaha County, Johnson County, Gage County, Lancaster County, Saline County, Fillmore County, York County, Hamilton County, and Merrick County, Nebraska. Line NPPD TL3504 originates at CNS-1 and extends 0.6 miles (1 km) east from the plant and midway to the Missouri River, where it connects with a transmission line owned by Mid-America Energy that is not considered in scope. A fourth unnumbered transmission line in the scope of license renewal connects from the plant to the switchyard and is also considered in scope (NPPD, 2008).

There are several additional transmission lines originating at the CNS-1 switchyard that are neither owned nor operated by CNS-1. Two transmission lines originating at the CNS-1 switchyard are owned by Omaha Public Power District (OPPD), and a third is owned by Aquila. As these three transmission lines are not owned or under the control of NPPD, they are not within the scope of license renewal for CNS-1 (NPPD, 2008).

The transmission lines do not cross any Federal, State, or local parks (NPPD, 2008). However, the western half of the transmission line corridor traverses counties that are part of the U.S. Fish and Wildlife Service's (USFWS) Rainwater Basin Wetland Management District (RBWMD). The RBWMB contains 61 tracts of wetlands comprising over 21,000 acres scattered over 14 counties in southeastern Nebraska, and are managed to provide resting stops for millions of migratory birds (USFWS, 2009h).

Farming occurs virtually unimpeded under the majority of the transmission lines, and only the footprints of the poles are not used for crops (NPPD, 2008). On the CNS-1 property the agricultural land is managed by a single farmer under an agreement with NPPD. According to staff of NPPD, approximately 70 percent of the transmission line corridor beyond the CNS-1 site traverses cropland, and NPPD has easements with the individual property owners to perform maintenance activities along the corridor. Where the remaining 30 percent of the transmission line corridor crosses forested areas, including wetlands and streams, NPPD has vegetative maintenance procedures in place to prevent vegetation from interfering with the lines (NPPD, 2006b).

NPPD utilizes an integrated management approach to maintain vegetation along the transmission line ROW that includes both mechanical and chemical control methods. Mechanical control methods in the non-cultivated areas include clearing only woody plants with growth habits that may interfere with the transmission lines or the removal of tall trees that may fall onto the transmission line tower poles. Chemical treatment is used to control brush and re-growth of stumps following mechanical cutting (NPPD, 2006b). Native grasses and low-lying woody plants are allowed to grow below the power lines within the forested ROWs (NPPD, 2008). All tree trimming performed by NPPD follows ANSI guidelines for maintaining safe clearance and operation of the electrical systems. Chemical control methods adhere to the State of Nebraska, Department of Agriculture guidelines for application of restricted-use herbicides. All personnel involved with herbicide applications are trained and certified on the application of restricted-use herbicides by the State of Nebraska or a reciprocating State. For mechanical vegetation management in wetlands or along the shoreline of the Missouri River, NPPD contacts the U.S. Army Corps of Engineers (USACE) to determine if there is a need to obtain a Section 404 permit (NPPD, 2006b). NPPD staff has indicated that no chemical treatment of vegetation is performed in wetlands. Chapter 3 of the NPPD Corporate Environmental Manual (NPPD, 2007b) includes provisions for NPPD personnel and vendors/contractors to follow for any land disturbance activities, including work performed in wetlands or along riverbanks.

ROW aerial inspections occur bi-monthly, and there is an annual foot patrol inspection; additional patrols are conducted following severe storms. Maintenance activities are performed in compliance with the Endangered Species Act (ESA), the Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act. Birds that are nesting are protected except for nests of pigeons, house sparrows, and starlings (NPPD, 2006b).

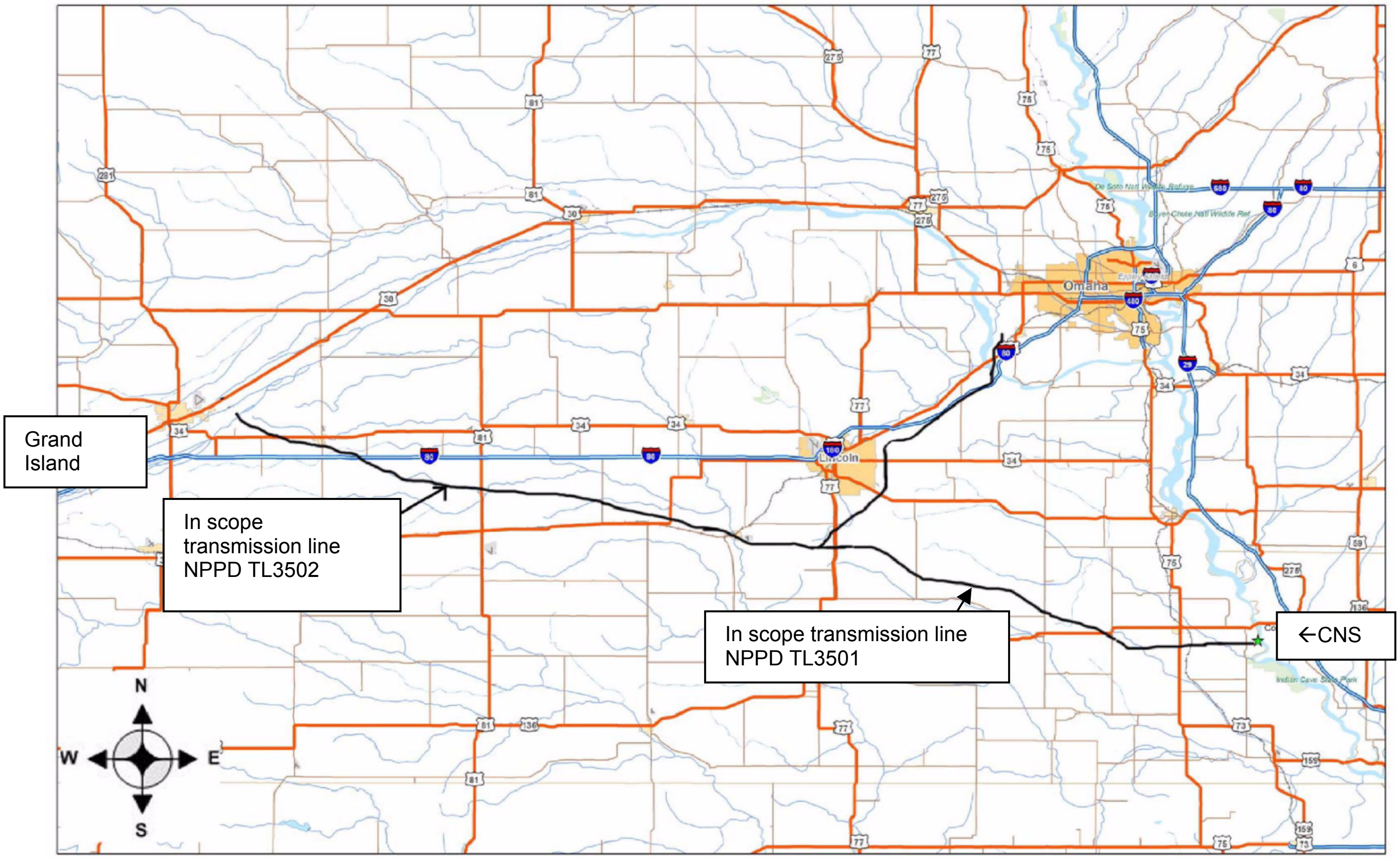


Figure 2.1.5-1. Cooper Nuclear Station, Unit 1 Transmission Line Corridor
(Modified from NPPD, 2008 CNS-1 ER.)

2.1.6 Cooling and Auxiliary Water Systems

CNS-1 lies on the western shore of the Missouri River, withdraws river water for its once-through cooling system, and discharges heated water back to the river. Unless otherwise cited, NRC staff drew information about CNS-1's cooling and auxiliary water systems from NPPD (2006c) and the applicant's ER. In the vicinity of the plant, the Missouri River has a regulated minimum flow of 31,000 cubic feet per second (cfs) (878 cubic meters per second (m^3/sec)) to the southeast. The circulating water intake structure is located on the western shore of the river behind a guide wall and submerged weir meant to reduce the amount of suspended sediment in the cooling water. The weir attaches to shoreline structures north of the intake and then runs parallel to the face of the intake at a distance of 14.25 feet (4.3 m). The wall continues past the intake and ends 40 feet (12 m) downstream of the downstream corner of the intake structure. In a line riverward of the weir wall and extending downstream of it, 23 sheet pile vanes (10 ft wide by 6 ft high, 3 m wide by 2 m high) oriented at a 22 degree angle to the weir redirect sand and gravel outward from the weir and the intake structure. After flowing generally south along the weir and vanes, river water must reverse course and turn northwest to move between the weir and shore and reach the intake bays. Water velocity between the weir wall and the cooling water intake structure is about 4 ft/sec (1.2 m/sec).

In winter, about 25 to 30 percent of main condenser discharge water recirculates through an ice control tunnel at the front of the intake structure and discharges in front of the trash rack to prevent icing. Water flows beneath a curtain wall at about 1.1 ft/sec (0.3 m/sec). Water enters the five intake bays, four of which provide circulating water and are 22 feet (6.7 m) wide and one of which provides service water and is 22.5 feet (6.8 m) wide. The incoming water then flows through trash racks, 3/8 inch (1.0 cm) vertical bars separated 3 inches (7.6 cm) on center, at up to 0.7 ft/sec (20 cm/sec).

The circulating water intake bays each separate into two screen bays and the service water intake bay narrows before water encounters the traveling screens, which are oriented at right angles to the flow. Water filters twice through nine 1/8 by ½-in. (.3 cm by 1.3 cm) smooth-top mesh modified dual-flow traveling screens (eight for circulating water and one for service water). The upward pass is in the front and the downward pass is behind the screens, that rotate continuously at 8.2 ft/min (2.5 m/min). The intake water velocity at the screens is about 2 ft/sec (0.6 m/sec).

After the 4.2-ft (1.28-m) wide traveling screen panels rotate over the upper cog and begin moving down, a high pressure (30–60 psig, 200–400 kPa) screen wash of 3000 gallons per minute (gpm) (0.19 m^3/sec) supplied by the service water pumps removes fish and debris, which return together to the river through an 18-in (0.46-m) diameter steel pipe that discharges downstream from the intake. Although the screens are fitted with fish baskets, the system has neither a low-pressure spray system to more gently remove fish from the screens nor a fish return trough to convey fish and other aquatic organisms back to the river separately from potentially damaging debris. Debris loads are about 10 cubic yards per month (8 m^3/month).

CNS-1 plans to install “dual-flow conversion screen fish handling systems” during its current operational term. This system will have low pressure (5 to 10 psi, 35-70 kPa) fish washing sprays on both the ascending and descending screens and a fish return trough that is separate from the debris trough. A recovery basket will collect fish and other aquatic organisms washed from the screens, and the fish trough will return them to the river. Figure 2.1.6-1, Figure 2.1.6-2, and Figure 2.1.6-3 show the CNS-1 intake structures.

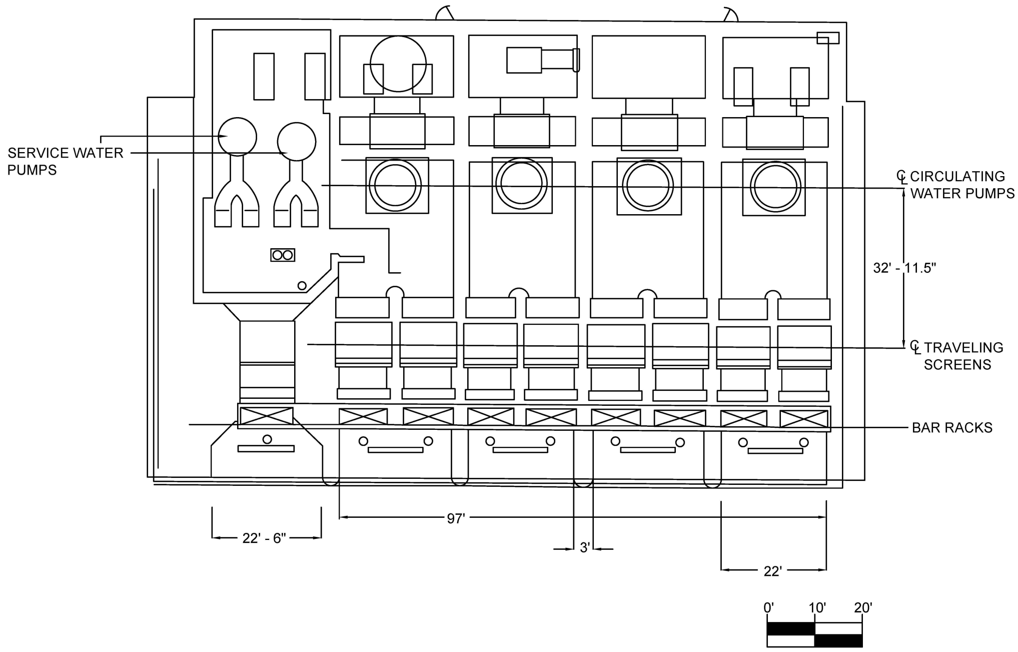


Figure 2.1.6-1. Cooper Nuclear Station, Unit 1, Intake Structure Plan
(Source: NPPD, 2008)

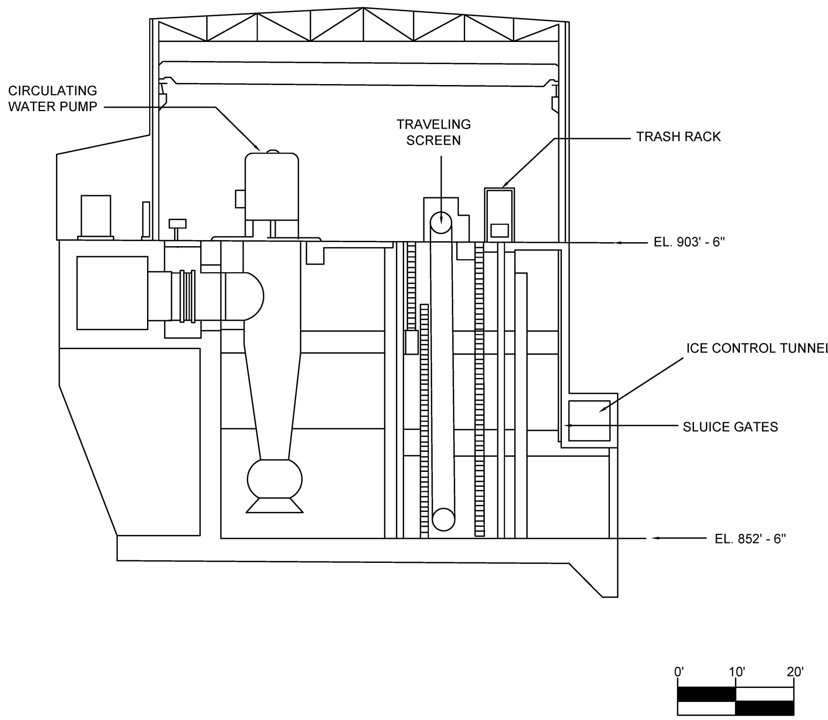


Figure 2.1.6-2. Cooper Nuclear Station, Unit 1, Intake Structure Section
(Source: NPPD, 2008)

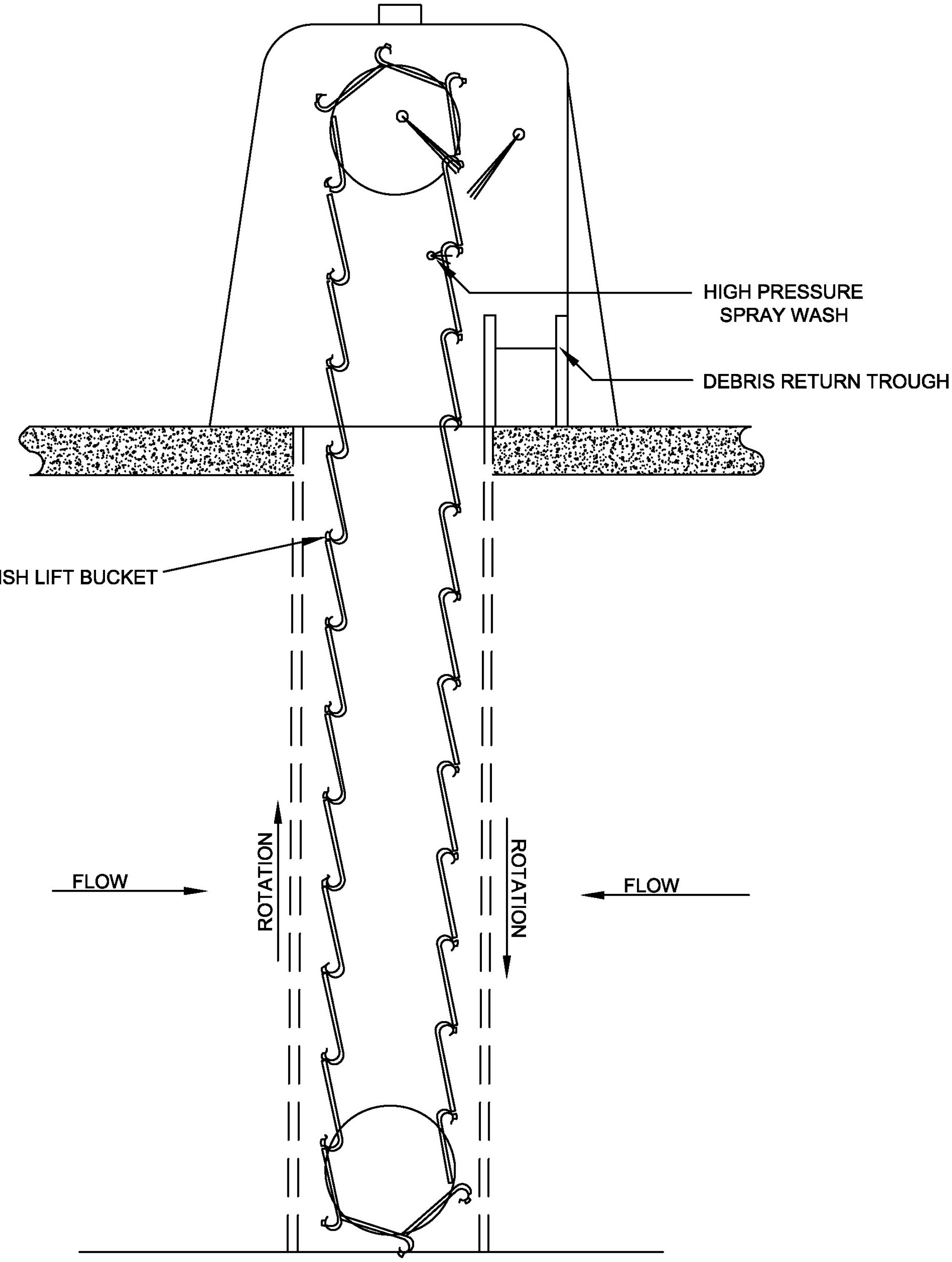


Figure 2.1.6-3. Cooper Nuclear Station, Unit 1, Typical Dual Flow Screen
(Source: NPPD, 2008)

After water passes through the traveling screens, the two screen bays of each intake bay rejoin behind the screens. The four circulating water pumps, one per bay, draw water from the bays and provide up to 159,000 gpm (10 m^3/sec) each. The four service water pumps in the fifth bay provide a combined flow of 32,000 gpm (2 m^3/sec). Water from the circulating water pumps travels to and circulates through the condenser, where it cools steam from the turbines. Because of the scouring from the suspended sediment, CNS-1 typically does not need to chlorinate the circulating water to control biological film fouling, although it has the capacity to chlorinate or brominate if needed. NPPD is studying the effectiveness of these options.

Water temperature increases about 17.8°F (10°C) as it passes through the condenser tubes. From the condenser, circulating cooling water flows through concrete tunnels to a seal well structure and then to the discharge canal, where it travels about 1,000 feet (300 m) to discharge to the river at a slight angle. Water velocity at the discharge is about 1 ft/sec (0.3 m/sec) at average river flow and about 5.6 ft/sec (1.7 m/sec) during low flows. The travel time from the intake structure to the discharge is about 20 minutes at high river flow and 10 to 12 minutes at low flow.

Cooling water flow varies with electrical load and ambient river water temperature. At full load during summer, the expected circulating water system flow is highest: about 636,000 gpm (40 m^3/sec). Circulating water flow is lower under other conditions. In comparison, the lowest river flow at CNS-1 is about 3,000 cfs. Under the worst conditions, the circulating water system flow would be about 47 percent of Missouri River flow. Stone riprap at the discharge structure prevents the discharge from eroding the river bottom.

2.1.7 Facility Water Use and Quality

CNS-1 has a once-through circulating water system withdrawing cooling water from and discharging to the Missouri River. Each of the four facility circulating water pumps can draw a maximum of 159,000 gpm. The four service water pumps provide a combined flow of 32,000 gpm. In addition, CNS-1 uses two wells to supply potable ground water to the facility, two wells to supply water to pump seals and one well for fire protection training (NPPD, 2008).

2.1.7.1 *Ground Water Use and Quality*

The CNS-1 property overlies the Missouri River Stream Valley Aquifer (described in Section 2.2.3) which consists of interbedded alluvial sand, silt, clay, and gravel ranging in thickness between 62 and 71 feet (18.9 and 21.6 m) (NDNR, 2008). Saturated thickness of the aquifer averages approximately 50 feet (15.2 m). In the area of CNS-1, the alluvial aquifer is in hydraulic contact with the Missouri River with seasonal discharge to the river during lower river stage and recharge from the river during high stage (NPPD, 2008c). Ground water usually flows from west to east towards the river, but will flow east to west when river levels are high in the spring.

The two potable water supply wells completed in the alluvial aquifer are registered with the Nebraska Department of Natural Resources (NDNR) and have a current combined pumping capacity of 250 gpm (0.016 m3/s) (NDNR, 2008). Normal operations require pumping only one well at a time to supply 125 gpm (0.008 m3/s). The wells together operate as a Nebraska Public Water Supply System under permit number NE3150505 from the Nebraska Department of Health and Human Services (NHHSS, 2000). The water is chlorinated, distributed onsite, and operated with preventive maintenance and cross connection/backflow prevention programs. NPPD plans to replace the two drinking water wells with two similar new wells in the near future.

A third alluvial aquifer well registered with the NDNR used for fire protection training has a capacity of 750 gpm (0.047 m^3/s). Two additional wells, River Wells A and B, have a capacity of 150 gpm (0.01 m3/s) each and are used to supply water for pump seals.

NPPD CNS-1 also has authorization number NE0208256 from the NDEQ to conduct underground injection of storm water run-off within the protected area using storm water drainage wells (dry wells) (NDEQ, 2000). These wells look like storm drains but contain gravel at the bottom that allows the collected storm water to seep into the fill material above the water table. This water eventually reaches the water table and disperses.

Ground water monitoring at CNS-1 is conducted by sampling 14 monitoring wells, eleven of which were installed to measure the concentration of tritium in ground water. Three of the wells are piezometers installed as part of the ISFSI Project. NPPD has documented seven instances of liquid radiological releases since the licensing of CNS-1 in 1974, but none of the releases is a current source of ground water contamination (CRA, 2007). Preliminary sampling and analysis results from the ground water monitoring program for tritium will be submitted and summarized in the final SEIS.

2.1.7.2 *Surface Water Use and Quality*

CNS-1 employs a once-through cooling system using water from the Missouri River. Wing dams on the Missouri side of the river are designed to force flow into the central channel of the river. Flow in the river is channelized and carries a heavy sediment load. Sedimentation at the CNS-1 intake is minimized by turning vanes and a sheet-pile wall set in the river that direct sediment away from the intake structure.

Surface water quality data in the CNS-1 vicinity are provided by USACE low flow studies in support of the Missouri River Master Water Control Manual. Results show relatively small ranges of values of temperature, pH, and dissolved oxygen, but wider variations of suspended solids (USACE, 2007). None of the samples from downstream of CNS-1 showed effects from operating the CNS-1 once-through cooling system. However, the NDEQ, under the authority of the Clean Water Act, has designated the Missouri River in the reach from the Platte River to the Kansas border as impaired for primary contact recreation and fish consumption due to the presence of fecal coliform and polychlorinated biphenyls (PCBs). Beneficial uses of surface water identified in the CNS-1 area are for agricultural and industrial water supply (NDEQ, 2004).

2.1.7.3 *National Pollutant Discharge Elimination System*

The Nebraska Department of Health, Water Pollution Control Council, originally authorized CNS-1 to use water from and discharge to the Missouri River. Discharge is regulated by Nebraska NPDES permit NE-0001244 which identifies effluent limitations, monitoring requirements and other conditions to comply with NDEQ Title 117 and Title 119, Chapter 27 (NPDES permits rules and regulations) and 40 CFR Part 423 (NPPD, 2008). The effluent limitations for each outfall are shown in Table 2.1.7-1.

Table 2.1.7-1. Effluent Limitations (mg/L) – National Pollutant Discharge Elimination System Permit for Cooper Nuclear Station, Unit 1

Total Suspended Solids			Oil and Grease		Total Residual Chlorine		Temperature-F	
Outfall No.	Avg. Month	Max. Daily	Avg. Month	Max. Daily	Avg. Month	Max. Daily	Max. current	Max. proposed
001	NLR	NLR	NLR	NLR	0.01	0.02	109.4	115.7
002a	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR
002b	30	100	NLR	10	NLR	NLR	NLR	NLR
002c	30	100	NLR	10	NLR	NLR	NLR	NLR
003	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR
004	30	100	NLR	10	NLR	NLR	NLR	NLR
005	30	100	15	20	NLR	NLR	NLR	NLR
006	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR
008	30	100	NLR	10	NLR	NLR	NLR	NLR
009	30	100	NLR	10	NLR	NLR	NLR	NLR

NLR = No Limit Required

Outfall 001, the main discharge canal outfall for the circulating water system, is located approximately 1000 feet downstream of the CNS-1 intake structure and empties to the Missouri River. The once-through service water and equipment non-contact cooling water discharges through Outfall 006, which empties into the discharge canal. Outfall 004 discharges overflow from the reverse osmosis treatment system and boiler blowdown and also empty into the circulating water discharge canal.

Outfalls 002a, 002b, and 002c discharge water from roof drain sumps outside the power block, from clear well discharge, and HVAC blowdown, respectively. Along with the intake screen backwash discharged through Outfall 003, Outfalls 002a, b, and c discharge to the Missouri River. Outfall 005 discharges batch volumes of sanitary waste from the sewage lagoon system. The discharge is sprayed on nearby farm land and is not directly connected to area surface water bodies. Outfall 008 discharges demineralized well water from the primary plant system’s waste sample tank and have had only one discharge in the last five years. Outfall 009 discharges demineralized well water from the sample tank floor drains in the radioactive control area. This outfall has not had a discharge in the last five years.

The only NPDES non-compliance reported in the last five years was total suspended solids (TSS) at Outfall 004 on August 31, 2008. The TSS averaged 37.4 milligrams per liter (mg/l) which exceeds the monthly daily permit limit of 30.0 mg/l . The cause of this small excess was found to be the presence of fish in the reverse osmosis treatment settling pond. The fish, introduced to the pond by flooding in 2008, stirred up bottom sediment and caused the sample to contain higher than average TSS. The treatment system did not cause the excess.

In addition to the NDEQ industrial wastewater NPDES permit, CNS-1 has an industrial storm water discharge permit NER000059 for storm water discharge outside the power block area. Inside the power block area, storm water discharge is directed to storm water drainage wells permitted as Class V underground injection wells by the NDEQ under permit NE0208256. The storm water enters the storm drains and disperses in the vadose zone (i.e., the portion of the earth between the top of the ground surface and the water table) above the local water table before it likely discharges to the Missouri River.

2.1.7.4 *Dredging*

CNS-1 has a USACE dredging permit NE 01-10322 to conduct maintenance dredging of the CNS-1 intake structure. A typical dredging event removes approximately 350 cubic yards (267.6 m^3) of sediment outside the main channel and discharges the dredged material downstream in the Missouri River (USACE, 2002).

2.2 SURROUNDING ENVIRONMENT

The vicinity of CNS-1 is sparsely populated with zero population within a one-half mile radius of the plant. Brownville, Nebraska, the nearest developed community, had a 2005 population of approximately 137. The largest town within 6 miles, Nemaha, Nebraska, located 2.5 miles southwest, had a 2005 population of approximately 177. The largest town with industry within 10 miles is Auburn, Nebraska, located to the west, with a 2005 population of approximately 3,076. Nebraska City, located approximately 24 miles northwest of the site, is the closest major town with a 2005 population of 7,035. Maryville, Missouri, located approximately 40 miles east of the plant, is the largest community within 50 miles with a 2005 population of approximately 10,567 (NPPD, 2008).

CNS-1 is located on the Missouri River at RM 532.5. In the vicinity of CNS-1, on average the Missouri River is approximately 800 feet wide and 28 feet deep. Under the present flow regulation, a minimum Nebraska City flow of 31,000 cfs is maintained for navigational purposes beginning in March and extending through November. During the winter months, a minimum flow of 3,000 cfs is required for sanitary purposes. The flow is highly channelized with swift flows and heavy sediment transport.

The site is located on a constructional plain bordering the west bank of the Missouri River situated on the first bottomland of the broad, nearly level, flood plain. The USACE has stabilized the channel by use of pile dikes and bank protection. Earthen levees running parallel with the Missouri River, and flood protection levees were constructed in the area to prevent meandering of the river within the alluvial flood plain. The eastern bank of the Missouri River is chiefly a densely forested land similar to the un-farmable bluffs that run parallel to the Missouri River. To the west there are bluffs that peak at 1,100 feet, but average 1,000 feet along the stretch of river from Brownville to Nemaha. Beyond the bluffs, the land is a gently rolling flood plain.

There are several Native American lands within a 50-mile radius of CNS-1 including the Sac and Fox Reservation, Iowa Reservation, and Kickapoo Reservation. There are also several local and county parks, golf courses, forest lands, wildlife areas, and other public recreation lands within a 50-mile radius of CNS-1 (NPPD, 2008).

2.2.1 Land Use

CNS-1 is located on approximately 1,359 acres (550 hectares (ha)) of land owned and operated by NPPD, including 239 acres (97 ha) on the opposite bank (east) of the Missouri River in

Atchison County, Missouri, see Figure 2.2.1. Of the 1,359 acres (550 ha), 949 acres (384 ha) are currently leased for agricultural activities such as farming and livestock: 234 acres (95 ha) in Missouri and 715 acres (289 ha) in Nebraska. The 234 acres (95 ha) on the Missouri side of the river intermittently flood and are mostly wooded wetlands, with 40 of these acres (16 ha) cleared for agricultural activities. The developed portion of the plant site consisting of the power plant structure and associated buildings, maintenance facilities, parking lots, and roads occupies approximately 55 acres (22 ha) of the site (NPPD, 2008).

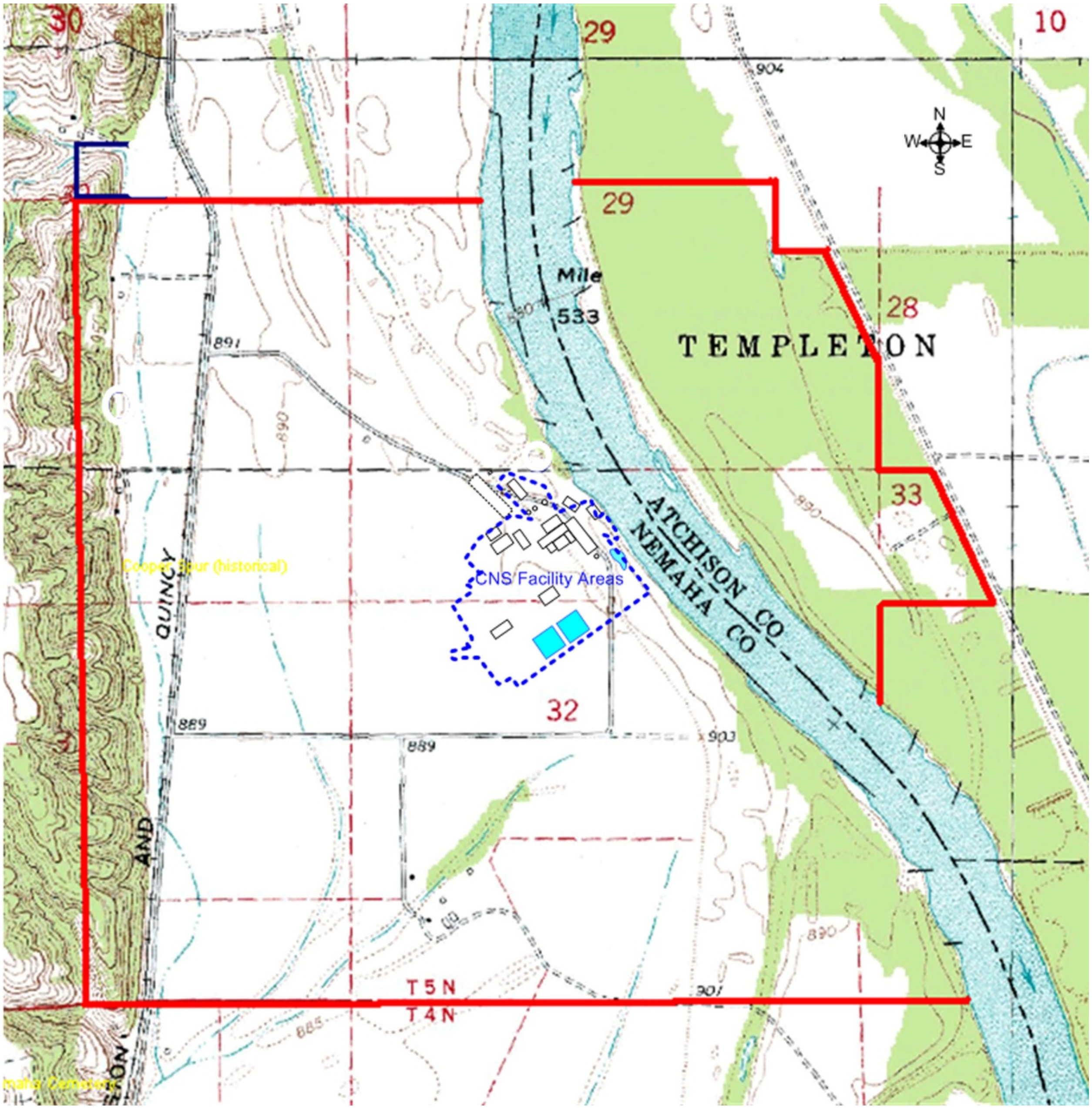


Figure 2.2.1-1. Cooper Nuclear Station Facility Location

The immediate area around the station is completely enclosed by a security fence, with access to the station controlled at a security gate. The exclusion area, as defined by 10 CFR 100.3, surrounds the plant site as shown in Figure 2.2.1-2. The plant site can be accessed by road on the west side or from the Missouri River on the east. Road access to the plant site is from Nemaha County 648A Avenue. A railroad spur connected to the site during construction was abandoned by the Burlington Northern Railroad. The Steamboat Trace Recreational Trail runs north and south through NPPD property west of the station along the abandoned railroad right-of-way (ROW). The nearest residences lie 0.9 miles beyond the site boundary to the northwest (NPPD, 2008).

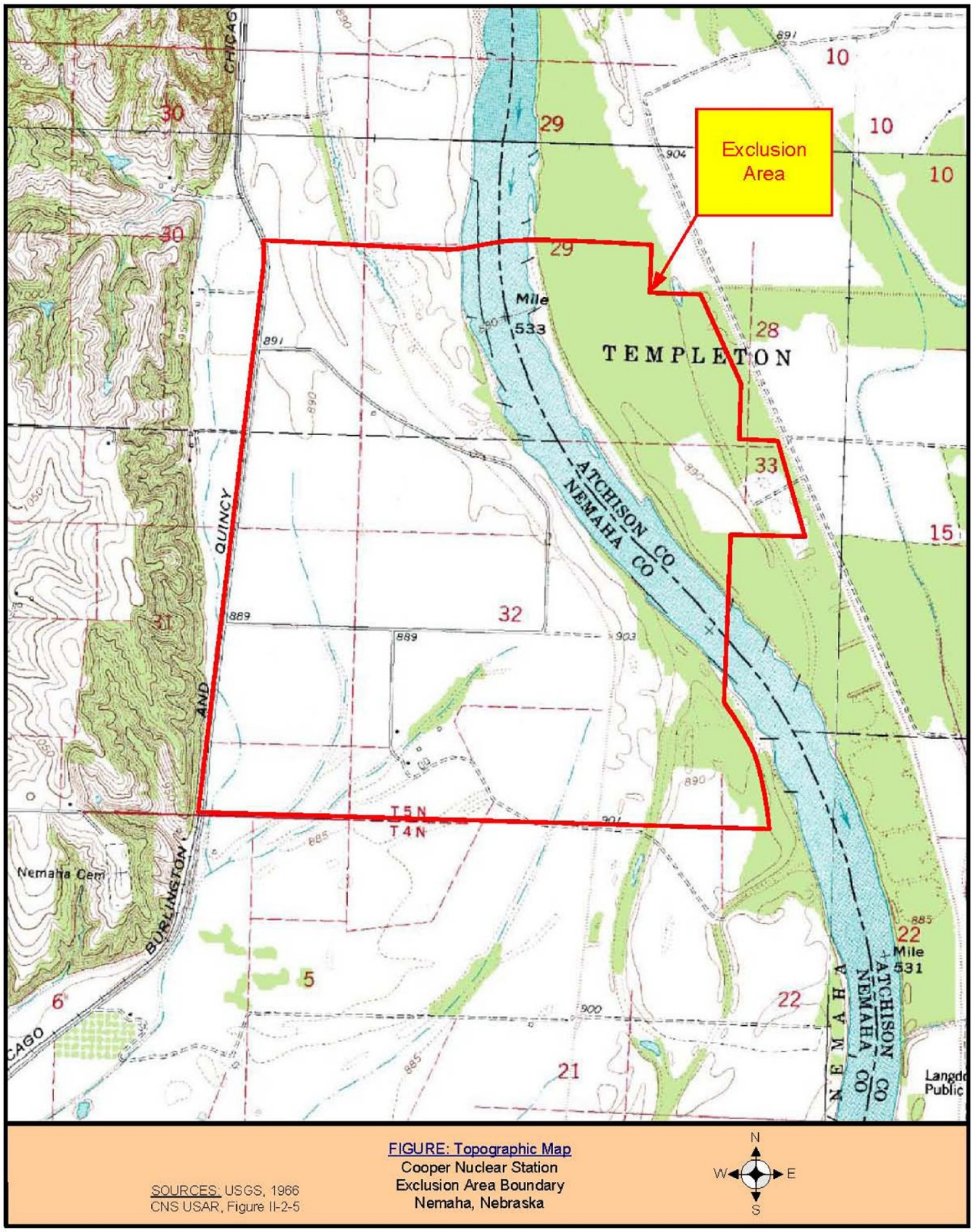


Figure 2.2.1-2. Cooper Nuclear Station, Unit 1, Site Boundary Map
(Source: NPPD, 2008a)

2.2.2 Climate and Meteorology

Nebraska is located in the middle portion of the Great Plains. The Great Plains occupy a large region extending from southern Canadian provinces and parts of States such as Montana, North Dakota, and Minnesota and southward to Texas, New Mexico, and Louisiana (David J. Wishart, 2004). Nemaha County, where CNS-1 is located, is a part of the Dissected Till Plains that occupy much of Iowa, eastern Nebraska, northwestern Missouri, and small areas of northwestern Illinois, southern Minnesota, and northeastern Kansas. Moderately dissected, glaciated, flat-to-rolling terrain that slopes gently toward the Missouri and Mississippi River valleys characterizes this area.

Nebraska has a highly variable continental climate, with a large range of both diurnal and annual temperatures and considerable diversity. There are significant precipitation and temperature variations from east to west of Nebraska. The climate of eastern Nebraska is classified as Dfa by Köppen Climate Classification System: a humid continental climate with hot summers and year round precipitation.

The State of Nebraska belongs to the High Plains National Oceanic and Atmospheric Administration (NOAA) Regional Climate Center, which is a Federal-State cooperative effort. The two closest NOAA National Weather stations, which provide the most current meteorological data for the area, are in Lincoln and Omaha, NE, and are located 61 miles (98 km) northwest and 62 miles (100 km) north from CNS-1 respectively.

Strong northwestern winds during winter bring cold Arctic air masses from Canada. Occasional low-pressure systems moving from southwestern States cause high winter winds and severe blizzards. The average annual wind speed for the National Weather Service (NWS) Station located in Lincoln, NE, is 10.1 mph (8.8 knots) and 10.5 mph (9.1 knots) for the Omaha NWS Station (NCDC 2009). In the summer, winds are predominantly from the south. Annual normals for the 1971–2000 30-year period, provided by the University of Lincoln, indicate that the annual mean temperature was 51.1°F (10.6°C), with a minimum annual temperature of 39.3°F (4°C), and a maximum annual temperature of 62.8°F (17.1°C) (UNL, 2009).

The occurrence of severe weather events in Nebraska is high. During 1950–2009, Nemaha County reported 274 storm events, mostly consisting of tornadoes and high winds with thunderstorms and hail. According to the National Climatic Data Center (NCDC), 17 tornadoes were reported in Nemaha County from January, 1950 to February, 2009: 5 @ F0, 7 @ F1, 4 @ F2, and 1 @ F3 strengths (NCDC, 2009a). Occurrence of floods in Nemaha County is less than 1 per year. Usually they do not cause any significant damage; however, the Auburn flood of 1996 caused $680,000 in property damage and $2.1 million in crop damage.

Nebraska has wide ranges of precipitation from year to year with a steady decrease of rainfall from east to west. East and southeast areas of Nebraska receive significantly more precipitation than other areas of the State, where drought is not uncommon. According to the 1971–2000 annual normals for Lincoln, Nebraska, annual precipitation was 28.37 inches (72 cm) (UNL, 2009).

Sections 101(b)(1), 110, 169(a)(2), and 301(a) of the Clean Air Act as amended (42 U.S.C. 7410, 7491(a)(2), 7601(a) established Mandatory Class I Federal Areas where visibility is an important value. There are no Mandatory Class I Federal areas in the State of Nebraska. The closest Mandatory Class I Federal area is Hercules-Glades Wilderness Area, which is located

295 miles southeast of CNS-1 in the State of Missouri. Due to the significant distance from the site, no adverse impacts on Class I areas are anticipated from CNS-1 operation.

2.2.2.1 *Air Quality Impacts.*

CNS-1 is located in Nemaha County, Nebraska, which belongs to EPA Region 7. There are no counties designated by the EPA as nonattainment or maintenance for any of the criteria pollutants in the 50-mile (81 km) vicinity of CNS-1. Douglas County, Nebraska, located approximately 72 miles (116 km) from CNS-1, is the closest maintenance county for lead.

The Nebraska Division of Air Quality of the NDEQ has primary responsibility for regulating air emission sources within the State of Nebraska. The NDEQ, with assistance from Lincoln-Lancaster County Health Department and Douglas County Health Department, conducts ambient air monitoring in Nebraska, operating 28 sites throughout the State with 34 monitors. The EPA and National Atmospheric Deposition Program also monitor air quality in Nebraska, which participates in the EPA's AIRNow Network that allows for continuous monitoring of the criteria pollutants and informs the public of current environmental conditions. NDEQ compiles an annual air quality report (NDEQ, 2008). In compliance with 40 CFR §58.10, NDEQ submitted a Network Plan for EPA review and approval that reflects changes to the ambient air monitoring program in Nebraska (NDEQ, 2009).

CNS-1 has a number of stationary emission sources, such as three standby emergency power supply diesel generators, auxiliaries required for safe starting and continuous operation, and several petroleum fuel storage tanks, which do not require the facility to secure Title V permit. CNS-1 is granted a low emitter status by the NDEQ Air Quality Section due to the actual quantities of emissions that are required to meet criteria and not to exceed thresholds for the emissions of pollutants defined in Chapter 5, Title 129 of Nebraska Administrative Code: for the emissions of particulate matter PM10, carbon monoxide (CO), volatile organic compounds (VOC), oxides of nitrogen (NOx), SO2 or SO3 or any combination of the two (SOx), single Hazardous Air Pollutant (HAP) or Hazardous Air Pollutant (HAPs) and lead. As reported and submitted to NDEQ, actual total emissions from all sources at CNS-1 from 2004 to 2008 were 11.52 tons (10.45 MT) per year, 10.73 tons (9.73 MT) per year, 13.21 tons (10.73 MT) per year, 11.43 tons (10.37 MT) per year, and 9.85 tons (8.94 MT) per year respectively. Highest emissions from 2004 to 2008 were reported in 2006: 0.16 tons (0.15 MT) per year of PM10, 2.41 tons (2.19 MT) per year of CO, 0.22 tons (0.20 MT) per year of VOC, 9.0 tons (8.16 MT) per year of NOx, 1.41 tons (1.28 MT) per year of Sox, and 0.01 tons (0.009 MT) per year of single HAP (NPPD, 2009c). The generators are tested periodically to ensure their continued ability to perform their intended function; and there are procedures in place to ensure continuous monitoring, sampling, and filtering of the oil. Used oil is collected for offsite disposal. Used oil disposal is discussed further in the waste management section.

CNS-1 operates a meteorological system that consists of two monitoring sites at the ground elevation of approximately 889 feet (271 m) above mean sea level (AMSL). The first monitoring site accommodates a 328-foot (100-m) primary meteorological tower and a 32.8-foot (10-m) back up tower. The former is located approximately 3,230 feet (985 m) and the latter is located approximately 1,597 feet (487 m) from the northwest corner of the reactor building respectively. The second monitoring site, a 328-foot (100-m) meteorological tower, with equipment and monitoring system that is nearly identical to the original 328-foot (100-m) tower, was recently built approximately 2,000 feet (610 m) northwest of the first site. There are two independent identical dual sensors, system A and system B, mounted onto the 328-foot (100-m) primary meteorological tower measuring temperature, wind speed, and direction at 32.8 feet (10 m), 197 feet (60 m) and 328 feet (100 m). Vertical temperature differential is measured with temperature sensors between all three levels. A relative humidity sensor is positioned at the 32.8 feet (10 m) level. Precipitation is measured at ground level (NPPD, 2008).

The meteorological data (15-minute and hourly average) is run through meteorological data validation software that checks and flags data discrepancies and inputs it to the CNS-1 plant computer. In the case of a complete system failure, the National Weather Service Office, located in Valley, Nebraska provides backup meteorological data by telephone or National Warning System (NPPD, 2008).

2.2.3 Ground Water Resources

As described by the United States Geological Survey (USGS, 1997), the Western Interior Plains Bedrock Aquifer System is present beneath the CNS-1 site but contains no fresh water. The only freshwater aquifer system beneath the site consists of unconsolidated alluvial deposits of the Missouri River Stream Valley Aquifer and glacial deposits of the Glacial Drift Aquifer. These deposits are reworked and difficult to distinguish within the main river valley. All of the onsite wells are completed in these deposits and the aquifer is under unconfined (water-table) conditions (NPPD, 2008).

As part of a hydrogeologic investigation undertaken by CNS-1 for the study of radioisotopes in ground water, CRA reviewed water use in the area surrounding the station and searched the NDNR water-well database for all wells in Nemaha County. Three irrigation wells, completed in the shallow unconsolidated aquifer, are located between two and three miles southwest of CNS-1. Four farm wells within one mile of the station, all only 15 feet deep, produce a limited amount of ground water. None of these wells are impacted by ground water pumping at CNS-1 because the station wells are screened in an unconfined aquifer and have limited radii of influence. A search of wells by NPPD in Atchison County, Missouri, across the river from CNS-1 identified no wells within two miles of the station. In addition, the Missouri River serves as a ground water recharge/discharge boundary.

Because of the limited radius of influence of CNS-1 wells completed in the unconfined aquifer, no public ground water supplies are close enough to CNS-1 to be impacted by ground water use at the station. There are no well-head protection areas or EPA-designated sole source aquifers in the vicinity of CNS-1 (CRA, 2007).

2.2.4 Surface Water Resources

CNS-1 is within the Nemaha River Basin whose water resources are managed by the Nemaha Natural Resources District (NNRD). The basin is defined as those areas south of the Platte River that drain directly into the Missouri River. Total area of the basin is 2,800 square miles (7,252 km^2) (NPPD, 2008).

Flow of the Missouri River at CNS-1 is partially controlled by the Gavins Point Dam located approximately 200 miles (321 km) upstream near Yankton, South Dakota. The USACE constructed and operates six of the seven main-stem dams on the Missouri River; the U.S. Bureau of Reclamation operates the seventh dam located east of Helena, Montana. The confluence of the Platte and Missouri rivers is located 63 miles (101 km) north of CNS-1. The Platte River discharges a significant amount of sediment into the Missouri, much of which is carried downriver to CNS-1 and beyond (NPPD, 2008).

At the CNS-1, the Missouri River is approximately 800 feet (244 m) wide and 28 feet (8.5 m) deep in the main channel. As currently regulated by the USACE, the minimum flow in the river for navigation purposes in March through November at Nebraska City, NE, 30 miles (48.3 km) north of CNS-1, is 31,000 cfs (m^3/s). In December through February, the minimum flow permitted is 3,000 cfs (85 m^3/s), primarily for sanitary purposes. The lowest flow recorded at Nebraska City was 4,320 cfs (122 m^3/s) in 1957. If a severe drought occurs, USACE would shorten the navigation season to keep upstream reservoirs high enough to maintain minimum sanitary flows. Water release schedules and priorities for the dams are contained in the USACE Master Manual (USACE, 2004).

Water level elevations in the river at CNS-1 range from 874.5 to 899.0 feet (266.5 to 274 m) AMSL with an average level of 880.0 feet (268 m). The mean annual discharge of the river at Nebraska City is 42,160 cfs (1,194 m^3/s) as measured and calculated for the years since 1948 when the upstream impoundments started to control flows. Because the river has been channelized and has a relatively uniform cross-section, flow velocity is up to 3 miles per hour (3.8 kmh), which is significantly higher than historic flows prior to completion of the major impoundments (NAS, 2002).

Significant changes in the Missouri River due to management practices include loss of natural flood and low flow processes, straightening of meanders, bank stabilization, and reduction of temperature variation. These changes, although ecologically significant, result in a more stable water supply for CNS-1.

2.2.5 Description of Aquatic Resources

2.2.5.1 *Ecosystem Services Provided by Missouri River Aquatic Ecosystems*

The Missouri River has provided and continues to provide many ecological services to people living within its basin. The phrase ecosystem services “refers to a wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life” (Daily et al., 1997). These services are intrinsic to the river itself and go beyond the obvious constructed economic services of providing a route for transportation or a source of water for irrigation and public consumption.

Daily et al. (1997) provide examples of general ecosystem services, and NRC staff identified the following ecosystem services specifically provided by the Missouri River. The Missouri River supports birds and other wildlife through fish, insect, and other food webs and also provides recreation and commercial fishing. The river supports populations of mussels that once were a major source of food, tools, and jewelry for Native Americans and later a source of buttons and starting nuclei for cultured pearls. It provides drinking water that supports many forms of domestic animals and wildlife and helps maintain biodiversity from which we derive key ingredients of our agricultural, pharmaceutical, and industrial enterprises. The river supports the aquatic phase of insect predators that help control agricultural and other pests.

Within the Missouri River ecosystem, bacteria, algae, fungi, and invertebrates absorb waste nutrients and break down, detoxify, and decompose various wastes and, in doing so, purify water. Living and nonliving components of the aquatic ecosystem participate in the oxygen, carbon, and nitrogen cycles and help mediate concentrations of oxygen and carbon dioxide in the air. Bacteria, fungi, and invertebrates that break down wastes and organic matter, help make the soil fertile where suspended solids that the river deposits following floods. In doing this, the river helps cycle and move nutrients. The river also helps disperse seeds of some natural vegetation. The Missouri River helps maintain the balance of recharge to the ground water and cycling of water back to air as part of moderating the water cycle. The river also provides aesthetic beauty, intellectual stimulation, and opportunities for education.

2.2.5.2 *Conceptual Model of Midwestern Rivers*

Karr et al. (1985) summarized the history and sources of degradation of Midwestern rivers. The conclusions, which they illustrate with examples from the Maumee and Illinois rivers are applicable to understanding the aquatic resources of the Missouri River near CNS-1 today. Karr et al. (1985) found that the human activity with the greatest impact on Midwestern fish communities was agriculture, which lowers the water table and supplies excess nutrients; navigational locks and channels in large rivers; impoundments, levees, and milldams; discharge of wastes that consume oxygen and toxic contaminants; overconsumption of water; and introduction of exotic species. The authors presented a conceptual model to illustrate the links between these activities and those for recovery and restoration and Midwestern river fish communities.

In their conceptual model (Figure 2.2.5-1), five primary variables affect the integrity of aquatic biota. (1) The energy source may be primarily allochthonous (not formed in situ, but originating in another place) organic matter or primary production. As well as the amount of energy, the size distribution of organic particles affects aquatic communities. (2) Water quality includes such factors as temperature, turbidity, dissolved oxygen concentration, soluble organic and inorganic materials, metals, and toxic substances. (3) Habitat structure includes such things as bottom type (e.g., hard substrata, sand); water depth; current velocity; availability of spawning, nursery, and hiding places; and habitat diversity. (4) Flow regime indicates water volume, seasonality and temporal distribution of flow and water volume, and frequency of flooding. (5) Trophic interactions among biotic components include such factors as competition, predation, disease, and parasitism. Natural changes and human activities act through these five primary variables effecting the integrity of aquatic biota to cause changes in aquatic communities. The following summary of natural and human history in the Missouri watershed, represented in Figure 2.2.5-1, shows continual changes in the factors that influence the structure and function of aquatic communities in this Missouri River .

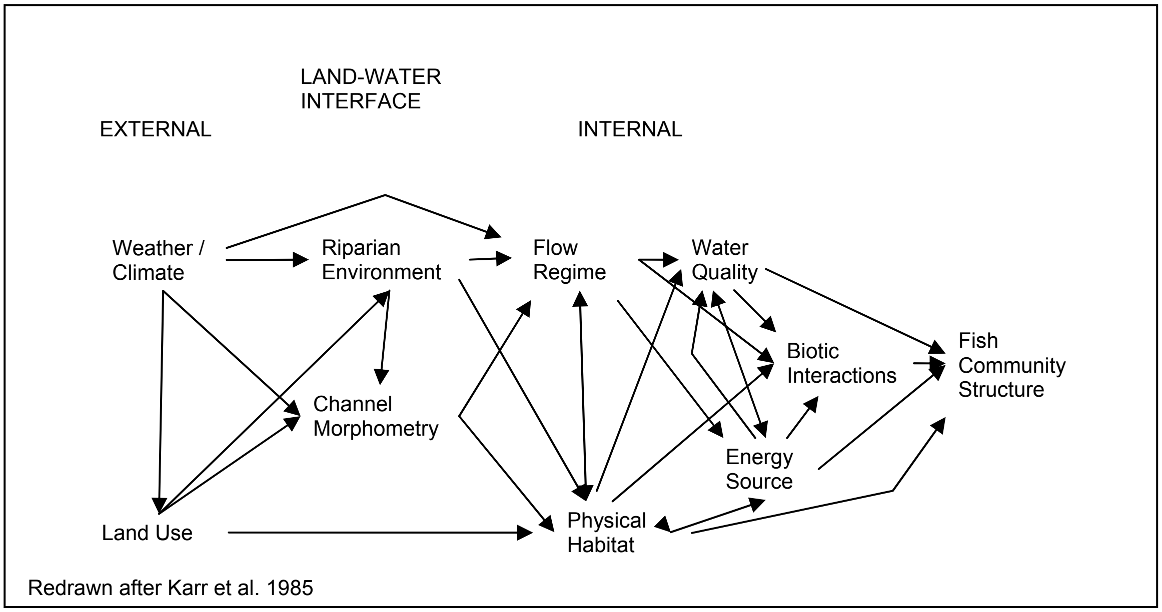


Figure 2.2.5-1. Conceptual model showing primary external and internal variables with their interactions that govern the integrity of the aquatic biota of Midwestern streams *(After Karr et al., 1985)*

2.2.5.3 *Description of the Missouri River Basin*

The nature of Missouri River aquatic resource communities strongly reflects the formation and history of the Prairie region it drains. The Missouri River basin is large, and its present ecology was formed fairly recently on a geological and evolutionary time scale. Because of its size, the basin encompasses many diverse habitats on regional and local levels. Because it is fairly recent, many species that live in the basin are not endemic but have evolved elsewhere and moved into the basin. The present ecology of aquatic communities reflects a history of change both prehistoric and historic and of habitat diversity within seasons and across various geographic scales.

The modern Missouri River basin is the second largest in the United States and drains about a sixth of the conterminous United States as well as part of Canada, including all or parts of 10 U.S. States, 2 Canadian provinces, and 25 Native American lands or tribal reservations. Many of the Missouri River's tributaries drain east to the main stem, which flows roughly southeast. Starting from the west, the river basin drains three physiographic divisions: the Rocky Mountain System, which contributes a little over 10 percent of total flow; the Interior Plains; and the Interior Highlands. Most of the river flows through the highly erodible soils of the Great Plains and Central Lowlands' physiographic provinces of the Interior Plains division, which produces high turbidity and sediment transport (Galat et al., 2005b).

Change and perturbation heavily influence the ecology of the Missouri River, including the aquatic ecology. Glaciers covered much of the basin during the last ice age and helped determine the course of the modern Missouri River and its tributaries as well as land forms and soils. The modern prairie drained by the Missouri River is relatively young and formed in the last several million years so that much of the flora and fauna have colonized from surrounding ecosystems and few species evolved in and are endemic to the prairie (Benedict et al., 1996). Between the last ice age, which ended about 10,000 years ago, and the beginning of recorded history of the prairie, invasion and colonization of the basin by plants and animals, and later humans, and extinction of nearly all large mammal species brought further change. Early human settlement probably had limited effects on the ecology of the basin until the twentieth century, when the Federal government intervened to encourage further settlement and development (National Research Council, 2002).

Increased settlement occurred through the 1800s, and irrigated agriculture resulted in the early construction of first small and then larger dams in the late 1800s. From the mid-1820s through the 1870s, the Federal government worked to remove large tree snags from the Missouri River to improve navigation. The USACE began stabilizing the river banks in the late 1880s. Construction of hydropower dams began in the late 1800s. Several irrigation projects began in 1904, and by the 1930s, most of the tributaries of the Missouri River had one or more dams. In the late 1920's, the USACE began a program that combined bank stabilization with dike construction and strategic dredging designed to narrow the river and eliminate meandering. Where the USACE eliminated wide bends in the river and narrowed the channel, the river's velocity increased, and in some places the river became self-scouring. The subsequent Federal Pick-Sloan Plan in 1944 led to the construction of six main-stem dams and dedicated upstream storage to three primary uses: hydropower generation, navigation enhancement, and flood control (National Research Council, 2002).

Today the Missouri River is highly regulated, with about 1,200 single-purpose and 100 multipurpose reservoirs, including six reservoirs on the main stem (Galat et al. 2005a, 2005b). The aquatic community has been highly influenced by damming and channelization. The reservoirs have changed lentic (i.e., pertaining to still or standing water) habitat into lotic (i.e. pertaining to flowing or running water) habitat and impair migration of fish and other aquatic organisms. Construction of structures such as dikes, levees, stabilization structures, and dams have added hard substrata, or replaced soft substrata with hard substrata in aquatic habitats. The reservoirs, channels, and structures affect physical habitat, water temperature and quality, flow regimes, suspended sediment loads, and light penetration, and many other attributes of the aquatic ecosystem (Galat et al. 2005a, 2005b). The prairie is subject to frequent perturbations on time scales that range from shorter than a year to those spanning decades or millennia, such as fire, draught, flooding, grazing, storms, and local events such as digging activities of animals (Benedict et al. 1996). All of these influences affect aquatic habitats and communities.

The climate in the basin is semi-arid, and both direct precipitation and snow melt contribute to the flow, which results in a seasonal succession of low and high flows. Before dam construction and regulation, river flows peaked twice a year: A smaller peak in March through April as snow and ice melted in the middle and upper basins and the prairie, and a second, larger peak in June as the result of melting snows in the Rocky Mountains and precipitation over the prairie. Overbank flooding was common during peak flows. Flows then declined in July and remained low until spring (Galat et al., 2005a).

Before dam construction and regulation of the river, the variation in flow drove changes in the river channel's location, form, and volume of sediment transported. The river carried large amounts of sediment and was known as the "Big Muddy." During high flows, erosion could be severe. As flooding subsided, the river deposited substantial amounts of sediments on flood plains. In a dynamic equilibrium, the river redistributed sediments between its channel and floodplain. The channel was braided to highly sinuous and "characterized by log jams, snags, whirlpools, chutes, bars, cut-off channels, and secondary channels around bars" (National Research Council 2002). Sand bars shifted frequently. "A typical cross-section of the pre-regulation Missouri River contained a deep channel, multiple side channels, oxbow lakes, islands, sand bars and dunes, and backwater habitats interspersed by areas of higher land." The seasonal pattern of flow and temperature cued many natural processes, such as fish spawning, insect emergence, and seed germination. The diverse habitat with frequent disturbance supported high biodiversity and biological productivity (National Research Council, 2002).

In the post-regulation Missouri River, main stem dams dampen the high variation in flows below them, and the extremely high and low flows no longer occur. Dredging and channelization have eliminated much of the temporal and spatial variation. In channelized areas, a typical cross section of the post-regulation Missouri River is trapezoidal rather than varied, and in places, complex. Suspended sediment loads now drop from suspension in the relatively still water of reservoirs behind dams, where clearer water supports greater primary productivity and aquatic species that hunt by vision. Channel degradation occurs below the dams while sedimentation accumulates in reservoirs, and these processes slowly change aquatic habitats. Seasonal cues to biological processes are muted. Fish no longer use floodplains seasonally for spawning and as nursery areas for their young. The water, sediment, and nutrients that once spread across the flood plains are now contained within the channel and reservoirs. In the change from pre-to post-regulation, some aquatic species thrived, and some, such as pallid sturgeon (*Scaphirhynchus albus*) and sauger (*Sander canadense*), experienced sharp reductions. Overall, the less diverse habitat and decreased disturbance of the post-regulation Missouri River support lower biodiversity and lower biological productivity (National Research Council, 2002).

The biological classifications of its terrestrial ecosystems, land uses, and the distribution of fish in the entire basin and in the main stem illustrate the spatial diversity of the Missouri River. The Missouri River flows through and drains six terrestrial ecoregions: North Central Rockies Forests, Montana Valley and Foothill Grasslands, Northwestern Mixed Grasslands, Northern Mixed Grasslands, Central Tall Grasslands, and the Central Forest/Grassland Transition Zone (Galat et al. 2005b). Within 3 miles (5 km) of the river, however, most of the land use is in cropland (33 percent), grassland (26 percent), and developed land (17 percent) (Galat et al. 2005b). Abell et al. (2000, 2008) define three aquatic ecoregions of the Missouri River primarily on the basis of fish distribution: the Upper Missouri, Middle Missouri, and the Central Prairie.

Based on geomorphology and hydrology, Galat et al. (2005a and 2005b) recognize three zones of the Missouri River main stem: The upper zone, from the origin of the Missouri River to Fort Peck Lake, Montana, which is the first major impoundment, is unchannelized and largely flows freely; the middle zone, from the upper end of Fort Peck Lake to the Gavins Point Dam, which forms Lewis and Clark Lake, is not channelized but has impoundments, and can be subdivided into a reservoir zone made up of individual impoundments separated by an inter-reservoir, riverine zone that connects them; and the lower zone, from Gavins Point Dam to the confluence with the Mississippi River, is channelized and has bank stabilization and floodplain levees. CNS-1 lies within the lower, channelized zone.

2.2.5.4 *Physical Features of the Missouri River near the Cooper Nuclear Station*

CNS-1 is located on the west bank of the Missouri River at RM 532.5 (1,960 river miles). The bottom contour of the river at CNS-1 is roughly trapezoidal. The Missouri River channel in front of CNS-1 is at an elevation of about 860 to 865 feet (262 to 265 m) AMSL compared to the natural grade level of the flood plain around CNS-1 of 890 feet (271 m) AMSL. On average, the river is about 800 feet (245 m) wide and 28 feet (8.5 m) deep in the vicinity of CNS-1. Riprap covers some areas of shoreline near the CNS-1, and soft sediments are typically composed of medium to course sand. Pile dikes and shoreline protection stabilize the channel. Gavins Point Dam, located about 200 river miles (322 river kilometers (RKm)) upstream in Yankton, South Dakota, largely controls the flow of the Missouri River at CNS-1. The flow changes seasonally, but the annual mean river flow from 1930 through 2001 was 38,251 cfs (1,083 m^3/sec) at the USGS gauging station located about 30 river miles (48 RKm) upstream at Nebraska City, Nebraska. NPPD owns the 345 kV transmission line designated as TL3504 that passes over the Missouri River at CNS-1; at the center of the Missouri River, transmission line ownership changes (NPPD, 2008).

2.2.5.5 *Potentially Affected Aquatic Resources*

Several publications and reviews provide comprehensive descriptions of the Missouri River aquatic ecosystems, including National Research Council (2002), Galat et al. (2005a, 2005b), and USACE (2004). From the headwater streams to the main stem Missouri River, aquatic communities show the affects of man's activities. Rabeni (1996) summarized the state of the fish and aquatic resources of the prairie ecosystem as follows:

> The ecological integrity of most prairie streams has been compromised, because every important relation has been affected: flow conditions by dewatering, altered land-use, and disruption of headwaters; energy source balance by the increase of instream primary production with nutrients and less shading; water quality by modern synthetic compounds and organic wastes; physical habitat by channelization and riparian degradation; and the biotic balance by the introduction of fish predators and competitors and elimination of important food sources.

Comparing this description to Karr et al.'s (1985) conceptual model of Midwestern rivers (Figure 2.2.5-1), one can see that human activities have adversely affected all aspects of the environment that influence the integrity of aquatic communities.

Much of the information summarized below is from a compendium of studies (Hesse et al., 1982b) conducted in the late 1960s and early 1970s to provide ecological information for assessing the impacts of Fort Calhoun and Cooper Nuclear Stations, both on the Missouri River. Fort Calhoun Station is a nuclear generating unit located at river mile marker (RM) 646.0 (1,040 RKm), about 113.5 river miles (183 RKm) north of CNS-1, which is located at RM 532.5 (857 RKm); the aquatic communities at the two stations are similar.

2.2.5.6 *Primary Producers: Phytoplankton, Periphyton, and Aquatic Macrophytes*

Before the completion of the dams on the main stem, phytoplankton abundance was low due to the high turbidity and current velocity and the lack of still water habitats. Although dams now replace lotic habitat with lentic habitat where sedimentation increases water clarity, the limiting factor for algal growth in much of the river is still light, not nutrients, due to turbidity (Galat et al., 2005b).

Galat et al. (2005a, in Rivers of North America) summarized the ecology of planktonic algae and cyanobacteria in the Missouri River basin. Most of the information dated from the 1980s or before. Reetz (1982) reported results of phytoplankton studies conducted in the Missouri River in the vicinity of CNS-1 and Fort Calhoun (Nuclear) Station, about 113.5 RM (183 RKm) north of CNS-1, from 1974 through 1977. The composition of the phytoplankton community through the year was largely determined by discharges from Lewis and Clark Lake (RM 811, RKm 1,305), which is 278.5 river miles (448 RKm) upstream, with modifications due to "production in backwater areas of the unchannelized river, production in pools behind the trail dikes in the channelized portion, input of phytoplankton from tributaries, and the scouring of periphytic forms" (Reetz, 1982, p. 73). While the species may have changed over the last several decades since Reetz's 1982 studies, the process he describes likely remains unchanged. Although Reetz (1982) could discern no clear trend in phytoplankton abundance at CNS-1 for the 1974–1977 study period, carbon fixation rates were generally lower in winter and highest in mid-summer. Carbon fixation is the photosynthetic process by which plants convert carbon dioxide (and water) to sugar (and oxygen).

Reetz (1982) compared phytoplankton functions at the intake and discharge of both CNS-1 and Fort Calhoun Station. Initial (7-hour) differences in carbon fixation rates at CNS-1 ranged from an average of about 17 percent inhibition during summer to no change during winter. The inhibition in the summer months appeared to depend on absolute discharge temperature and the highest inhibition rates (above 26 percent) occurred when absolute discharge temperatures exceeded 101 °Fahrenheit (38.5 °C). Recovery from initial inhibition at CNS-1 occurred within 48 hours. While the river would carry phytoplankton far downstream in 48 hours so that a substantial part of the river would be affected, Reetz (1982) concluded that the low rate of water use by CNS-1 compared to river flow combined with the rapid mixing of the thermal plume would make the effects relatively unnoticeable.

Farrall and Tesar (1982) reported results of periphytic algae studies conducted in the Missouri River in the vicinity of CNS-1 from 1972 through 1977, and Fort Calhoun Station from 1974 and 1975. Periphytic algae are those algae attached to solid surfaces under water such as rocks, logs, pilings and other structures. Because they remain in one place, periphytic algae colonizing natural and artificial substrata can be used as indicators of environmental effects. Algae fix carbon through photosynthesis and are a base of food webs. In some rivers, such as the Missouri River, organic matter from land and upstream sources is often another base of local aquatic food webs. Farrell and Tesar (1982) did not detect changes in the diversity, density, and biovolume of periphytic algae related to water temperature in the vicinity of CNS-1, although species composition did reflect water temperature. Although these results may generally be indicative of periphyton responses and processes at CNS-1 today, species composition and magnitude of response, which depends on the species involved, may have changed over the decades since Ferral and Tesar's (1982) studies.

High turbidity, unstable substrates, and variable currents almost exclude aquatic macrophytes from the Missouri River (Galat et al. 2005, in Rivers of North America), and NRC staff found no studies of these macrophytes in the vicinity of CNS-1.

2.2.5.7 *Invertebrates: Zooplankton and Benthos*

Repsys and Rogers (1982) reported results of invertebrate zooplankton studies conducted in the Missouri River in the vicinity of CNS-1 and Fort Calhoun Station from 1972 through 1977. Zooplanktons are animals suspended in the water column and typically contain permanent residents of the water column; temporary members swept up by currents, etc.; and organisms that spend only part of their life cycle in the water column, such as insect and fish eggs and larvae. Zooplankters eat algae and bacteria, protozoans, other zooplankton, detritus, fish eggs and larvae, or a combination of these, and, in turn, are eaten by other invertebrates, fish, and amphibians. In general, zooplanktons are more adapted to the lentic environment of lakes and reservoirs than the lotic environment of streams and rivers. In flowing water environments, currents and suspended sand can buffet zooplankters and cause mechanical damage, while smaller suspended silt and clay particles can adhere to their bodies and interfere with respiration and feeding.

Repsys and Rogers (1982) concluded that the zooplankton community near CNS-1 appears to be largely determined by upstream reservoirs, where the lotic environment encourages their production. The most common groups they collected include copepods and cladocerans (both crustaceans) and rotifers. While the general pattern of abundance in the study indicated relatively high crustacean peaks in late fall to spring and reduced populations during summer and early autumn, the pattern was poorly defined. The authors concluded that the seasonality of zooplankton densities in the limnetic Lake Francis Case, which is more like a natural lake and has high zooplankton production, influenced through releases the pattern of zooplankton downstream in the smaller and less productive Lewis and Clark Lake, which in turn influenced through releases the pattern of zooplankton downstream at CNS-1.

Decreasing zooplankton densities in the river indicated to them that zooplankton populations originating in the highly productive Lake Francis Case experienced considerable mortality on the downriver journey to CNS-1. Repsys and Rogers (1982) also investigated the effects of CNS-1 on zooplankton populations in 1974 through 1978. High absolute discharge temperatures ≥ 95 °F (35 °C) critically affected zooplankton survival, as did duration of exposure. Repsys and Rogers (1982) concluded that entrainment losses were small when compared to the large downstream decreases in zooplankton. Without further studies, NRC staff concludes that these general patterns and processes most likely still occur, although species composition and magnitude of response, which depends on the species involved, may have changed over the decades since Repsys and Rogers' (1982) studies.

Carter et al. (1982) reported results of benthic infaunal and epifaunal (called aufwuchs on the artificial substrate samples employed by Carter et al.) invertebrate studies conducted in the Missouri River in the vicinity of CNS-1 and Fort Calhoun Station from 1973 through 1977. Benthic infauna refers to the organisms that live in underwater sediments, and benthic epifauna refers to organisms that live on underwater surfaces. Benthic invertebrates form a complex community. Various members may eat algae filtered from the water column, suspended detritus and organisms, sediments, periphytic algae and bacteria, other benthic organisms, and fish eggs and larvae. Carter et al. (1982) report that the channel area of the Missouri River in the vicinity of CNS-1 is largely unsuitable for macroinvertebrates because of continuous shifting and scouring of bottom sediments. In the lee of wing dikes, sedimentation occurs during periods of low flow and supports infaunal communities that may be lost due to scouring during periods of high flow. The seasonal diversity of the benthic community in this area is inversely related to the variability of the flow as measured on a daily basis (Carter et al., 1982): benthic diversity is higher when flows are stable. The most common members of the benthic community are oligochaete worms, primarily tubificids, which live in tubes and may avoid direct contact with the currents, and secondarily naids, which live in the surface layers of sediments and may be subject to low level scouring. Another numerically important group was insect larvae of the family Chironomidae, or non-biting midges (flies). All of these groups are indicative of organically enriched sediments and tolerate low dissolved oxygen levels and so have been designated as indicators of poor water quality (Barbour et al., 1999).

Epifaunal invertebrates in this section of the river are typically found on dikes and riprap. Carter et al. (1982) report that the most common members on dykes and artificial substrate samplers were chironomid, trichopterid (caddisfly), and ephmeropterid (mayfly) larvae. The caddisfly larvae found here are typically net spinners and filter feeders whose survival depends on currents. The chironomid larvae included grazers, predators, and tube-dwellers. The insect larvae are seasonal members of the macroinvertebrate community that become terrestrial after emergence. Carter et al. (1982) were not able to detect consistent changes in the epifaunal invertebrate community due to the operation of CNS-1.

2.2.5.8 *Larval Fish*

Hergenrader et al. (1982) report the results of both field and entrainment studies on larval fish in the vicinity of CNS-1 in 1974 through 1976. Several life stages of fish may occur in the plankton, where they are called ichthyoplankton, and may be subject to entrainment at power plants: eggs; larvae, which include both yolk-sac and post yolk-sac larvae and have little or no fin development; post larvae, which have fully developed fins but bodies that have not yet reached the adult form; and juveniles, which have attained the adult form but are still immature. Eggs and juveniles in the collections near CNS-1 were not commonly caught, and made up two percent and one percent, respectively, of all ichthyoplankton. Larval fish were common in the drift near CNS-1 from May through July, and the numerically dominant fish larvae were freshwater drum, catastomids (e.g., suckers), cyprinids (e.g., minnows), and carp. Larval fish were rare or absent in other months. Although freshwater drum comprised only about five percent of adult fish in the vicinity of CNS-1, since they are pelagic spawners, spawning in the open water column, they contributed 70 to 90 percent of the larvae. Other species commonly found as larvae in the drift, common carp (*Cyprinus carpio*), catastomids, gizzard shad (*Dorosoma cepedianum*), and goldeneye (*Hiodon alosoides*), are also either random or pelagic spawners. The larvae of most of the game fish in the area—white bass (*Morone chrysops*), sunfish (*Lepomis* spp.), crappie (*Pomoxis* spp.), sauger (*Stizostedion canadense*), walleye (*Sander vitreus*), and channel catfish (*Ictalurus punctatus*)—were relatively under-represented because most of these fish either build nests or spawn randomly, most have adhesive and demersal (sinking) eggs, and some of these species provide parental care of the eggs and larvae.

Depending on the species, the sources of the larvae near CNS-1 included the upstream Louis and Clark Lake, tributaries, cut-off chutes, and backwaters. Densities of ichthyoplankton also depended on time of year, river flow, horizontal position in the river (cutting bank, mid-channel, or filling bank), depth and patterns of vertical migration, and growth and mortality rates (Hergenrader et al., 1982).

Hergenrader et al. (1982) also report on entrainment mortality. NRC staff conclude that little can be learned from their direct observations of entrainment mortality because the control mortality measured at the intake was very high, which makes estimation of plant-induced mortality impossible, and because they only observed immediate mortality (typically 20 to 40 minutes after collection), which does not provide an estimate of longer-term or chronic mortality. Injured larvae may not die immediately, and today the standard holding time for fish larvae in short-term chronic toxicity tests with a survival endpoint is typically seven days (EPA, 2002) in order to account for mortality that is not immediate. In order to determine if entrainment (and impingement) were having an effect on the fish populations in the area, Hergenrader et al. (1982) looked for changes in adult fish populations resulting from impacts to ichthyoplankton but detected none. They concluded that either no significant changes occurred or "[t]oo few resources (financial, technical, equipment, labor) were applied over too small a time frame in too restricted an area to detect the changes which have occurred."

2.2.5.9 *Fish*

Galat et al. (2005a, 2005b) report about 183 fish species from the Missouri River, of which about 136 were found in the main channel. No fish species are unique to the main stem (i.e., endemic species), and just two are endemic to the Missouri River basin. About three quarters of Missouri River fish species are native, that is, they live and survive in the river under natural conditions and have not been introduced by human activity. The majority of the species (68 percent) belong to just five families: Cyprinidae (e.g., carp, chub, dace, shiners, minnows); Catostomidae (e.g., suckers, chubsuckers, redhorse, buffalo); Salmonidae (e.g., trout, salmon, whitefish); Centrarchidae (e.g., sunfish; crappies; freshwater basses, but not striped bass and white bass); and Ictaluridae (e.g., catfish, bullhead, madtom). About half of the species are "Big-River species," meaning that they occur primarily in the main channel. Lists of species from the Missouri River can be found in Galat et al. (2005a) and USACE (2003, as reproduced in the ER).

Galat et al. (2005a) present summary data from which the NRC staff made several observations. The study lists 53 species as prevalent or common in the Central Lowlands physiographic province that includes CNS-1. The species were assigned to mutually exclusive guilds: most (27 spp.) are macrohabitat generalists and the rest distribute evenly between fluvial specialists and fluvial dependents (12 species each). The generalists may inhabit either reservoirs or river segments that connect them, while the other two groups are either specialized for or dependent on flowing river habitat. The high proportion of generalists reflects the variability and history of continued change in the Missouri River system. In terms of habitat, 46 of the prevalent fish species in the Central Lowlands have been found in the channel and channel borders, 9 in floodplains, and 8 in reservoirs, including the species that can be found in more than one of these habitats. The high proportion found in the channel and channel border reflects the history of the river as a flowing water body before regulation and formation of reservoirs. With the main channel and channel borders, 35 species are associated with the main channel, 9 with channel borders, and 8 are "waifs," that is, removed from their original habitats.

CNS-1 is located below the Gavins Point Dam, the last of the six major dams, in a riverine environment that extends unimpeded to the mouth of the Missouri River at St. Louis. The upper section of this reach is unchannelized north of Sioux City, Iowa with such diverse habitat characteristics as chutes, backwater marshes, sandbars, islands, snags, deep pools, and variable current velocities. The environment is changing due to the downstream effects of Gavins Point Dam and the sedimentation that occurs behind it as well as some armoring of the riverbed and bank stabilization, which cause channel degradation and siltation of shallow areas, with associated loss of marshes, backwaters and chute habitats (USACE, 2004, p.100). Downstream of Sioux City, construction of dikes, revetments and channelization result in a less diverse environment. Yet, the most common fish species are similar in the unchannelized and channelized portions of the river. These include emerald shiner (*Notropis antheroides*), river carpsucker (*Carpiodes carpio*), channel catfish (*Ictalurus punctatus*), gizzard shad (*Dorosoma cepedianum*), red shiner (*Notropis lutrensis*), shorthead redhorse (*Moxostoma macrolepidotum*), common carp (*Cyprinus carpio*), and goldeye (*Hiodon alosoides*). Big river fish in the lower river and its major tributaries include pallid (*Scaphirhynchus albus*), shovelnose sturgeon (*Scaphirhynchus albus*), and paddlefish (*Polyodon spathula*) (USACE, 2004).

The aquatic community, particularly the fish community, may not be stable and may still be changing in response to historical changes in land use, river regulation, and other human activities. For example, USACE (2004) reports that the benthic fish community appears to be changing based on 1996 and 1997 studies. The diversity of species in the unchannelized section appears to be increasing, possibly due to the diverse habitats. Typically more species are found at shallow depth (less than 2 meters) and slower water velocities (less than 0.6 m/sec), and fish in the unchannelized section are most abundant in the backwater areas. In the channelized segment below Sioux City, most fish near revetments and dikes. Although surveys have found the most fish in this segment in side channels, but few such habitats remain. USACE (2004) reported that ecologists know very little of the mechanisms that control fish production in the channelized segment of the river.

Other investigators have reached similar conclusions. Rabeni (1996) found that "[d]rastic changes in the streams and rivers of the prairie region and their fish fauna have occurred in the last 150 years." More recently, NRC (2003) reported that:

> The aquatic resources in the vicinity of Fort Calhoun Station are associated with the Missouri River. The species composition of the fish community in this reach of the river has changed significantly (due to channelization) from the 1973 to 1977 fish studies associated with the initial licensing of Fort Calhoun Station and its operations.

2.2.6 Terrestrial Resources

The CNS-1 site is located within the Missouri alluvial plains level IV ecoregion in Nebraska and Missouri, and lies near the western limit of a relatively flat, 6-mile-wide (10 km) alluvial floodplain. Natural relief on the CNS-1 site is limited to about 10 feet (3 m). Much of this floodplain has been ditched and drained for farming, with numerous levees constructed for flood protection. Immediately west of the CNS-1 site and running north-south are bluffs rising approximately 170 feet (52 m) above the CNS-1 property and the Missouri River (NPPD, 2008) that transition into the Nebraska/Kansas loess hills level IV ecoregion (USGS, 2001).

According to the ER, the CNS-1 facilities are located within 55 acres (22 ha) of a 1,121-acre (454 ha) site in Nemaha County, Nebraska, adjacent to the western bank of the Missouri River at RM 532.5. There is an additional 239 acres (97 ha) of undeveloped CNS-1 property across the Missouri River and adjacent to its east bank in Atchison County, Missouri. The CNS-1 property in Nebraska is bordered on the west by Nemaha County Road 648A Avenue, the Missouri River on the east, and by agricultural lands on the north and southsides. The CNS-1 property in Missouri is adjacent to the eastern bank of the Missouri River and is bordered by cropland on its north, south, and east sides (Figure 2.2.1-1) (NPPD, 2008).

On the Nebraska side of the CNS-1 site, approximately 900 acres (364 ha) are currently used for agricultural activities. There are also more than 120 additional acres (49 ha) of vegetated, non-agricultural land located primarily contiguous with the riverbank but extending inland in some areas into the farm fields on the site. Most of these vegetated areas are classified as palustrine forested, scrub-shrub, and emergent wetlands (USFWS, 2009a) and include two segments of intermittent streams and, according to NPPD staff, a 55-acre (22 ha) wetland mitigation site. One wetland area is located in the middle of a farm field in the south-central part of the property (Figure 2.2.6-1). The USFWS has identified over 700 wetlands within a 6.0-mile (10 km) radius of CNS-1 (USFWS, 2007b). The remaining acreage on the Nebraska side includes the riverbank, streams and canals, and transmission line corridors. Several segments of intermittent streams are subject to plowing, which may impact wetland resources (NPPD 2008a). NPPD staff noted that these intermittent streams drain south from the CNS-1 site into the adjacent USACE Langdon Bend Wetlands Restoration Project and into the Little Nemaha River, and finally into the Missouri River (NDNR, 2009). The Langdon Bend project is one component of the larger Missouri River Mitigation Project (USACE, 2004b). Additional surface water at the CNS-1 site drains from the wetlands and fields directly into the Missouri River by way of manmade drainage ditches and into the Little Nemaha River by way of the intermittent tributary system. However, NPPD staff indicated that the farm fields and wetland areas still flood, primarily from overland drainage, and occasionally because of overbank flow from the Missouri River.

NPPD staff indicated that a system of levees on the Nebraska side of the CNS-1 site is designed to protect the CNS-1 reactor and support buildings from a 200-year flood event. Additional levees have been constructed along both sides of the Missouri River floodplain through the entire CNS-1 site. Levee construction on the Missouri River was initiated in 1945 as part of a Federal project implemented in 1912 to deepen and widen the Missouri River for navigation purposes. Earthen levees were constructed along the eastern border of the CNS-1 property located in Missouri.

On the Nebraska side of the river, the alluvial bottomland and rolling floodplains are dominated by cottonwood *(Populus deltoides*), green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), elm (*Ulmus spp*.), lowland tallgrass prairie, big bluestem (*Andropogen gerardii*), prairie cordgrass (*Spartina pectinata*), switchgrass (*Panicum virgatum*) and several sedges (USGS, 2001).

In Missouri on the CNS-1 property, approximately 200 acres (81 ha) of the 239 acres (97 ha) are classified as palustrine forested wetlands and flood periodically. NRC staff noted during the site audit evidence of flood water from the Missouri River reaching over four feet high on some trees on the Missouri side of the CNS-1 property. The two transmission line corridors running east-west through the Missouri property (not in scope) are primarily emergent wetlands where the transmission lines do not cross cropland. Less than 40 acres (16 ha) of the 239 acres (97 ha) have been cleared and are used for agricultural activities (NPPD, 2008).

The forested riparian areas on the Missouri side of the CNS-1 property are dominated by cottonwood, American sycamore (*Platenus occidentalis*), silver maple (*Acer sacharrinum*), black willow (*Salix nigra*), boxelder, buttonbush (*cephalanthus occidentalis*), and false indigo (*Amorpha fruticosa*) (NRCS, 2007). The two transmission line corridors located on the Missouri side are dominated primarily by emergent wetlands vegetation, similar to the grasses described on the Nebraska side, as well as some scrub-shrub wetlands vegetation.

Several exotic invasive plant species are located along the riverbank of the CNS-1 site, and include purple loosetrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*) (NRCS, 2007). The common reed (*Phragmites austrailis*) is another exotic invasive species found along the riverbank in the vicinity of the CNS-1 site that was recently added to the list of noxious weeds by the Nebraska Department of Agriculture (NDA, 2008).

While much of the CNS-1 site and vicinity is agricultural land, there are a number of wooded areas and hedgerows that provide habitat for several species of mammals common to this region, including coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), eastern cottontail rabbit (*Sylvilagus floridanus*), muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), bobcat (*Lynx rufus*), mice (Bailey, 2007).

The CNS-1 site provides habitat to a variety of game birds and resident and neo-tropical migratory songbirds primarily along the transmission line corridor and within the wooded wetland and scrub-shrub habitat on both sides of the river, some of which were observed by

NRC staff during the site audit. Species of game birds that are commonly found in the vicinity of CNS-1 include the northern bobwhite quail (*Colinus virginianus*), the ring-necked pheasant (*Phasianus colchicus*), the wild turkey (*Meleagris gallopavo*), and the greater prairie chicken (*Tympanuchus cupido*). Other birds commonly found on CNS-1 property and the transmission line corridor include cliff swallows (*Petrochelidon pyrrhonota*), the American kestrel (*Falco sparverius*), the turkey vulture (*Cathartes aura*), the killdeer (*Charadrius vociferus*), the horned lark (*Eremophila alpestris*), and the American bald eagle (*Halieatus leucocephalus*) (Bailey, 2007; UNSM, 2007a). There is an active bald eagle nest on the Missouri side of the CNS-1 property with a breeding pair of eagles that have produced a number of chicks over the past several years (NPPD, 2008). Although no longer protected under the ESA, the bald eagle is still protected from any take without a permit under the Bald and Golden Eagle Protection Act (50 CFR Part 22) (NPPD, 2008).

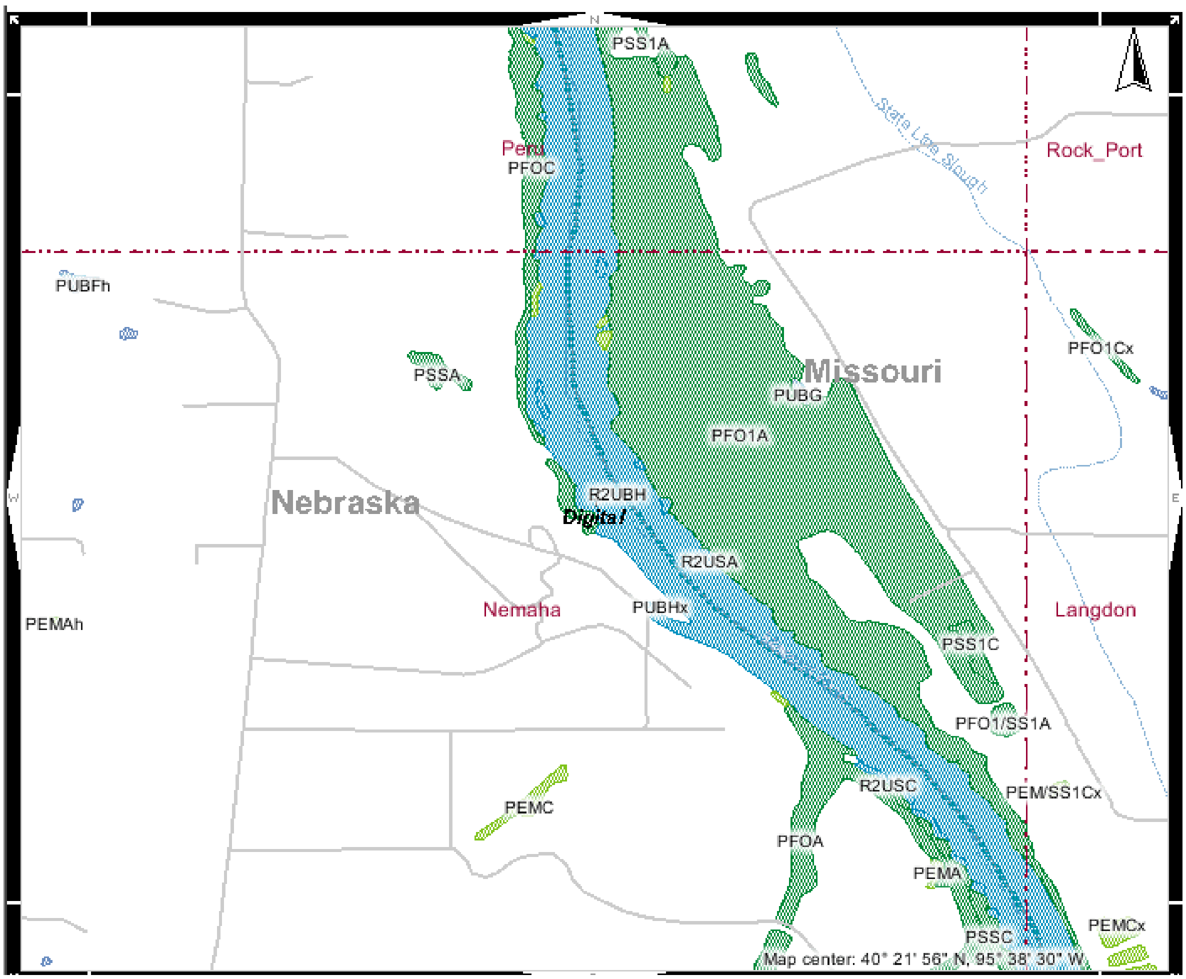


Figure 2.2.6-1. Nontidal Wetlands Located on the Cooper Nuclear Station, Unit 1, Site *(Source: USFWS, 2009a; National Wetlands Inventory; Nemaha Quad; NPPD, 2008a). (Note that the wetlands polygon is approximate, and includes the 55-acre (22-ha) NPPD wetlands mitigation site.)*

The CNS-1 is located along an overlapping section of the Mississippi and Central Flyways, with 20 waterfowl species following the Missouri River during fall and spring migrations. These waterfowl may utilize the wetlands located on the CNS-1 site (NPPD, 1971) and its vicinity. The ER contains information on observed bird mortality at CNS-1 from 2003–2006, including a great horned owl (Bubo virginianus), three additional birds, and the death in 2006 from West Nile Virus of a juvenile bald eagle found near CNS-1 (NPPD, 2008).

Several amphibians and reptiles are found or are potentially found in the vicinity of CNS-1 and the transmission line corridor. Reptiles include the painted turtle (*Chrysemys picta*), the common snapping turtle (*Chelydra serpentine*), the eastern rat snake (*Elaphe obsoleta*), two species of garter snakes (*Thamnophis* spp.), and the prairie kingsnake (*Lampropeltis calligaster*). Amphibians include the Cope's gray treefrog (*Hyla chrysoscelis*), the northern cricket frog (*Acris crepitans*), the northern leopard frog (*Rana pipiens*), and the bullfrog (*Rana catesbeiana*) (UNSM, 2007b).

2.2.7 Protected Species

National Marine Fisheries Service (NMFS) and USFWS are responsible for listing aquatic and terrestrial species as threatened and endangered at the Federal level, as delegated by the ESA. The State may list additional species that are regionally threatened or endangered. For the purposes of this Supplemental EIS, we have included all Federally and State-listed species that occur or potentially occur in Nemaha County, Nebraska (the location of CNS-1) and Johnson, Gage, Lancaster, Saline, Fillmore, York, Hamilton, and Merrick Counties, Nebraska, as well as Atchison County, Missouri (Illinois Wildflowers, 2009; Kansas Wildflowers and Grasses, 2009; MOBOT, 2009; MDC, 2009b; MDC, 2009c; Missouri Plants, 2007; NatureServe, 2009d; NatureServe, 2009e; NGPC, 2008; NGPC, 2009c; NPPD, 2008a; NRCS, 2009; USFWS, 2008a; USFWS, 2009b; USGS, 2006; USGS, 2008; UWYO, 2002), where transmission line corridors associated with CSN-1 lie (Table 2.2.7-1). On January 15, 2008, the NPPD contacted the USFWS regional offices in Nebraska and Missouri, the NGPC, and the MDC regarding any concerns these Federal and State natural resources agencies may have as a result of the license renewal action as CNS-1. The NGPC has not commented upon potential impacts to Federally or State-listed threatened or endangered species, but has provided an updated list of Nebraska species of concern (NGPC, 2009c).

Table 2.2.7-1. Listed Aquatic and Terrestrial Species

The species listed are Federally-listed, Nebraska-listed and/or Missouri-listed as threatened, endangered, or State species of concern (SC). State SC may be further classified as S-1, S-2, S, or SX as described at the bottom of this table. The listed species may occur on the CNS-1 site or in its vicinity, within the Missouri River, or within the transmission line corridors.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
		Fish		
Acipenser fulvescens	Lake sturgeon	-	T (NE)	Large turbid rivers
Cycleptus elongates	Blue sucker	-	T (NE)	Rivers
Fundulus zebrinus	Plains killifish	-	SC (MO)	Streams and lakes
Hybognathus argyritis	Western silvery minnow	-	SC (MO)	Creeks and backwaters
Hybognathus placitus	Plains minnow	-	SC (MO)	Perennial plains streams

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Macrhybopsis meeki	Sicklefin chub	-	T (NE)	Free-flowing rivers with high turbidity
Macrhybopsis gelida	Sturgeon chub	-	E (NE)	Free-flowing rivers with high turbidity
Platygobio gracilis	Flathead chub	-	E (MO)	Main stem Missouri River and small streams
Scaphirhyncus albus	Pallid sturgeon	E	E	Main stem Missouri and Mississippi rivers
		Reptiles and Amphibians		
Agkistrodon contortrix	Copperhead	-	S2 (NE)	In or near deciduous forest in hilly situations; vicinity of rock outcrops; floodplains; mesic situations near water in the arid west.
Ambystoma texanum	Smallmouth salamander	-	S1 (NE)	Adults migrate from upland, mesic forests to breed in fishless, seasonal, and semipermanent wetlands.
Carphophis vermis	Western wormsnake	-	S2 (NE)	Woodlands; forest edge; moist, rocky, hillsides; riparian corridors in prairies; burrowing in or using soil, fallen logs, debris.
Crotalus horridus	Timber rattlesnake	-	S1 (NE)	Riparian; forested and scrub-shrub wetlands; high, dry ridges; hilltop rock outcrops in thick woods.
Elaphe vulpina vulpine	Western fox snake	-	E (MO)	Farmlands, prairies, stream valleys, woods, and dune habitats.
Eumeces obsoletus	Great plains skink	-	S2 (MO)	Open plains; rolling grasslands with few trees and scattered rocks. Takes refuge under rocks, logs; other cover.
Lampropeltis calligaster	Yellow-bellied kingsnake	-	S2 (NE)	Prairies, (including sand prairies), open grassland, forest edge; fields; ditches; woodlands; stream valleys and bluffs.
Lampropeltis getula	Common kingsnake	-	S1 (NE)	Open coniferous forest; prairie; desert; woodland; swamps; coastal marshes; river bottoms; farmland; chaparral.
Liochlorophis vernalis	Smooth green snake	-	S1 (NE) SX (MO)	Meadows, grassy marshes, moist grassy fields at forest edges, stream borders; mountain shrublands, bogs, abandoned farmland; vacant lots. Extirpated in MO.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Ophisaurus attenuatus	Slender glass lizard	-	S1 (NE)	Open grassland; prairie; open and woodland edge; scrubby areas; fallow fields; near streams and ponds; often in habitats with sandy soil.
Rana pipiens	Northern leopard frog	-	S2 (MO)	Springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes; permanent water with rooted aquatic vegetation; wet meadows and fields. Overwinters usually underwater.
Regina grahamii	Graham's crayfish snake	-	S2 (NE)	Sluggish and still waters and their vegetated margins; marshes, swamps; roadside ditches.
Sistrurus catenatus	Massasauga rattlesnake	-	T (NE) E (MO)	Wetlands, grassland/herbaceous, old field, savanna, shrubland/chaparral, woodlands.
Thamnophis proximus	Western ribbonsnake	-	S2 (NE)	Semiaquatic. Wide range shrubby habitats near lakes, ponds, sloughs, ditches, swamps, and marshes.
		Birds		
Ammodramus henslowii	Henslow's sparrow	-	S2 (NE)	Grassland; open fields and meadows; shrubby vegetation; damp or low-lying areas.
Bonasa umbellus	Ruffed grouse	-	SX (NE)	Presumed extirpated. Dense forest with some deciduous trees; both wet and relatively dry situations.
Charadrius melodus	Piping plover	T	T (NE)	Sandy upper beaches with sparse vegetation, sparsely vegetated shores and islands of shallow lakes, ponds, rivers, and impoundments.
Falco peregrinus	Peregrine falcon	-	S1 (NE) S1 (MO)	Various open situations with suitable nesting cliffs; tall buildings with ledges. Non-breeding – occurs in farmlands, marshes, lakeshores, river mouths, tidal flats, urban areas.
Grus American	Whooping crane	E	E (NE)	Wetlands, wet meadows, sandbars and shallow water in rivers.
Lanius ludovicianus	Loggerhead shrike	-	S2 (MO)	Open country with scattered trees and shrubs, savanna, desert scrub, open woodland; often perches on poles, wires or fence posts.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Laterallus jamaicensis	Black rail	-	S1 (NE) S1 (MO)	Breeding and non-breeding: shallow portions of salt, brackish, and freshwater marshes; pond borders; wet meadows; and grassy swamps.
Numenius borealis	Eskimo curlew	E	SX (NE)	Possibly extinct. Non-breeding: grasslands; pastures; plowed fields; and less frequently, marshes and mudflats. Nests in open Arctic tundra.
Rallus elegans	King rail	-	S1 (NE) S1 (MO)	Freshwater marshes, upland-wetland marsh edges, flooded farmlands, shrub swamps.
Sterna antillarum athalassos	Interior least tern	E	E (NE) S1 (MO)	Bare sand bars and sandy shorelines of large rivers, lakes and sand pits.
Strix varia	Barred owl	-	S2 (NE)	Dense woodland and forest, swamps, wooded river valleys.
Thryothorus ludovicianus	Carolina wren	-	S2 (NE)	Open deciduous woodland; thickets; undergrowth; parks; forest edge; pine barrens; shrubbery of residential areas.
Tryngites subruficollis	Buff-breasted sandpiper	-	S1 (NE)	Migratory through NE. Short grass plains and dry uplands. Man-altered habitats – fields; golf courses; runways.
		Mammals		
Glaucomys volans	Southern flying squirrel	-	T (NE)	Red oak-basswood-ironwood forest.
Lontra canadensis	River otter	-	T (NE)	Streams, lakes, ponds, swamps, marshes, estuaries (in some areas), exposed outer coast.
Microtus pinetorum	Woodland vole	-	S1 (NE)	Wide variety of habitats; prefers upland wooded areas with thick layer of loose soil and humus in shallow burrows.
Mustela nigripes	Black-footed ferret	E	E (NE)	Limited to open habitat and burrows used by prairie dogs: grasslands and shrub steppe.
Perognathus flavescens	Plains pocket mouse	-	S2 (MO)	Tallgrass prairie, sandy-loose soil prairies.
Spermophilus franklinii	Franklin's ground squirrel	-	S2 (MO)	Tallgrass and mid-grass prairies; riparian areas; forest-field edges, fields, hedgerows, unmowed strips of railroad rights-of-way and roadsides.
Spilogale putorius interrupta	Plains spotted skunk	-	S1 (NE) E (MO)	Forested areas; habitats with significant cover; open and brushy areas; rocky canyons and outcrops in woodlands and prairies

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Myotis sodalis	Indiana bat	E	E (MO)	Hibernates in caves; foraging habitats include riparian areas, upland forests, ponds, and fields.
		Insects		
Atrytone arogos iowa	Iowa skipper	-	S1 (NE)	Short grass prairie in Colorado to mesic or dry tall grass prairie.
Cicindela nevadica linolnaina	Salt Creek tiger beetle	E	E (NE)	Eastern Nebraska saline wetlands and their associated streams.
Cicindela togata	White-cloaked tiger beetle	-	S1 (NE)	Very open saline areas far from vegetation. Salt flats, salt marshes, saline lakeshores.
Melanoplus packardii	Packard's grasshopper	-	S2 (MO)	Bare, somewhat grassy beaches; sandy woods, always on dry sand and not on vegetation.
Nicrophorus americanus	American burying beetle	-	S1 (NE) SH (MO)	Broad vegetational tolerances. Mature forest; grassland; old field shrubland.
		Plants		
Agalinis purpurea	Large-purple false foxglove	-	S1 (NE)	Moist sand prairies; sandy savannas, paths and openings in sandy woodlands; boggy areas; occasional disturbance.
Anagallis minima	Chaffweed	-	S1 (NE)	Bare damp ground, by roadsides.
Anemone cylindrical	Thimbleweed	-	S2 (MO)	Dry open woods, slopes, prairies, along railroad grades.
Arisaema dracontium	Green dragon	-	S2 (NE)	Moist deciduous woodlands; shady seeps; and wooded areas adjacent to springs and vernal pools.
Arnoglossum atriplicifolium	Pale Indian-plantain	-	S2 (NE)	Full to partial sun; prairies, woods; in sandy, loamy soil.
Asclepias amplexicaulis	Clasping milkweed	-	S1 (NE)	Prairies; glades; rocky open woods; roadsides; railroads.
Asclepias purpurascens	Purple milkweed	-	S1 (NE)	Rocky open woods, glades; prairies; stream banks; wet meadows; valleys; thickets; roadsides.
Astragalus lotiflorus	Low milk vetch	-	S2 (MO)	Dry native prairie in areas where the shortgrasses like blue grama grow.
Bidens polylepis	Awnless beggar-ticks	-	S2 (NE)	Wet prairies and meadows; swampy woods; roadsides; disturbed grounds.
Blephilia hirsuta	Hairy Woodmint	-	S1 (NE)	Rich, moist, shady woods, slopes and valleys.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Bouteloua gracilis	Blue grama	-	S1 (MO)	Dryish soils on upland short grass prairies and along railroad tracks.
Bouteloua hirsute var. hirsuta	Hairy grama	-	S2 (MO)	Shortgrass prairies.
Brachyelytrum erectum	Bearded shorthusk	-	S2 (NE)	Mesic upland forests; bottomland forests; occasional dry upland forest.
Buchloe dactyloides	Buffalo grass	-	SH (MO)	Possibly extirpated
Carex bushii	Bush's sedge	-	S1S2 (NE)	Moist prairies, fields, and meadows in full sun (ODNR 1998).
Carex crus-corvi	Ravenfoot sedge	-	S1 (NE)	Wet meadows and swamps (MSU 2007).
Carex frankii	Frank's sedge	-	S1S2 (NE)	Edges of wet woods; seasonally wet meadows (USU 2006).
Carex sprengelii	Longbeak sedge	-	S1 (MO)	Moist soil on bottomlands and streambanks; cliffs and rocky slopes.
Castilleja sessiliflora	Downy painted cup	-	S2 (MO)	Dry prairies and rocky hillsides.
Coeloglossum viride	Long-bract Green orchis	-	S1 (NE)	Sub-arid soil in damp open woods; mesic to wet woodlands, thickets and shrub boarders; disturbed areas.
Corallorhiza wisteriana	Spring coralroot	-	S1 (NE)	Terrestrial in moist hardwood forests and hammocks. Mycorrhizal with fungi.
Cornus racemosa	Gray dogwood	-	S1 (NE)	Thickets and moist soil in riparian zones, roadsides, on sandy slopes and limestone ridges.
Corydalis aurea	Golden Corydalis	-	S1 (NE)	Rocky or sandy soils along lakes or ponds or in open woods.
Cypripedium calceolus	Yellow lady's-slipper	-	S1 (NE)	Rich, humus and decaying leaf litter in wooded areas, often on rocky wooded hillsides.
Cypripedium candidum	Small white lady's slipper	-	T (NE) S1 (MO)	Mesic/wet blacksoil prairie; glacial till hill prairie, sedge meadow, glade. Calcareous soils. Extirpated/possibly extirpated in MO.
Dalea enneandra	Nine-anther dalea	-	S2 (MO)	Grassland and prairie.
Dasistoma macrophylla	Mullein foxglove	-	S1 (NE)	Rich woodlands, often along streams.
Desmodium cuspidatum	Toothed tick-trefoil	-	S2? (NE)	Dry or rocky woods; thickets; bluffs; base of slopes; ridges; ravines; valleys.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Dracocephalum parviflorum	American dragonhead	-	S1 (NE)	Woodland; shrublands; openings.
Eleocharis atropurpurea	Purple spikerush	-	S1 (NE) S1 (MO)	Banks; hammocks; irrigation ditches; lake and pond margins.
Eleocharis wolfii	Wolf's spikerush	-	S2 (NE)	Marshes, wet to wet-mesic prairies, wetland margins; wet ditches, sandy roadsides, mud flats.
Erysimum inconspicuum	Small-flower prairie wallflower	-	S2 (NE)	Dry native prairie; found where grazing is light or moderate.
Erythronium mesochoreum	Midland fawnlily	-	S2 (NE)	Prairies and open woods; occasionally found in cut-over woods.
Galearis spectabilis	Showy orchis	-	S1 (NE)	Floodplains.
Gastrophryne olivacea	Great Plains narrowmouth toad		S2 (NE)	Variable. Creeks; pools; temporary pools; grasslands; rocky wooded hills; rotten logs; burrows under rocks.
Gentiana alba	Yellow gentian	-	S1 (NE)	Mesic black soil prairies; upland forests; rocky bluffs.
Helianthemum bicknellii	Plains frostweed	-	S1S2 (NE)	Sandy soil of open woodlands and prairie areas.
Heliotropium curassavicum var. curassavicum	Seaside Heliotrope	-	S1 (NE) S1 (MO)	Dry or moist saline and alkaline areas; seasonal flooding.
Isoetes melanopoda	Blackfoot quillwort	-	S1 (NE)	Submerged or in wet soil of swales and temporary ponds.
Lactuca tatarica var. pulchella	Blue lettuce	-	S1 (MO)	Plains, foothills, montane; meadows, roadside ditches.
Lespedeza violacea	Violet bush-clover	-	S1 (NE)	Edges of open upland woods, roadsides; thickets; rocky prairies; dry, rocky soils.
Leucospora multifida	Narrowleaf paleseed	-	S1 (NE)	Shores and stream banks, often where sandy.
Liatris squarrosa var. hirsuta	Glades gayfeather	-	S1? (NE)	Diverse; including dry, sandy, upland prairies.
Melica nitens	Three-flower melicgrass	-	S1 (NE)	Open woods; moist canyon slopes; canyon bottoms; roadsides; rocky grasslands; streambanks.
Monotropa uniflora	Indian-pipe	-	S1 (NE)	Non-green herb parasitic on roots of pines.
Neeragrostis reptans	Hairy creeping lovegrass	-	S1 (NE) SH (MO)	Wet sandy or muddy stream banks and alluvial bar.
Nothocalais cuspidate	Prairie dandelion	-	S2 (MO)	Dry upland areas of prairies, hill prairies, and rocky slopes.
Nymphaea odorata	American water-lily	-	S2 (NE)	Lakes; lake margins; ponds; quiet bays in lakes and rivers; slow-moving streams; ponds.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Orobanche uniflora	One-flowered broomrape	-	S1 (NE)	Parasitic. Wooded slopes; lowland; rocky base of bluffs.
Oxytropis lambertii var. lambertii	Locoweed	-	S2 (MO)	Extirpated/possibly extirpated.
Packera glabella	Grassleaf ragwort		S1 (NE)	Moist-to-wet habitat. (UT 2009)
Panax quinquefolium	American ginseng	-	T (NE)	Rich, cool, moist but not extremely wet woods, under a closed canopy; slopes; ravines.
Paronychia canadensis	Forked nailwort	-	S1 (NE)	Dry sandy or rocky places.
Pediomelum argophyllum	Silvery psoralea	-	S2 (MO)	Moist prairies, rocky hillsides, lowlands, stream valleys, and open woodlands.
Pellaea atropurpurea	Purple-stem cliffbrake	-	S2 (NE)	Crevices of rock outcrops, bluffs and boulders; sinkholes; dry soils adjacent to dolomite glades.
Penstemon grandiflorus	Large beard-tongue	-	S1 (MO)	Prairie bluffs in open grassy places.
Penstemon tubiflorus	White-wand beardtongue	-	S1 (NE)	Rich loam or sand loam soil from open prairies to deciduous forests; disturbed areas; rocky glades; along railroads.
Platanthera praeclara	Western prairie fringed orchid	T	T (NE) E (MO)	Tallgrass prairie; moist, calcareous or subsaline prairies and sedge meadows (many flooded for a period of 1-2 weeks during the year).
Podophyllum peltatum	Mayapple	-	S2 (NE)	Rich cove forests; mesic hardwood forests; low topographic positions.
Quercus alba	White oak	-	S1 (NE)	Deciduous forests; mesic; bottomland soil.
Ruellia strepens	Limestone wild petunia	-	S2 (NE)	Moist woods, around ponds and lakes, along streams.
Salicornia rubra	Western glasswort	-	S1 (NE)	Saline or alkaline soil of flats, shores, seepage areas and ditches.
Schoenoplectus saximontanus	Rocky Mountain bulrush	-	S1 (NE) S1 (MO)	Damp soils to emergent, freshwater ponds; ditches, often drying; disturbed and sandy areas.
Senna marilandica	Maryland senna	-	S1S2 (NE)	Prairie ravines, open woods, thickets, disturbed areas, and bases of slopes and bluffs; dry, gravelly soils.
Sparganium chlorocarpum	Greenfruit bur-reed	-	S2 (NE)	Shallow water or mud of marshes, streams, ditches and ponds, where the water is fairly fresh.

Scientific Name	Common Name	Federal Status[a]	State Status[b,c]	Habitat
Spiranthes vernalis	Twisted ladies'-tresses	-	S2? (NE)	Moist open areas, meadows, swales, bogs.
Symphoricarpos occidentalis	Wolfberry	-	S1 (MO)	Open prairies, and moist, low ground around streams or lakes.
Trifolium reflexum	Buffalo clover	-	S1 (NE)	Rocky open woods; glades; old fields; prairies.
Triodanis perfoliata var. biflora	Claspingleaf Venus'-looking-glass	-	S1 (NE)	Dry sandy or gravelly prairies, pastures, waste ground, and occasionally woodlands.
Verbena simplex	Narrowleaf vervain	-	S1 (NE)	Dry, open waste areas, rocky prairie hillsides, and roadsides.
Veronicastrum virginicum	Culver's-root	-	S1 (NE)	Varied habitats. Moist tallgrass prairie and prairie remnants, moist woods, woodland borders, thickets, fields and meadows, stream banks and terraces.
Viola palmata	Palmate-leaved violet	-	S2 (NE)	Dry upland woodlands, rocky wooded slopes, and thinly wooded bluffs.
Vitis cinerea	Pigeon grape	-	S1 (NE)	Low woods, floodplains, along streams, marshes, bottomlands.
Yucca glauca	Small soapweed yucca	-	S2 (MO)	Loess hill prairies.

[a] E = Endangered; T = Threatened

[b] NE = Nebraska; MO = Missouri

[c]S = State listing; S1 = critically imperiled; S2 = imperiled; SX - presumed extirpated; SH - possibly extirpated. Note that S3 species (“vulnerable”) are not included in this list in order to maintain a less-expansive list.

Sources: NGPC, 2008; NGPC, 2009c; MDC, 2009b; MDC, 2009c; USFWS, 2008a; USFWS, 2009b; University of Wisconsin (UW), 2009.

2.2.7.1 *Aquatic Species*

Table 2.2.7-1 presents aquatic species that are listed as protected by the USFWS, the State of Nebraska, and the State of Missouri that have the potential to occur in counties near CNS-1 or along the transmission corridors. One fish species is listed by USFWS for Nemaha County, Nebraska: the pallid sturgeon (*Scaphirhynchus albus*) (USFWS, 2007). Regarding State-listed species, Hesse et al. (1982) report the identification of several fish species then listed as threatened or endangered by Iowa, Missouri, or Nebraska, based on studies from 1971 through 1977 from the channelized Missouri River in the reach from Fort Calhoun Station to CNS-1. These included skipjack herring (*Alosa chrysochloris*, listed in Iowa), sturgeon chub (*Macrhybopsis gelida*, listed in Iowa and Missouri), blue sucker (*Cycleptus elongates*, listed in Missouri), plains killifish (*Fundulus kansae*, listed in Missouri), and burbot (*Lota lota)*, listed in Missouri). Of these, they collected a single sturgeon chub (in 1977), three plains killifish (in 1971), ten burbot, and consistent low numbers of blue suckers near CNS-1. MDC (2009) no longer lists sturgeon chub, plains killifish or burbot, and Iowa no longer lists the sturgeon chub (Iowa Administrative Code, Chapter 77). Fish species that the States of Missouri and Nebraska currently list and that Hesse et al. (1982) collected near CNS-1 or in the reach between CNS-1 and FCS in the 1971 though 1977 studies include sturgeon chub, blue sucker, and plains killifish. NRC staff did not find more recent data on fish species living in the Missouri River near CNS-1, but lack of captures does not necessarily indicate absence of uncommon species in any case.

Life History of Pallid Sturgeon

Sturgeons are members of an order of fish (Acipenseriformes) that probably evolved in the Devonian age. Living members of this order in North America include the paddlefish and eight sturgeon species. The paddlefish (*Polyodon spathula*) and three sturgeon species, the lake sturgeon (*Acipenser fulvescens*), pallid sturgeon (*Scaphirhynchus albus*), and the shovelnose sturgeon (*S. platorynchus*), live in the Missouri and Mississippi rivers. In the past, commercial fishermen harvested all three of the sturgeon species in the Missouri and Mississippi rivers. Today pallid sturgeon are a Federally-listed endangered species, and lake sturgeon are listed as endangered by Nebraska. The life history information below is from Dryer and Sandvol (1993) and USFWS (2007) if not otherwise cited.

Pallid sturgeons have a flattened snout, a long tail, and rows of bony armor plates. The upper side is convex and the lower side is straight. They have an inferior (bottom-facing) mouth and eat invertebrates, such as the immature stages of insects, and fish. The body shape is well adapted swimming close to the bottom of relatively fast flowing, large rivers. The diet, inferior mouth, and barbels in front of the mouth are well adapted to feeding on or near the bottom in highly turbid environments.

The USFWS listed pallid sturgeon as endangered in 1990. The historic abundance of pallid sturgeon is somewhat vague since biologists did not recognize it as a separate species from shovelnose sturgeon until 1905, but its historical range probably extended from the middle and lower Mississippi River in the south up through the Missouri River and lower reaches of the Platte, Kansas, and Yellowstone rivers in the north and west. The pallid sturgeon is one of the largest fish species in those rivers. Available information suggests that the pallid sturgeon was not a common species since the time of European settlement. Today pallid sturgeon are among the rarest fish of the Missouri and Mississippi River basins, and the present range includes the States of Montana, North and South Dakota, Nebraska, Iowa, Kansas, Missouri, Illinois, Kentucky, Arkansas, Mississippi, and Louisiana. The populations are largely older fish that will die off in the near future.

Fisheries biologists know little about pallid sturgeon reproduction or even preferred spawning habitats and conditions. Hurleya et al. (2004) tracked sonically-tagged pallid sturgeon in the Mississippi River and found that they exhibited positive selection for the main-channel border, downstream island tips, between-wing-dam, and wing-dam-tip habitats; they showed negative selection for main-channel, downstream of wing dams, and upstream of wing dam habitats. The sturgeon exhibited little habitat selection for temperature or dam discharge. The authors concluded that habitat enhancement and restoration of habitat diversity might be necessary for recovery of pallid sturgeon.

Reports of pallid sturgeon reproduction are rare. The USGS (2007), NGPC, and the USACE confirmed spawning of two female pallid sturgeon in the upstream reaches of the lower Missouri River in May 2007. The capture of young pallid sturgeon that would verify natural reproduction are also rare: none were captured between 1978 and a Mississippi River trawl survey in 1998 through 2000 using equipment designed to capture larval fish in deep, turbulent water (Hrabik et al., 2007). Hrabik et al. (2007) concluded that those latest captures verified reproduction, possibly from the lower Missouri River to the upper and lower Mississippi River, although they also found no evidence of recruitment of pallid sturgeon because they captured no juveniles after 374 trawl hauls that captured over 21,735 fish in that 1998 through 2000 survey. Wildhaber et al. (2007) suggest that one or more of the following factors may be responsible for the lack of finding larval pallid sturgeon and of recruitment: lack of successful spawning, low recruitment, high mortality, ineffective sampling methods, inadequate sampling of drift and settling locations, or rapid dispersal and washout of sturgeon larvae in the Missouri and Mississippi rivers. Pallid sturgeon larvae are indistinguishable from those of the congeneric shovelnose sturgeon, which may also help to explain the paucity of reported collections in the past. Also, the construction of dams and other structures with resulting habitat change and the elimination of shallow areas in the river with little or no flow have probably deprived sturgeon of critical nursery areas needed for the survival of immature sturgeon (MDC, 2009).

Larval pallid and shovelnose sturgeon become strongly photopositive and migrate upwards toward the light starting the first day after hatching. As a result, they remain far above the bottom, even at the water surface, and migrate far downriver (Kynard et al., 2002). Cultured yearling pallid sturgeon in laboratory studies also migrate downstream during summer and fall, which suggests a two-stage (larval, then yearling) downriver migration in the first year of life. Adult sturgeons are also highly migratory and often migrate hundreds of miles in a year.

The young of both shovelnose and pallid sturgeon eat invertebrates, but as pallid sturgeon grow, they become more piscivorous. Gerrity and Guy (2006) found that the diet of juvenile pallid sturgeon of age 6 and 7 was mostly fish, compared to the diet of shovelnose sturgeon, which is mainly aquatic insects. Sturgeon chub (*Macrhybopsis gelida)* and sicklefin chub (*M. meeki)* together comprised 79 percent of the number of identifiable fish in juvenile pallid sturgeon stomachs. Populations of these two cyprinid minnows have declined throughout much of the Missouri River due to the construction of dams and man's other alterations of river habitat. While the population of the piscivorous pallid sturgeon has declined in the Missouri and Mississippi rivers, the population of its similar, insectivorous congener, shovelnose sturgeon, has not declined. Gerrity and Guy (2006) concluded that the prevalence of sicklefin chub and sturgeon chub as a food resource of juvenile pallid sturgeon may help explain the decline of pallid sturgeon populations and that recovery and management of native cyprinids is a potentially important step in the recovery of pallid sturgeon.

Male pallid sturgeons are believed to mature at 7 to 9 years after which they spawn at intervals of 2 to 3 years. Females may reach sexual maturity at 7 to 15 years and spawn at intervals up to 10 years. Individuals may reach ages of 60 years or more and reach lengths of 6 feet (2 m). Like many other fish species, the largest individuals are found farthest north in the species' range and maximum size decreases with distance south. For example, the maximum weight of pallid sturgeon in the upper Missouri River in Montana and North Dakota is 86 pounds (39 kg), in the Missouri River in South Dakota and Nebraska 46 pounds (21 kg), and in the Mississippi River 26 pounds (12 kg). They become much larger than shovelnose sturgeon, which rarely weigh more than 8 pounds (3.6 kg).

While they were successful in the historical Missouri and Mississippi rivers, with the high flow and turbidity and diverse habitats of floodplains, backwaters, chutes, sloughs, islands, sand and gravel bars, and both braided and main channels, they are not so well adapted to the Missouri and Mississippi rivers today with the construction of dams that isolated subpopulations, channelization, controlled flow, and elimination of habitat diversity. USFWS (2007) concludes that man's activities have adversely affected all of the 3,350 miles (5,390 km) of river habitat within their range, and habitat alteration and loss may be the biggest threat to their existence. Other threats may include hybridization with shovelnose sturgeon, commercial fishing, and exposure to environmental contaminants such as polychlorinated biphenyls, cadmium, mercury, selenium, chlordane DDT, DDE, and dieldrin, all of which have been found in pallid sturgeon tissue in the past.

During the early 1990s, the MDC developed "action plans" for lake and pallid sturgeon with a goal of reestablishing self-sustaining populations so they can be delisted as endangered species and ultimately provide limited sport fisheries. These plans stress the restoration of both species through habitat improvement, artificial propagation, protection, research, management, and education (MDC, 2009). As part of this effort, the MDC's Blind Pony Fish Hatchery has raised and stocked over 13,000 fingerling pallid sturgeon and 200,000 fingerling lake sturgeon into the Missouri and Mississippi rivers (MDC, 2009). In addition to these efforts, the USGS (Wildhaber et al., 2007) has developed a conceptual life history to organize the understanding about the complex life history of *Scaphirhynchus* sturgeons and improve understanding of the effects of management actions on the ecological requirements of pallid and shovelnose sturgeons. The USFWS's Pallid Sturgeon Recovery Plan (Dryer and Sandvol, 1993) designated six recovery priority management areas (RPMAs) for implementation of recovery tasks, and CNS-1 is located within RPMA 4.

In 2000, the USACE, which provides the primary operation management of the Missouri River, asked the USFWS for formal consultation under the ESA on the Operations of the Missouri River Main Stem System, and related Operations of the Kansas River Tributary Reservoirs, and the Operations and Maintenance of the Missouri River Bank Stabilization and Navigation Project (USFWS, 2000). The USACE had prepared biological assessments for these projects and determined that their operations may affect listed species, including the endangered pallid sturgeon. The USFWS found that the proposed actions were likely to jeopardize the continued existence of pallid sturgeon, as well as the endangered least tern and threatened piping plover, though not the then-threatened bald eagle. Working together, the USACE and the USFWS developed Reasonable and Prudent Alternatives under the ESA to help insure the continued existence of the three species by returning some natural form and function to sections of the Missouri and Kansas rivers. Under the Alternatives, the following five actions are designed for pallid sturgeon: (1) enhance flow by including a spring release from Fort Peck dam and a spring rise and summer drawdown from Gavins Point dam to provide spawning clues and enhance aquatic habitat; (2) restore, create, enhance, acquire, or conserve habitat; (3) unbalance the upper reservoirs, (4) use an adaptive management process combined with monitoring; and (5) increase pallid sturgeon propagation and augmentation efforts while the habitat and hydrology improvements are being implemented.

USFWS (2003a, 2003b) issued a Supplemental Biological Opinion that applied only to operations in 2003 due to a continuing drought. It represented a collaborative effort between the USFWS and the USACE and considered habitat conditions and new information not considered in the November 2000 biological opinion. The USACE changed flow regime in the Missouri River and the USFWS stocked year-old pallid sturgeon, both as interim measures in 2003. USFWS (2003a, 200b) reported that the long-term survival of pallid sturgeon will depend on a more natural hydrograph consisting of an increase in spring flows and declining summer flows.

2.2.7.2 *Terrestrial Species*

Federally Protected Species

Eight animal and plant species Federally-listed as threatened or endangered (Table 2.2.7-1) are known to occur or to potentially occur on terrestrial habitat within the vicinity of CNS-1 or along the associated in-scope transmission line corridor. The ranges of four of these species, the Indiana bat (*Myotis sodalis*), the western prairie fringed orchid (*Platanthera praeclara*), the piping plover (*Charadrius melodius*), and the interior least tern (*Sterna antillarum athalassos*) may include the CNS-1 site. The Indiana bat and interior least tern are listed as endangered, and the western prairie fringed orchid and piping plover are listed as threatened (USFWS, 2008a; USFWS, 2009b).

Seven Federally-listed species are potentially present along the transmission line corridor, including the western prairie fringed orchid. The endangered species are the Salt Creek tiger beetle (*Cincindela nevadica lincolniana*), the black-footed ferret (*Mustela nigripes*), the interior least tern, the Eskimo curlew (*Numenius borealis*), and the only known wild population of whooping crane (*Grus americana*). The Eskimo curlew is extirpated from Nebraska and is globally extinct or near-extinct. The piping plover is listed as a threatened species and may be found along the western limit of the transmission line corridor by the Platte River, along with the interior least tern and whooping crane (NatureServe, 2009e; USFWS 2008a, 2009b, 2009c).

While threatened piping plovers have not been observed along the CNS-1 shoreline, they have been found along the Missouri River in close proximity to CNS-1 and along the Platte River near the western limit of CNS-1 transmission line NPPD TL3502 (USFWS 2002, 2009c; NatureServe, 2009a). The piping plover is a small shorebird with a white underbelly and pale brownish upper parts, with an average length of 6–7 inches (16–18 cm) and a wingspan of about 15 inches (38 cm). The plover has a small black ring around the base of its neck and a black band over its eyes on its forehead (NatureServe, 2009a, USFWS, 1997). Piping plover habitat includes river channels, their associated sandbars and islands, and their sparsely vegetated shorelines and peninsulas (USFWS, 2002). Even though the shoreline along the Missouri River at CNS-1 does not contain the characteristics required by piping plovers for nesting, but they have been reported in the vicinity of CNS-1. Critical habitat has been designated for the northern Great Plains breeding population of the piping plover along portions of the Platte River in Hamilton County and Merrick County, which is the location of the transmission line crossing of the Platte River near Grand Island, Nebraska. Critical habitat has also been designated along the Missouri River near the Nebraska-South Dakota border, but not in the vicinity of the CNS-1 site (NPPD, 2008a; USFWS, 2002). The destruction or degradation of their habitat and poor breeding success caused by predation are the major reasons for the decline of piping plover populations. Dam construction and channelization of the Missouri River have caused the loss of sandbar nesting habitat for the piping plover (USFWS 1997, 2002).

Interior least terns are found along portions of the Missouri River in North Dakota, and also nest along portions of the Platte River and its tributaries in Hamilton County and Merrick County, Nebraska, near the western limit of transmission line NPPD TL3502 (NatureServe, 2009b; NGPC, 2009a). The interior least tern is a swallow-like bird 8–9 inches (22–24 cm) long with a wingspan of about 20 inches (31 cm). It has a pale gray and white body with a glossy black crown, and a long black-tipped yellow-orange bill. The interior least tern nests in habitat similar to that used by piping plovers. Threats to the interior least tern are also similar to those of the piping plover, with sand and gravel pits now providing some of the only available nesting habitat for least terns (NGPC, 2009a; USFWS, 2008b).

The current range of the Indiana bat includes Atchison County, Missouri, on the east side of the Missouri River from CNS-1, but does not include Nebraska (USFWS, 2008a; MDC 2009b, 2009c). The Indiana bat is a medium-sized bat about two inches (5 cm) long and weighing about one-quarter ounce (7 gm) (NYS DEC, 2009) with a wingspan of about eight inches (20 cm) and brownish-gray fur (MDC, 2009a). The Indiana bat hibernates in caves during the winter and migrates to streams and rivers in wooded areas in the summer where they roost under loose tree bark (NYS DEC, 2009; MDC, 2009a). Critical habitat for the Indiana bat has been designated in Missouri but not in Atchison County (USFWS, 2008a). A number of factors have contributed to population declines for the Indiana bat; a primary cause for their decline has been from humans disturbing bats hibernating in caves during the winter. Stream channelization, deforestation, and agricultural development threaten the habitat of Indiana bats in their summer range (MDC, 2009a).

The western prairie fringed orchid occurs both in Nebraska and Missouri. It is found in Otoe County, located immediately north of Nemaha County, which is the location of CNS-1. It is also found in Atchison County, Missouri, the location of the Missouri portion of the CNS-1 property (USFWS 2008a, 2009b). The western prairie fringed orchid produces flower stalks up to about 4 feet (133 cm) tall, with up to 40 one inch (2.5 cm) white flowers, attached to the stalk (USFWS, 2003; MN DNR, 1991). It grows in moderately wet to wet prairies and meadows and is occasionally found in old fields and roadside ditches. Habitat loss through conversion to cropland is the greatest threat to populations of the western prairie fringed orchid (USFWS, 2003).

The only known existing wild population of whooping cranes migrates along the Platte River at the western limit of the CNS-1 transmission line corridor near Grand Island. The whooping crane is a large white crane standing as tall as 5 feet (1.5 m) with a wingspan of 8 feet (2.5 m) and weighing over 17 pounds (8 kg), making it the largest bird in North America and one of the three largest cranes in the world (NGPC, 2009b). Adult whooping cranes have a red crown and black forehead with black primary feathers visible during flight (USFWS, 2009k). Whooping cranes live and breed in wetlands, and feed primarily on crabs, small fish and other invertebrates (NGPC, 2009b; NatureServe, 2008a). Whooping cranes declined to the brink of extinction in the first half of the 20th century mainly caused by a loss of habitat to agriculture, human disturbance of nesting areas for eggs, and uncontrolled hunting for meat and plumage. By 1941, only 14 whooping cranes existed (NatureServe, 2008a; NGPC, 2009b). Current threats to their population include habitat degradation, low productivity associated with drought and/or winter malnutrition, collisions with power lines along their migration routes, and severe weather phenomena during nesting season (NatureServe, 2008a; USFWS, 2009c).

There are currently three populations of whooping cranes totaling less than 400 adult and juvenile birds, including one wild population and two experimental, nonessential populations. The wild population of whooping cranes overwinters in the Aransas National Wildlife Refuge in

Texas, and migrates north in the spring to one small breeding area in Canada (USFWS, 2009g). The wild population uses the Platte River and its tributaries and surrounding wetlands along its migratory corridor in the spring and fall. CNS-1 transmission line NPPD TL3502 crosses the Platte River along the whooping crane migratory corridor one mile from the endpoint of the transmission line near Grand Island, Nebraska. Critical habitat has been designated for whooping cranes on the Platte River, located approximately 25 miles (40 km) southwest of Grand Island (USFWS, 1978). One of the two experimental populations breeds in Idaho and overwinters in Utah. The second experimental population breeds in Wisconsin and overwinters in Florida and several other southeastern States (NatureServe, 2008a).

Captive breeding programs over the past several decades have increased whooping crane populations sufficiently to allow creation of the two experimental populations. As of April 2008, however, there were still less than 400 adult and juvenile whooping cranes in existence between these three flocks. Both the wild population and the experimental populations still suffer significant mortality attributable to severe weather, lack of food, and collisions with power lines. The wild Aransas population lost 57 adult and juvenile whooping cranes between spring 2008 and winter 2009, for a loss of 21 percent of its population in 12 months. The spring 2009 flock of whooping cranes at Aransas totaled 247 birds (Stehn, 2009).

The NPPD has coordinated efforts with the USFWS to address the potential risk of bird collisions with transmission line NPPD TL3502, which crosses the Platte River near the end of the CNS-1 transmission line corridor, located approximately 4 miles (6 km) east of Grand Island, Nebraska. The Federally-endangered whooping crane (*Grus Americana*), the interior least tern (*Sterna antillarum athalassos*), and the Federally threatened piping plover (*Charadrius melodius*) utilize the Platte River and associated wetlands around Grand Island for different portions of their lifecycle, such as for migration, resting, feeding, and nesting, and risk collisions with the NPPD transmission line. The USFWS has indicated that collisions with transmission lines are the main cause of whooping crane mortality during their migrations (USFWS, 2009c). On May 8, 2009, the NPPD informed the USFWS that NPPD had agreed to mark that portion of the NPPD transmission line that crosses the Platte River with bird flight diverters to increase the visibility of the transmission line and reduce the risk of birds colliding with the line (NPPD, 2009). The USFWS replied to NPPD on June 8, 2009, informing them that NPPD had satisfactorily addressed the concerns of the USFWS regarding bird collisions (USFWS, 2009l).

The extremely rare Salt Creek tiger beetle is found only in the northern third of Lancaster County, Nebraska (Cornell University, 2008; USFWS, 2005; NatureServe, 2008b). The transmission line corridor for CNS-1 traverses the southern portion of Lancaster County (NPPD, 2008). The Salt Creek tiger beetle is about one-half inch (1.0 cm) long and is metallic brown to dark olive green above with a metallic dark green underside (USFWS 2005, 2009h). The tiger beetle is an active predator, grasping other small invertebrates for prey with its mandibles. The Salt Creek tiger beetle, limited to three populations totaling less than 150 adults, is found only in saline wetlands and along muddy banks of associated streams and tributaries of Little Salt Creek in Lincoln, Nebraska. Threats to the remaining populations of the Salt Creek tiger beetle include habitat loss and degradation caused by development, increased water runoff and sediment runoff from urban areas, eroding banks associated with development, bank stabilization projects, pollution, pesticides, and habitat loss and degradation from grazing and cultivation (Cornell University, 2008; USFWS, 2005). On December 12, 2007, the USFWS proposed the designation of critical habitat for the Salt Creek tiger beetle (USFWS, 2009i).

The black-footed ferret is considered to be one of the most endangered mammals in the United States, and has the potential to survive in Hamilton County and Merrick County, Nebraska, near the western limit of transmission line NPPD TL3502 (USFWS, 2009b; NPPD, 2008a). It is a member of the weasel family (*Mustelidae*), and is the only ferret native to North America. The black-footed ferret's distinctive coloration includes a black face mask, black feet, and a black-tipped tail, with a light yellow-buff color on its back and body. It is approximately 6 inches (15 cm) tall, 18–24 inches (50–60 cm) long including a 6-inch (15 cm) tail, and weighs 1.5–2.5 pounds (0.7–1.1 kg) (Defenders of Wildlife, 2009; NatureServe, 2009c; USFWS 2000, 2009j).

Black-footed ferrets once ranged throughout the Great Plains region of the United States and part of southern Canada. They live primarily on the open prairie and spend most of their time underground in prairie dog burrows, relying on prairie dogs as their prey. Through the first half of the twentieth century, the conversion of open prairie to farmland, the shooting and poisoning of prairie dogs to eliminate them from livestock grazing areas, and sylvatic plague wiped out large numbers of prairie dogs and correspondingly decimated the black-footed ferret population. The black-footed ferret was feared extinct by the mid 1970s, until a small population of 130 was identified in Wyoming in 1981 (Black-footed Ferret Recovery Implementation Team, 2009; Defenders of Wildlife, 2009; USFWS, 2000). A captive breeding program over the last 25 years has increased their population from a low of 18 wild black-footed ferrets to their present number of 750 living in the wild, including an experimental nonessential population, and 250 living in captive breeding facilities (USFWS 2000, 2009j). Current threats to the black-footed ferret still include their reliance on prairie dogs as their food source, the corresponding prairie dog management practices implemented by agricultural interests competing for land, and the reduction and fragmentation of prairie dog populations to less than five percent of their historic range (Defenders of Wildlife, 2009; NatureServe, 2009c).

<u>State Protected Species</u>

A total of 115 terrestrial species (41 terrestrial animal species and 74 terrestrial plant species) are protected by Nebraska and Missouri, and are listed as endangered, threatened, or species of special concern (S1; S2; SX; SH) (Table 2.2.7-1). Ninety-three of the protected species occur in Nebraska, and 37 of the protected species are in Atchison County, Missouri. These 115 species have the potential to inhabit the counties within the vicinity of CNS-1 and/or the transmission line corridor, including Nemaha County, Johnson County, Gage County, Lancaster County, Saline County, Fillmore County, York County, Hamilton County, and Merrick County, Nebraska, and Atchison County, Missouri. These 41 animal species include 14 bird species, 12 reptile species, 2 amphibian species, 8 mammal species, and 5 insect species (NGPC 2008, 2009c; MDC 2009b, 2009c; USFWS 2008a, 2009b). The NPPD has indicated that no currently Federally or State-listed terrestrial plant or animal species have been observed on CNS-1 property (NPPD, 2008).

Forty-nine of the protected species inhabit Nemaha County, Nebraska, the location of CNS-1, including 15 species of mammals, birds, reptiles, and amphibians, and 34 species of plants (Table 2.2.7-1). Nebraska lists two mammals, the southern flying squirrel (*Glaucomus volans*) as threatened and the woodland vole (*Microtus pinetorum*) as a species of concern. Both species occur in Nemaha County. Six bird species protected by Nebraska that occur in Nemaha County include the ruffed grouse (*Bonasa umbellus*), the whip-poor-will (*Caprimulgus vociferous*), the peregrine falcon (*Falco peregrinus*), the barred owl (*Strix varia*), the blue-gray gnatcatcher (*Polioptila caerula*), and the Carolina wren (*Thryothorus ludovicianus*) (NatureServe, 2009e; NGPC, 2009c). The peregrine falcon was once a Federally-listed species, but was delisted in 1999. The bald eagle (*Haliaeetus leucocephalus*), an S3 designation, has been observed on both sides of the Missouri River on CNS-1 property. The bald eagle was likewise a listed species, but was delisted in 2007. Both the peregrine falcon and the bald eagle are protected under the Migratory Bird Treaty Act, and the bald eagle is also protected under the Bald and Golden Eagle Protection Act. There is an active bald eagle nest adjacent to a field on the Missouri side of the CNS-1 property. Six Nebraska State protected reptiles and one amphibian known to inhabit Nemaha County include the western wormsnake (*Carphophis vermis*), the yellow-bellied kingsnake (*Lampropeltis calligaster*), the common kingsnake (*Lampropeltis getula*), the smooth green snake (*Liochlorophis vernalis*), Graham's crayfish snake (*Regina grahamii*), the Massasauga rattlesnake (*Sistrurus catenatus*), and the smallmouth salamander (*Ambystoma texanum*) (NatureServe, 2009e, NGPC, 2009c).

Nebraska lists 27 animal species and 39 plant species that are protected and occur or potentially occur in the counties traversed by the transmission line. Species listed as endangered by Nebraska that occur or potentially occur in the counties traversed by the transmission line corridor include the whooping crane, interior least tern, Salt Creek tiger beetle, American burying beetle (*Nicrophorus americanus*), Eskimo curlew, and black-footed ferret. Species listed as threatened by Nebraska that occur or potentially occur in the counties traversed by the transmission line corridor include the Massasagua rattlesnake, the piping plover, and the river otter (*Lontra canadensus*) (NatureServe, 2009e; NGPC, 2009c).

The 37 protected species in Atchison, County, Missouri (the eastern portion of the CNS-1 site), include 16 species of mammals, birds, reptiles, amphibians, and insects, and 21 species of plants. Two mammals that potentially occur on the CNS-1 site in Missouri include the State endangered Indiana bat (*Myotis sodalis*) and the plains spotted skunk (*Spilogale putorius interrupta*). Other State protected mammals include the plains pocket mouse (*Perognathus flavescens*) and Franklin's ground squirrel (*Spermophilus franklinii*). Five bird species protected by Missouri also are in Atchison County, and include the peregrine falcon, the loggerhead shrike (*Lanius ludovicianus*), the black rail (*Laterallus jamaicensis*), the king rail (*Rallus elegans*), and the interior least tern. Four reptiles protected by Missouri and known to inhabit Atchison County are the western fox snake (*Elaphe vulpine*), the smooth green snake, the Massasauga rattlesnake, listed as State endangered, and the Great Plains skink (*Eumeces obsoletus*). One amphibian protected by Missouri and known to inhabit Atchison County is the northern leopard frog (*Rana pipiens*). Two insect species are protected by Missouri and found in Atchison, County, and include Packard's grasshopper (*Melanoplus packardii*), and the American burying beetle. The western prairie-fringed orchid is State listed as endangered (MDC 2009b, 2009c; NatureServe 2009d).

2.2.8 Socioeconomic Factors

This section describes current socioeconomic factors that have the potential to be directly or indirectly affected by changes in operations at the CNS-1. The CNS-1 and the people and communities surrounding it can be described as a dynamic socioeconomic system. The nuclear power plant requires people, goods, and services from local communities to operate the plant; and the communities, in turn, provide the people, goods, and services to run the plant. CNS-1 employees residing in the community receive income from the plant in the form of wages, salaries, and benefits, and spend this income on goods and services within the community, thereby creating additional opportunities for employment and income. People and businesses in the community also receive income for the goods and services sold to CNS-1. Payments for these goods and services create additional employment and income opportunities in the community. The measure of a communities' ability to support the operational demands of CNS-1 depends on the ability of the community to respond to changing socioeconomic conditions.

The socioeconomics region of influence (ROI) is defined by the areas where CNS-1 employees and their families reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. The CNS-1 ROI consists of a four-county area (Nemaha, Otoe, and Richardson counties in Nebraska and Atchison County in Missouri) where approximately 90 percent of CNS-1 employees reside. The following sections describe the housing, public services, offsite land use, visual aesthetics and noise, population demography, and the economy in the ROI surrounding CNS-1.

NPPD employs a permanent workforce of approximately 750 employees (NPPD, 2008). Approximately 90 percent live in Nemaha, Otoe, and Richardson counties, Nebraska, and Atchison County, Missouri (Table 2.2.8-1). Most of the remaining 10 percent of the workforce are divided among 23 counties in Iowa, Kansas, Missouri, and Nebraska with numbers ranging from 1 to 13 employees per county. Given the residential locations of CNS-1 employees, the most significant impacts of plant operations are likely to occur in Nemaha, Otoe, Richardson, and Atchison counties. The focus of the socioeconomic impact analysis in this supplemental environmental impact statement (SEIS) is therefore on the impacts of the CNS-1 on these four counties.

Table 2.2.8-1. Cooper Nuclear Station, Unit 1 Employee Residence by County

County	Number of Employees	Percentage of Total
Nemaha, NE	359	48
Otoe, NE	108	14
Atchison, MO	106	14
Richardson, NE	100	13
Fremont, IA	13	2
Holt, MO	12	2
Cass, NE	11	2
Other	41	5
Total	750	100

Source: NPPD, 2008a

Refueling outages at the CNS-1 normally occur at 18-month intervals. During refueling outages, site employment increases by as many as 700 to 900 workers for approximately 30 days (NPPD, 2008). Most of these workers are assumed to be located in the same geographic areas as CNS-1 employees.

2.2.8.1 *Housing*

Table 2.2.8.1-1 lists the total number of occupied and vacant housing units, vacancy rates, and median value in the four-county ROI. According to the 2000 Census, there were approximately 17,700 housing units in the socioeconomic region, of which approximately 15,800 were occupied. The median value of owner-occupied housing units in the three Nebraska counties ranged from $38,900 in Richardson County to $78,000 in Otoe County. The vacancy rate was the lowest in Otoe County (7.7 percent) and highest in Richardson County (12.4 percent). Atchison County, Missouri, has the smallest number of total and vacant housing units among the four counties (USCB, 2009).

By 2007, the estimated number of housing units grew in all three counties by approximately 3 percent of their total inventories. In Nemaha County the number of housing units grew to an estimated total of 3,540 units in 2007, an increase of more than 100 units. In Otoe County the number of housing units grew by more than 390 units to an estimated total of 6,955 units or approximately 6 percent. The estimated total number of housing units also increased slightly in Atchison County, Missouri (USCB, 2009).

Table 2.2.8.1-1. Housing in Nemaha, Otoe, and Richardson Counties in Nebraska and Atchison County in Missouri

	Nemaha	Otoe	Richardson	Atchison	ROI
2000					
Total	3,439	6,567	4,560	3,103	17,669
Occupied housing units	3,047	6,060	3,993	2,722	15,822
Vacant units	392	507	567	381	1,847
Vacancy rate (percent)	11.4	7.7	12.4	12.3	10.5
Median value (dollars)	58,200	78,000	38,900	49,800	56,225
2007*					
Total	3,540	6,955	4,563	3,129	18,187

* Estimated occupied housing units, vacancy, and median value data is not available for all counties.

Source: USCB, 2009a.

2.2.8.2 *Public Services*

This section presents information regarding public services including water supply, education, and transportation.

<u>Water Supply</u>

Because 90 percent of workers at CNS-1 reside in Nemaha, Otoe, and Richardson counties, Nebraska and Atchison County, Missouri, the discussion of public water supply systems is limited to these counties. In Table 2.2.8.2-1, information about municipal water suppliers in these counties, their permitted capacities and/or maximum design yields, reported annual peak usage, and population served are presented. The primary source of potable water in the vicinity of the CNS-1 is ground water. Most of Nemaha, Atchison, and Richardson counties are not served by community water supplies. Private ground water wells supply much of the water to residents in the area.

There are four wellhead protection areas within 10 miles of CNS-1: Village of Nemaha, Nemaha County Rural Water District (RWD) No. 1, City of Auburn, and Village of Stella. CNS-1 does not use public water systems for cooling or process water systems. NPPD relies on ground water wells and surface water from the Missouri River for all of its water needs at the CNS-1. Two wells supply potable water to the facility (NPPD, 2008).

Community water supply systems in Nemaha County include the City of Auburn, the City of Nemaha, Nemaha County RWD No. 1, Nemaha County RWD No. 2, and the City of Peru. The Village of Brownville no longer uses its own supply wells, but is connected to Nemaha County RWD No. 1 (NPPD, 2008). The Auburn Board of Public Works operates the Auburn Municipal Water System. Eleven wells can provide up to 1,728,000 gallons of water per day. The system provides an average of 700,000 gallons of water per day and can meet a peak demand of

1,181,700 gallons per day. The system has a storage capacity of 1,650,000 gallons (NDED and NPPD, 2008a). The Nemaha municipal water system serves the Village of Nemaha and provides an average of 17,500 gallons of water per day and can meet a peek demand of 30,000 gallons per day. The system has a rated capacity of 216,000 gallons per day (NPPD, 2008).

Nemaha County RWD No. 1 has a rated capacity of 100,000 gallons per day with a peak demand of 90,000 gallons per day. The Nemaha County RWD No. 1 public water system serves rural Nemaha County including the Village of Brownville. Nemaha County RWD No. 2 has an average service demand of 206,300 gallons per day. The storage capacity is reported to be 230,000 gallons (NPPD, 2008).

The Peru Municipal Water System serves the municipality of Peru in Nemaha County. The Peru system has a rated capacity of 576,000 gallons per day with an average of 83,000 gallons and a peak demand of 113,500 gallons per day (NPPD, 2008).

Nebraska City Utilities provides water to the residents of Nebraska City in Otoe County. This water system has a rated capacity of 6,300,000 gallons per day with an average of 2,500,000 gallons and a peak demand of 3,500,000 gallons per day (Great Plains Energy, 2009).

Falls City provides water to approximately 4,800 residents in Richardson County. The water system has a rated capacity of 2,160,000 gallons per day with an average of 690,000 gallons and a peak demand of 1,528,000 gallons per day (Great Plains Energy, 2009).

Richardson County RWD No. 1 and the Village of Shubert have community water systems within ten miles of CNS-1. Richardson County RWD No. 1 system has a capacity of 230,000 gallons per day with an average demand of 100,000 gallons per day. The Village of Shubert operates a municipal water system with a capacity of 204,000 gallons per day, with an average daily demand of 22,800 gallons (NPPD, 2008).

Almost all potable water use within Atchison County is from ground water supplied from wells, with the exception of Westboro, Missouri which purchases water from a surface water source. The Rock Port Municipal Water System on average supplies approximately 300,000 gallons per day with a system capacity of approximately 720,000 gallons per day (MDNR, 2008).

Table 2.2.8.2–1. Public Water Supply Systems (thousand gallons per day)

Water Supplier [a]	Water Source [a]	Average Daily Demand	System Capacity	Population Served [a]
Nemaha County, Nebraska				
City of Auburn	GW	1,182	1,728	3,217
Village of Nemaha	GW	30	216	188
City of Peru	GW	114	576	923
Nemaha County RWD No. 1	GW	90	100	800
Nemaha County RWD No. 2	GW	206	230	1,315
Otoe County, Nebraska				
City of Nebraska	GW	2,500	6,300	7,192
Richardson County, Nebraska				
City of Falls City	GW	690	2,160	4,761
Richardson County RWD No. 1	GW	100	230	805
Village of Shubert	GW	23	204	240
Atchison County, Missouri				
Fairfax	GW	185	308	645
Public Water System District No. 1 of Atchison County	GW	171	1,310	831
City of Rock Port	GW	300	720	726
Tarkio Board of Public Works	GW	225	756	1,957
Westboro	SW	20	75	160

GW = ground water; SW = surface water; RWD = rural water district

[a] EPA, 2009b

Source: EPA, 2009b;Nebraska Department of Economic Development (NDED and NPPD, 2008a; NPPD, 2008a; Great Plains Energy, 2009; MDNR, 2008.

Education

The CNS-1 is located in the Auburn Public School District, Nemaha County, which has an enrollment of approximately 882 students in the 2008–2009 school year (Nebraska Department of Education (NDE, 2009). Nemaha County has 2 public school districts with over 1,100 enrolled students (NDE, 2009). Otoe and Richardson counties have 4 school districts each (NDE, 2008). Total enrollment in Otoe and Richardson County schools in the 2008–2009 school year was approximately 2,900 and 1,600 students, respectively (NDE, 2009).

Transportation

Several highways serve as transportation corridors within Nemaha and Atchison counties. The primary highways in Nemaha County include U.S. Highways 75 and 136 and Nebraska State Highways 62, 67, and 105. Access to the site is by Nemaha County Road 648A Avenue located on the west side of CNS-1 property. County Road 648A Avenue intersects US Highway 136 which runs east to west, north of CNS-1 at Brownville, Nebraska. State Highway 67 traverses Nemaha County north to south to the west of CNS-1. U.S. Highway 75 bisects Nemaha County running north to south. Plant workers living east and west of CNS-1 travel on U.S. Highway 136 to Nemaha County Road 648A Avenue to the site access road, and workers living north and south travel on U.S. Highway 75 and Nebraska State Highway 67 to U.S. Highway 136.

The primary highways in Atchison County, Missouri on the east side of the Missouri River include Interstate 29 (I-29), U.S. Highways 136, 59, and 275, Missouri State Highways 46 and 111, and County Roads B, M, and T. I-29 runs north to south through Atchison County roughly parallel to the river between Council Bluffs, Iowa northeast of CNS-1 and St. Joseph, Missouri, southeast of CNS-1. CNS-1 employees who reside in Missouri can access the site by using either U.S. Highways 136 or 159, which cross the Missouri River at Brownville and Rulo, Nebraska (in Richardson County), respectively. U.S. Highway 136 bisects Atchison County east to west in Missouri, similar to Nemaha County on the west side of the river. Atchison County is also bisected by U.S. Highway 59 which runs north to south through the central portion of the county.

Primary highways in Richardson County include U.S. Highways 73, 75, and 159 and State Highways 8, 62, 67, and 105. U.S. Highway 75 runs north and south through both Nemaha and Richardson counties. U.S. Highway 159 crosses the river downstream of CNS-1 at Rulo, Nebraska, from Holt County, Missouri.

The primary highways in Otoe County include U.S. Highways 50 and 75 and Nebraska State Highways 2, 43, 66A, 67, and 128. Otoe County is bisected north to south by U.S. Highway 50 and Nebraska State Highway 2. Access to Otoe County directly from CNS-1 is primarily from Nebraska State Highway 67 and U.S. Highway 75.

Table 2.2.8.2–2 lists commuting routes to CNS-1 and average annual daily traffic (AADT) volume values. The AADT values represent traffic volumes for a 24-hour period factored by both day of week and month of year.

Table 2.2.8.2-2. Major Commuting Routes in the Vicinity of Cooper Nuclear Station, Unit 1 in 2006 Average Annual Daily Traffic Count

Roadway and Location	Average Annual Daily Traffic (AADT) [a]
U.S. Highway 136 (between State Highway 67 and Brownville, NE)	2,905
U.S. Highway 136 (between Brownville, NE and Missouri River)	2,615
U.S. Highway 136 (between Interstate 29 and the Missouri River in Missouri)	2,487
U.S. Highway 136 at Rock Port, MO	3,194
U.S. Highway 136 (between Auburn, NE and State Highway 67)	3,205
State Highway 67 (between Nemaha, NE and Brownville, NE	960
State Highway 67 at Nemaha, NE	770
State Highway 67 south of CNS-1	625
State Highway 67 at Peru, NE	1,025
U.S. Highway 75 (between State Highway 67 and U.S. Highway 136, Auburn, NE)	5,220
U.S. Highway 75 (near Julian, NE)	4,640
U.S. Highway 75 (south of Nebraska City, NE)	5,585
Interstate 29 north of U.S. Highway 136 in Missouri	10,325
Interstate 29 south of U.S. Highway 136 in Missouri	11,832

Source: NDOR, 2007; MOBOT, 2007.

[a] All AADTs represent traffic volume during the average 24-hour day during 2006.

U.S.=United States

2.2.8.3 *Offsite Land Use*

Offsite land use conditions in Nemaha County, Otoe County, Richardson County, and Atchinson County, are described in this section. In addition to property taxes, Nemaha and other counties in the vicinity of CNS-1 receive revenue from sales taxes and fees paid by NPPD and its employees residing in the region. Changes in the number of workers at CNS-1 and tax payments to local jurisdictions could affect land use conditions in these counties.

CNS-1 is located in eastern Nemaha County. Otoe, Richardson, and Atchison counties are located along the Missouri River, north, south, and east of Nemaha County, respectively. The four-county area near CNS-1 is rural and largely unincorporated. Less than half of the population in the four-county area lives in incorporated towns and villages. Most of the land in the four-county area is in agricultural use or is forest or open land. Only a small percentage of the land has been developed for residential, commercial, or industrial purposes. Forested areas are generally limited to narrow strips of land along streams and rivers and steep, hilly areas unsuitable for agriculture.

Nemaha, Richardson, and Atchison counties have seen a steady decline in population over the past 50 years as residents leave farms to seek employment in larger cities and towns. Most towns and villages located within a 50-mile radius of CNS-1 are small and primarily support agricultural communities. The closest communities to CNS-1 are the Village of Brownville, located approximately two miles northwest of CNS-1 and the town of Nemaha to the south. Industrial developments in the four-county area are located in the larger communities of Auburn and Nebraska City, Nebraska, and Marysville, Missouri.

Nemaha County occupies approximately 409 square miles (262,000 ac) (USCB, 2009c). Approximately 213,000 acres or 81 percent of the land in Nemaha County was used for agriculturally related activities in 2007. There were 449 farms, with most of the agricultural land devoted to cropland (80 percent) and pasture (12 percent) (USDA, 2009). Nemaha County does not have county-wide zoning regulations although the city of Auburn has local zoning regulations (NPPD, 2008).

Otoe County occupies roughly 616 square miles (394,000 ac) (USCB, 2009c). The largest category of land use, approximately 322,000 acres or 82 percent, is devoted to agriculture in Otoe County, with 804 farms in 2007. Approximately 80 percent of the agricultural land is in cropland and approximately 11 percent pasture (USDA, 2009). Otoe County has county-wide zoning regulations to manage future growth and development in the county.

Richardson County occupies roughly 553 square miles (354,000 ac) (USCB, 2009c). The largest category of land use, approximately 279,000 acres or 79 percent, is devoted to agriculture in Richardson County, with 707 farms in 2007. Approximately 75 percent of the agricultural land is cropland and approximately 14 percent, pasture (USDA, 2009). Richardson County does not have county-wide zoning regulations although the City of Falls city has local zoning regulations (NPPD, 2008).

Atchison County, Missouri occupies approximately 545 square miles (349,000 ac) (USCB, 2009c). Approximately 87 percent of Atchison County land is used for agricultural purposes. In 2007, the county had 501 farms on approximately 304,000 acres. Major agricultural uses consist of croplands (87 percent) and 6 percent pasture (USDA, 2009). Atchison County currently does not have county-wide zoning regulations to manage future growth and development (NPPD, 2008).

No significant change in land use is anticipated for the future in these four counties. Land use trends reflect a slow, but steady overall decline in population in the region. Limited potential commercial and urban development occurs in the small urban areas where public services and utilities are available. No significant changes in future agricultural acreage, farm size, and land uses are anticipated for the four-county region near CNS-1.

2.2.8.4 *Visual Aesthetics and Noise*

CNS-1 can be seen from the river, but is partly shielded by vegetation along the river. Predominant features are the reactor building, which is approximately 290 feet tall, the elevated release point (325 feet) and meteorological tower (328.8 feet). The turbine building and reactor containment structures dominate the landscape of the site. The 239 undeveloped acres of CNS-1 site on the Missouri (east) side of the river provides a wooded view from the river.

Noise from nuclear plant operations can be detected offsite. Sources of noise at CNS-1 include the turbines and large pump motors. Given the industrial nature of the station, noise emissions from the station are generally nothing more than an intermittent minor nuisance. However, noise levels may sometimes exceed the 55 dBA level that the EPA uses as a threshold level to protect against excess noise during outdoor activities (EPA, 1974). However, according to the EPA this threshold does “not constitute a standard, specification, or regulation,” but was intended to provide a basis for State and local governments establishing noise standards.

2.2.8.5 *Demography*

According to the 2000 Census, approximately 18,318 people lived within 20 miles of CNS-1, which equates to a population density of 15 persons per square mile (NPPD, 2008). This density translates to Category 1, Most sparse (less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles). Approximately 160,211 people live within 50 miles of CNS-1 (NPPD, 2008). This equates to a population density of 20 persons per square mile. Applying the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants* NUREG-1437 proximity measures, CNS-1 is classified as proximity Category 1 (no city with 100,000 or more persons and less than 50 persons per square mile within 50 miles). Therefore, according to the sparseness and proximity matrix presented in the GEIS, CNS-1 rankings of sparseness Category 1 and proximity Category 1 result in the conclusion that CNS-1 is located in a low population area.

Table 2.2.8.5-1 shows population projections and growth rates from 1970 to 2050 in Nemaha, Otoe, and Richardson County, Nebraska, and Atchison County, Missouri. The growth rate in Nemaha County showed a decrease of 5.1 percent for the period of 1990 to 2000. County populations are expected to continue to decline in Nemaha, Richardson, and Atchison counties in the next decades although Otoe County’s population is expected to increase through 2050.

Table 2.2.8.5-1. Population and Percent Growth in Nemaha, Otoe, and Richardson County, Nebraska, and Atchison County, Missouri, from 1970 to 2000 and projected for 2006 to 2050

Year	Nemaha, NE		Otoe, NE		Richardson, NE		Atchison, MO	
	Population	Percent Growth[a]	Population	Percent Growth[a]	Population	Percent Growth[a]	Population	Percent Growth[a]
1970	8,976	—	15,576	—	12,277	—	9,240	—
1980	8,367	-6.8	15,183	-2.5	11,315	-7.8	8,605	-6.9
1990	7,980	-4.6	14,252	-6.1	9,937	-12.2	7,457	-13.3
2000	7,576	-5.1	15,396	8.0	9,531	-4.1	6,430	-13.8
2007	***7,039***	***-7.1***	***15,647***	***1.6***	***8,351***	***-12.4***	***6,108***	***-5.0***
2010	6,767	-10.7	15,704	2.0	8,408	-11.8	5,927	-7.8
2020	6,456	-4.6	16,399	4.4	7,892	-6.1	5,559	-6.2
2030	6,033	-6.6	17,414	6.2	7,398	-6.3	5,280	-5.0
2040	5,685	-5.8	18,216	4.6	6,889	-6.9	4,942	-6.4
2050	5,318	-6.5	19,071	4.7	6,384	-7.3	4,618	-6.5

— = No data available.

[a]Percent growth rate is calculated over the previous decade.

Sources: Population data for 1970 through estimated population data for 2006 (USCB, 2009); population projections for 2010–2030 by Bureau of Business Research (BBR), University of Nebraska-Lincoln, Nebraska Population Projections (2008) and Missouri State Demographer, Office of Administration, No Date; population projections for 2040 and 2050 (calculated).

Demographic Profile

The 2000 and 2006 (estimate) demographic profiles of the four-county ROI population is presented in Table 2.2.8.5-2 and Table 2.2.8.5-3. In 2000, minorities (race and ethnicity combined) comprised 3.8 percent of the total four-county population. The minority population is composed of Hispanic or Latino and American Indian residents.

Table 2.2.8.5-2. Demographic Profile of the Population in the Cooper Nuclear Station Unit 1 Four-County Socioeconomic Region of Influence in 2000

	Nemaha, NE	Otoe, NE	Richardson, NE	Atchison, MO	Region of Influence
Total Population	7,576	15,396	9,531	6,430	38,933
Race (percent of total population, Not-Hispanic or Latino)					
White	97.1	96.3	95.1	96.6	96.2
Black or African American	0.4	0.2	0.2	2.1	0.5
American Indian and Alaska Native	0.2	0.2	2.1	0.2	0.7
Asian	0.6	0.2	0.1	0.1	0.3
Native Hawaiian and Other Pacific Islander	0.0	0.0	0.0	0.0	0.0
Some other race	0.0	0.0	0.0	0.0	0.0
Two or more races	0.6	0.6	1.4	0.3	0.7
Ethnicity					
Hispanic or Latino	76	377	100	43	596
Percent of total population	1.0	2.4	1.0	0.7	1.5
Minority Population (including Hispanic or Latino ethnicity)					
Total minority population	218	574	469	219	1,480
Percent minority	2.9	3.7	4.9	3.4	3.8

Source: USCB, 2009

According to the USCB's 2007 estimates published in 2009, minority populations in the four-county region were estimated to have increased by over 500 persons and comprised 5.4 percent of the total four county population (see Table 2.2.8.5-3). Most of this increase was due to an estimated influx of Hispanic or Latinos (over 320 persons), an increase in population of over 55 percent from 2000. This was the largest percentage increase of any minority population and a one percent increase in Hispanic or Latino population when compared to the total four-county population. The next highest percentage increase in minority population was Asian, an increase of over 51 percent from 2000. However, this resulted in only a very slight increase in population as a percentage of the total four-county population.

Table 2.2.8.5-3. Demographic Profile of the Population in the Cooper Nuclear Station Four-County Socioeconomic Region of Influence in 2007, Estimated

	Nemaha, NE	Otoe, NE	Richardson, NE	Atchison, MO	Region of Influence
Total Population	7,039	15,647	8,351	6,108	37,145
Race (percent of total population, not Hispanic or Latino)					
White	95.9	94.1	93.9	95.6	94.6
Black or African American	0.6	0.5	0.3	2.3	0.7
American Indian and Alaska Native	0.3	0.4	2.6	0.3	0.9
Asian	0.8	0.3	0.5	0.3	0.4
Native Hawaiian and Other Pacific Islander	0.0	0.0	0.0	0.0	0.0
Some other race	*	*	*	*	*
Two or more races	0.6	0.8	1.4	0.3	0.8
Ethnicity					
Hispanic or Latino	126	612	111	73	922
Percent of total population	1.8	3.9	1.3	1.2	2.5
Minority Population (including Hispanic or Latino ethnicity)					
Total minority population	288	930	506	269	1,993
Percent minority	4.1	5.9	6.1	4.4	5.4

* Some other race was eliminated from the Census estimate.

Source: USCB, 2009

<u>Transient Population</u>

Within 50 miles (80 km) of the CNS-1, colleges and recreational opportunities attract daily and seasonal visitors who create demand for temporary housing and services. In 2009, there were approximately 8,018 students attending colleges and universities within 50 miles (80 km) of the CNS-1 (IES, 2009).

In 2000 in Nemaha County, 1.6 percent of all housing units are considered temporary housing for seasonal, recreational, or occasional use. By comparison, seasonal housing accounted for 0.6 percent, 1.3 percent, and 1.6 percent of total housing units in Otoe and Richardson counties and Nebraska, respectively (USCB, 2009). Seasonal housing accounted for 1.2 percent and 2.7 percent of total housing units in Atchison County and Missouri, respectively (USCB, 2009). Table 2.2.8.5-4 provides information on seasonal housing for the 24 counties located all or partly within 50 miles of the CNS-1.

Table 2.2.8.5-4. Seasonal Housing in Counties Located within 50 Miles of the Cooper Nuclear Station, Unit 1

County [a]	Housing units	Vacant housing units: For seasonal, recreational, or occasional use	Percent	
Iowa	1,232,511	16,472	1.3	
Fremont	3,514	56	1.6	
Mills	5,671	64	1.1	
Montgomery	5,399	38	0.7	
Page	7,302	47	0.6	
Taylor	3,199	19	0.6	
County Subtotal	25,085	224	0.9	(avg.)
Kansas	1,131,200	9,639	0.9	
Atchison	6,818	47	0.7	
Brown	4,815	36	0.7	
Doniphan	3,489	28	0.8	
Jackson	5,094	42	0.8	
Marshall	4,999	46	0.9	
Nemaha	4,340	35	0.8	
County Subtotal	29,555	234	0.8	(avg.)
Missouri	2,442,017	66,053	2.7	
Andrew	6,662	58	0.9	
Atchison	3,103	38	1.2	
Holt	2,931	391	13.3	
Nodaway	8,909	60	0.7	
County Subtotal	21,605	547	4.0	(avg.)
Nebraska	722,668	11,912	1.6	
Cass	10,179	541	5.3	
Gage	10,030	56	0.6	
Johnson	2,116	14	0.7	
Lancaster	104,217	303	0.3	
Nemaha	3,439	56	1.6	
Otoe	6,567	37	0.6	
Pawnee	1,587	78	4.9	
Richardson	4,560	59	1.3	
Sarpy	44,981	211	0.5	
County Subtotal	187,676	1,355	1.7	(avg.)
County Total	263,921	2,360	1.2	(avg.)

Source: USCB, 2009

[a] Counties within 50 miles of the CNS-1 that are totally or partially located within the 50-mile radius.

avg. = percent average for counties within the CNS-1 50-mile radius and excludes State percentage.

Migrant Farm Workers

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence. Some migrant workers follow the harvesting of crops, particularly fruit, throughout rural areas of the United States. Others may be permanent residents near the CNS-1 who travel from farm to farm harvesting crops.

Migrant workers may be members of minority or low-income populations. Because they travel and can spend a significant amount of time in an area without being actual residents, migrant workers may be unavailable for counting by census takers. If uncounted, these workers would be "underrepresented" in USCB minority and low-income population counts.

Information on migrant farm and temporary labor was collected in the 2007 Census of Agriculture. Table 2.2.8.5-5 provides information on migrant farm workers and temporary farm labor (less than 150 days) within 50 miles of the CNS-1. According to the 2007 Census of Agriculture, approximately 7,000 farm workers were hired to work for less than 150 days and were employed on 3,300 farms within 50 miles of the CNS-1. The county with the largest number of temporary farm workers (774 workers on 280 farms) was Lancaster County, Nebraska (USDA, 2009).

In the 2007 Census of Agriculture, farm operators were asked for the first time whether or not any hired migrant workers, defined as a farm worker whose employment required travel that prevented the migrant worker from returning to their permanent place of residence the same day. A total of 87 farms in the 50-mile radius of the CNS-1 reported hiring migrant workers in the 2007 Census of Agriculture. Nodaway County, Missouri, and Lancaster County, Nebraska reported the most farms (18 and 17, respectively) with hired migrant workers, followed by Nemaha County, Nebraska with 10 farms (USDA, 2009).

According to the 2007 Census of Agriculture estimates, 195 temporary farm laborers (those working fewer than 150 days per year) were employed on 84 farms in Nemaha County, and 311 and 323 temporary farm workers were employed on 145 and 143 farms in Otoe and Richardson counties, respectively (USDA, 2009). Atchison County, Missouri, had 226 temporary farm workers employed on 99 farms (USDA, 2009).

Table 2.2.8.5-5. Migrant Farm Workers and Temporary Farm Labor in Counties Located within 50 Miles of the Cooper Nuclear Station, Unit 1

County [a]	Number of farms with hired farm labor [b]	Number of farms hiring workers for less than 150 days [b]	Number of farm workers working for less than 150 days [b]	Number of farms reporting migrant farm labor [b]
Iowa	23,287	19,204	50,266	123
Fremont	126	95	247	2
Mills	91	70	NA	0
Montgomery	118	100	187	0
Page	189	158	276	0
Taylor	134	103	259	1
County Subtotal	658	526	969	3
Kansas	14,437	11,558	30,682	193
Atchison	115	105	231	0
Brown	171	142	333	3
Doniphan	130	108	211	0
Jackson	145	128	319	2
Marshall	246	209	498	3
Nemaha	289	250	584	10
County Subtotal	1,096	942	2,176	18
Missouri	18,263	15,052	33,424	745
Andrew	134	113	258	2
Atchison	134	99	226	2
Holt	136	105	214	1
Nodaway	308	251	472	18
County Subtotal	712	568	1,170	23
Nebraska	14,603	11,261	29,583	468
Cass	148	119	273	4
Gage	322	272	585	7
Johnson	120	105	NA	5
Lancaster	310	280	774	17
Nemaha	107	84	195	3
Otoe	175	145	311	2
Pawnee	91	83	NA	0
Richardson	164	143	323	3
Sarpy	87	69	218	2
County Subtotal	1,524	1,300	2,679	43
County Total	3,990	3,336	6,994	87

Source: 2007 Census of Agriculture - County Data (USDA, 2009)

[a] Counties within 50 miles of the CNS-1 that are totally or partially located within the 50-mile radius

[b] Table 7. Hired Farm Labor - Workers and Payroll: 2007

2.2.8.6 *Economy*

This section contains a discussion of the economy, including employment and income, unemployment, and taxes.

Employment and Income

Between 2000 and 2007, the civilian labor force in Nemaha County decreased 9.4 percent from 3,931 to 3,560. During the same time period, the civilian labor force in Otoe County grew by 13 percent. By 2007, the civilian labor force in Richardson and Atchison counties decreased by 6.3 and 2.4 percent, respectively (USCB, 2009).

In 2000, educational, health, and social services represented the largest sector of employment in the four-county region followed by manufacturing. The educational, health, and social services sector employed the most people in Nemaha County followed by transportation, warehousing, and utilities sectors. A list of some of the major employers in Nemaha County is provided in Table 2.2.8.6-1. As shown in the table, the largest employer in Nemaha County is the CNS-1.

Table 2.2.8.6-1. Major Employers in Nemaha County

Firm	Number of Employees
Cooper Nuclear Station	750
Armstrong Cabinets	162
Peru State College	160
Auburn Public Schools	142
Nemaha County Good Samaritan Home	75
Magnolia Metals, Inc.	65
Nemaha County Hospital	65
Nemaha County Government	48
Johnson-Brock Public Schools	44

Source: NDE, 2009 and NPPD, 2009

Estimated income information for the CNS-1 region of influence is presented in Table 2.2.8.6-2. According to the USCB's 2007 estimates, median household income averages in Nemaha, Otoe, Richardson, and Atchison counties were below their respective State median household income averages. In 1999, per capita income in the four counties was also below both State averages. In 2007, an estimated 13.3 and 13.4 percent of the county populations in Nemaha and Richardson counties were living below the official poverty level, while the percentage for the State of Nebraska as a whole was 11.1 percent. Conversely, Otoe County was estimated to have the smallest percentage of persons living in poverty (9.4 percent). In Atchison County an estimated 14.0 percent of the county population was living below the official poverty level, while the percentage for the State of Missouri as a whole was 13.3 percent.

Table 2.2.8.6-2. Estimated Income Information for the Cooper Nuclear Station Region of Influence in 2007

	Nemaha	Otoe	Richardson	Nebraska	Atchison	Missouri
Median household income (dollars)	41,024	45,018	36,092	47,072	38,114	45,012
Per capita income in 1999 (dollars)	17,004	17,752	16,460	19,613	16,956	19,936
Percent of individuals living below the poverty level	13.3	9.4	13.4	11.1	14.0	13.3

Source: USCB 2009

Unemployment

According to the USCB's 2007 estimates, the unemployment rates in Nemaha, Otoe, and Richardson counties were 3.9, 3.0 and 4.0 percent, respectively, which was slightly lower than the unemployment rate of 4.8 percent for the State of Nebraska (USCB, 2009). The unemployment rate in Atchison County was 4.3 percent, which was much lower than the 6.5 percent for the State of Missouri (USCB, 2009).

Taxes

As a not-for-profit public corporation and political subdivision of the State of Nebraska, NPPD is exempt from paying income or property taxes. Instead, in lieu of tax, other payments are made to State, county, and local governments in which NPPD provides retail electric power.

According to the Nebraska State Constitution Article VIII, Section 11:

> Every public corporation and political subdivision organized primarily to provide electricity or irrigation and electricity shall annually make the same payments in lieu of taxes as it made in 1957, which payments shall be allocated in the same proportion to the same public bodies or their successors as they were in 1957.
>
> The legislature may require each such public corporation to pay to the treasurer of any county in which may be located any incorporated city or village, within the limits of which such public corporation sells electricity at retail, a sum equivalent to five (5) per cent of the annual gross revenue of such public corporation derived from retail sales of electricity within such city or village, less an amount equivalent to the 1957 payments in lieu of taxes made by such public corporation with respect to property or operations in any such city or village. The payments in lieu of taxes as made in 1957, together with any payments made as authorized in this section shall be in lieu of all other taxes, payments in lieu of taxes, franchise payments, occupation and excise taxes, but shall not be in lieu of motor vehicle licenses and wheel taxes, permit fees, gasoline tax and other such excise taxes or general sales taxes levied against the public generally.
>
> So much of such five percent as is in excess of an amount equivalent to the amount paid by such public corporation in lieu of taxes in 1957 shall be distributed in each year to the city or village, the school districts located in such city or village, the county in which such city or village is located, and the State of Nebraska, in the proportion that their respective property tax mill levies in each such year bear to the total of such mill levies (Neb. Const. art. VIII, sec. 11 (1958); Adopted 1958,).

NPPD is Nebraska's largest electric utility, with a chartered territory including all or parts of 91 of Nebraska's 93 counties. NPPD pays monies in lieu of property taxes to the counties in which it provides retail electric power. As part of NPPD's generation capacity, a portion of the in lieu of tax payments and payments to retail communities may be attributed to CNS-1.

NPPD paid approximately $6.6 million in 2006 and $7.0 million in 2007 in lieu of taxes to the 91 counties in which NPPD is chartered (NPPD, 2008). Each county receives 5 percent of the total gross revenues NPPD receives from electricity sales within the county. The actual in lieu of tax allocation attributable to CNS-1 is not recorded by NPPD. NPPD's power generation units provide power to the grid, and county retail sales are then from the grid. However, CNS-1 represents approximately 24 percent of NPPD's power generation capacity. Based on 24 percent generation, the payments in lieu of tax that could be attributed to CNS-1 were approximately $1.6 million in 2006 and $1.7 million in 2007 (see Table 2.2.8.6-3).

NPPD also pays back 12 percent of the total gross revenues received from retail communities, which amounted to approximately $17.5 million in 2006 and $18.3 million in 2007 (NPPD, 2008). Based on 24 percent of NPPD's total generation capacity, CNS-1's contribution to retail communities was $4.2 million in 2006 and $4.4 million in 2007 (see Table 2.2.8.6-3).

Since NPPD's charter is to provide electricity to customers throughout the State, these payments would continue regardless of whether or not the CNS-1 is operating.

NPPD pays sales/use taxes on purchases made by CNS-1. As shown in Table 2.2.8.6-3, CNS 1 paid $943,020 in sales/use taxes in 2007; $1,353,435 in 2006. City sales taxes are paid to the town of Auburn, Nebraska. NPPD also pays a special assessment for the Brownville-Nemaha Levee District that is paid to the county treasurer (NPPD, 2008b). As shown in Table 2.2.8.6-3, the total taxes and payments to the State, counties, and retail communities attributable to CNS-1 in 2006 were approximately $7.2 million and $7.1 million in 2007.

Table 2.2.8.6-3. Cooper Nuclear Station, Unit 1 Estimated Tax Distribution, 2005–2007

Tax	2005	2006	2007
Nebraska State Sales/Use Tax	$1,082,780	$1,353,435	$943,020
City of Auburn, NE Sales/Use Tax	240	455	40
Special Assessment on Brownville-Nemaha Levee Paid to Nemaha County	5,090	5,090	5,090
Nemaha County, NE Real Estate Taxes	10,865	10,980	11,140
Atchison County, MO Real Estate Taxes	145	145	140
Nebraska in Lieu of Taxes to Counties with NPPD Retail Electric Sales Attributed to the CNS-1	1,607,135	1,595,752	1,687,056
Payments to Retail Communities Attributed to CNS-1	4,267,771	4,233,381	4,436,089
Total	$6,976,031	$7,201,244	$7,084,582

Source: NPPD, 2008b

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the CNS-1 site and in the surrounding area.

2.2.9.1 *Cultural Background*

CNS-1 is located on a 1,120 acre tract in the floodplain on the west bank of the Missouri River in Nemaha County, Nebraska. To the west of the site are bluffs. CNS-1 also owns an additional 239 acres on the eastern side of the river in Atchison County, Missouri. The eastern bank is a densely forested area that periodically floods, with bluffs that run parallel to the river. The region around CNS-1 site contains prehistoric and historic Native American and Euro-American cultural resources. Twelve properties in Nemaha County are listed in the *National Register of Historic Places* (NRHP) (NPS, 2009). The nearest NRHP property is the Captain Meriwether Lewis Dredge. Seven NRHP properties are located in Atchison County.

2.2.9.2 *Prehistoric Periods*

<u>First Arrivals</u>

CNS-1 is situated in the Missouri River Valley on the eastern edge of the Central Great Plains and northwest edge of the Missouri Prairie-Timberlands. The first peoples began emigrating into the region toward the end of the Pleistocene (pre-Clovis ca. 11,500 years ago). There is a growing body of evidence indicating that a "First Arrivals" archeological period (circa. 13,000 and 17,000 years ago) preceded the Paleo-Indian period. A handful of sites in the Central Plains date between about 13,000 and 17,000 years ago, however, most of these sites have limited evidence of human occupation (Hofman, 1996). Acceptance of archeological remains older than the long accepted Clovis Culture remains controversial (Hofman, 1996; Holen, 1994).

<u>Paleo-Indian Period</u>

The Clovis Culture (ca. 11,500 years ago) is the earliest dated and accepted evidence of human habitation during the Paleo-Indian period in the New World. The climate during the Paleo-Indian period was much cooler and wetter than today. The eastern edge of the Central Plains was broad open grassland occupied by great herds of now extinct animals. Paleo-Indian populations were highly mobile and left little evidence of their activities. Most Paleo-Indian sites would have been short-term occupations (campsites). Paleo-Indian peoples subsisted on hunted game and gathered plant material. Distinctive point styles and variations in other tool types defined the Clovis, Folsom, Midland, and later Paleo-Indian groups (Hofman, 1996). To date, no early sites have been identified in Nemaha or Atchison counties, but such resources may exist as deeply buried deposits along relic terraces.

<u>Archaic Period</u>

During the Archaic Period, subsistence hunting and gathering underwent changes to adapt to resource availability. As glaciers retreated northward and larger animals disappeared from the region, humans adapted to modern plants and smaller game animals. The Dalton Culture (circa 8,500 to 7,500 years ago) is generally identified as late Paleo-Indian or Early Archaic period or as a transition between the two (O'Brien and Wood, 1995). The Archaic period is subdivided into the following periods: Early Archaic Logan Creek Complex (circa 7,500 to 6,000 years ago), Middle Archaic Jacomo Complex (circa 5,500 to 5,000 years ago) and Late Archaic Nebo Hill Complex (circa 4,500 to 2,500 years ago). Early Archaic people did not appear to establish permanent settlements, though there is evidence that some locations were utilized frequently. Archaic people collected, hunted, and gathered most of what they needed for survival in their home territory with a wider range of tools.

Climatic conditions during the Archaic Period entered a warmer/dryer phase around 5,500 years ago. Late Archaic cultures began to settle in the Missouri River Valley about 3,000 years ago. Archaeological evidence indicates that larger; semi-permanent warm weather settlements were established along the higher terraces, while winter encampments were located in upland areas along small streams. Archaic sites identified in the CNS-1 area typically consist of lithic scatters with various dart points identified as "Archaic".

Woodland Period

The Woodland period (circa. 2,500 to 1,000 years ago) is defined by the introduction of agriculture to augment subsistence hunting and gathering. The reliance on agriculture led to the establishment of permanent settlements during this period. Other characteristics of Woodland culture include increased population, emergence of social hierarchy, expanded interregional trade, elaborate ceremonialism with stone-lined graves and burial mounds, and the introduction of the bow and arrow.

During the middle Woodland period (circa 2,000 to 1,500 years ago), indigenous groups began increasing in population). Woodland peoples spread along valleys over the entire eastern half of Nebraska, western part of Iowa, and parts of South Dakota and Kansas. These people were forager-gardeners living in small villages along the higher valley terraces. Several Middle Woodland sites have been identified in Nemaha and Atchison counties.

During the late Woodland period (circa 1,500 to 1,100 years ago), larger middle Woodland villages were abandoned in favor of smaller camps and individual home sites, generally in the uplands away from the river bottoms. The number of burial mounds increased dramatically. Most of the mounds were small and low with distinctive rock structures. Many mounds have been lost to plowing, but rock structures around graves are commonly found on bottom terraces and points on both sides of the river.

Plains Village Period

Around 1,000 years ago, most groups had established permanent villages. The Plains Village peoples were farmers and bison hunters living in larger villages along the river terraces. Smaller hamlets, hunting camps, and kill sites have also been recorded in the uplands. This culture disappeared about 700 years ago for unknown reasons. Climatic conditions during this time were becoming warmer and dryer, and drought may have forced people out of traditional farming areas. Additionally, there was an influx of people coming onto the Plains from the northeast and west that may have made living in the region untenable.

2.2.9.3 *Historic Period*

Historic Tribes and Fur Traders

The eighteenth and nineteenth centuries brought the first wave of Europeans to the east Central Plains region. French, and later Spanish land claims, inspired trade and exploration of the Missouri River Valley. French fur traders were known to visit the area. Indian populations were subsequently displaced.

Traffic along the Missouri River increased after the Louisiana Purchase in 1803. The Lewis and Clark expedition of 1804 paved the way for subsequent U.S. military expeditions and the establishment of trading posts and missions. On July 13, 1804, the Lewis and Clark expedition passed the remains of a trading post said to have been where Benet of St. Louis traded with the Otoe and Pawnee for two years. Other American Indian groups that passed through the area included the Omaha, Osage, Delaware, Pottawatomi, Sauk and Fox, Winnebago, and Miami.

On July 15, 1804, the Lewis and Clark party camped along a rise on the west side of a bend in the river. There is some dispute about the actual location of the encampment. Nebraska researchers place the camp on the Missouri side of the present river channel and Missouri historians place the camp roughly where the CNS-1 is located.

Historic accounts of the Lewis and Clark expedition describe a beautiful valley filled with grape vines and wild cherries, which first attracted settlers to the area in the 1840s (Plamondon, 2000). Settlement was gradual, but steadily spread along the eastern side of the river (National Historical Company, 1882). The Kansas-Nebraska Act of 1854 created the Nebraska Territory. Nemaha County was established a year later (Heritage, 2004). Settlement along the river increased in the 1850s with Brownville, Nebraska, being established as a major steamboat port and shipping point. The towns of Nemaha, Brownville, and Peru prospered along the bluffs above the Missouri River, and settlement of the interior away from the river remained low until the Nebraska Railway Company reached the area in 1874 (Heritage, 2004). An 1865 Government Land Office plat showed two farmsteads located on or near the area occupied by the CNS-1. By 1911, there were nine homesteads and a school.

The arrival of railroads spurred the development of the interior areas away from the river at the expense of the towns located along the bluff tops. Brownville rapidly declined because of this. The building of the Brownville Bridge in 1939 connected the two sides of the river but did little to alleviate the town's economic downfall.

Construction of CNS-1 began in 1968. Consumers Public Power District (CPPD) planned and financed the construction and became NPPD on January 1, 1970 (NPPD, 2008).

2.2.10 Historic and Archaeological Resources at the Cooper Nuclear Station, Unit 1 Site

No prehistoric or historic sites listed or eligible for listing on the NRHP or the State historic registers are located on the CNS-1 site. Historic archaeological sites have been identified within a 6-mile radius of the site. A great deal of archaeological and historical research has been conducted within both Nemaha County, Nebraska and Atchison County, Missouri. The bluffs along either side of the Missouri River and the higher terraces along the river valley bottom lands were favored habitation sites for prehistoric and historic people.

Only one previous historical survey has been conducted on the CNS-1 property. This survey evaluated the eligibility of the William Dawson House located in the southwest corner of the CNS-1 site near the bluff for listing on the NRHP. The William Dawson House (Site # NH00-69) was recorded in Nebraska historic archives but was not included on the NRHP. The Dawson House was torn down in 1970, shortly after it was recorded.

A formal survey of the entire CNS-1 property has not been completed, however, a number of archaeological surveys have been conducted in the surrounding area. In the 1930s, A.T. Hill and Paul Cooper walked the bluffs along both sides of the river valley in search of Woodland mound sites. The Whitten Archeological Site, Archeological Survey No. 25NH4, was excavated along the bluffs north of the CNS-1 site. Despite the fact that the mounds were reportedly leveled by cultivation, excavations succeeded in locating two concentrations of human remains along with grave goods and other artifacts (Hill and Cooper, 1937). The Nebraska State Historical Society Site Survey Form notes that: "… (two) skeletons were sent to U.S. National Museum in accordance with our WPA (Works Progress Administration) contract." The note is dated June 21, 1944. It is unclear from the archaeological site description if the Whitten site extended onto the CNS-1 property.

In April 2007 and March 2008, NPPD contracted with Enercon Services, Inc. to conduct a Phase 1A Literature Review and Archeological Sensitivity Assessment for the CNS-1 site. The 55 acres occupied by the CNS-1 were heavily disturbed. The Enercon study identified two probable prehistoric lithic scatters and three former historic home sites on the CNS-1 site. The report also noted the potential for additional prehistoric and historic resources to be found throughout the area. Enercon also noted the potential for a camp site occupied by the Lewis and Clark Expedition in 1804 being located on CNS-1 property. The exact location of this campsite remains unknown.

2.3 RELATED FEDERAL AND STATE ACTIVITIES

The NRC staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating license for the CNS-1. Any such activity could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency in the preparation of the CNS-1 SEIS.

The NRC has determined that there are no Federal projects that would make it desirable for another Federal agency to become a cooperating agency in the preparation of the SEIS. Federal lands, facilities, national wildlife refuges, forests, and parks within 50 miles of the CNS-1 are listed below.

- Langdon Bend, 1 mile south-southeast (USACE)
- Derion Bend, 8 miles southeast (USACE)
- Nishnabotna, 9 miles north-northwest (USACE)
- Corning, 12 miles southeast (USACE)
- Kansas Bend, 12 miles north-northwest (USACE)
- Thurnau, 15 miles southeast (USACE)
- Lower Hamburg Bend, 15 miles north-northwest (USACE)
- Hamburg Bend, 17 miles north-northwest (USACE)
- Rush Bottom Bend, 22 miles southeast (USACE)
- Sac and Fox Reservation, 23 miles south-southeast (U.S. Department of the Interior, Bureau of Indian Affairs)
- Iowa Reservation, 26 miles south-southeast (U.S. Department of the Interior, Bureau of Indian Affairs)

- Squaw Creek National Wildlife Refuge, 28 miles southeast (USFWS)
- Copeland Bend, 29 miles north-northwest (USACE)
- Auldon Bar, 36 miles north-northwest (USACE)
- Noddleman Island, 39 miles north-northwest (USACE)
- Tobacco Island, 43 miles north-northwest (USACE)

NRC is required under Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA) to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. Federal Agency consultation correspondence and comments on the SEIS are presented in Appendix E.

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3.0 ENVIRONMENTAL IMPACTS OF REFURBISHMENT

Environmental issues associated with refurbishment activities are discussed in NUREG-1437, "*Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*, Volumes 1 and 2 (NRC 1996). The GEIS includes a determination of whether or not the analysis of the environmental issues can be applied to all plants and whether or not additional mitigation measures are warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply to all plants, or for some issues, apply only to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis. It has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this supplemental environmental impact statement (SEIS) unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, therefore, an additional plant-specific review of these issues is required.

License renewal actions include refurbishment for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. Environmental issues associated with refurbishment, which were determined to be Category 1 issues, are listed in Table 3-1.

Environmental issues related to refurbishment considered in the GEIS that are inconclusive for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2.

The potential environmental effects of refurbishment actions are identified, and the analysis will be summarized within this section, if such actions are planned. Nebraska Public Power District (NPPD) indicated that it has performed an evaluation of systems, structures, and components pursuant to Section 54.21 of Title 10 of the *Code of Federal Regulations* (10 CFR 54.21) to identify the need to undertake any major refurbishment activities that are necessary to support continued operation of CNS-1 during the requested 20-year period of extended operation. Items that are subject to aging and might require refurbishment to support continued operation during the renewal period are listed in Table B.2 of the GEIS.

1 **Table 3-1. Category 1 Issues for Refurbishment Evaluation**

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
Surface Water Quality, Hydrology, and Use (for all plants)	
Impacts of refurbishment on surface water quality	3.4.1
Impacts of refurbishment on surface water use	3.4.1
Aquatic Ecology (for all plants)	
Refurbishment	3.5
Ground Water Use and Quality	
Impacts of refurbishment on ground water use and quality	3.4.2
Land Use	
Onsite land use	3.2
Human Health	
Radiation exposures to the public during refurbishment	3.8.1
Occupational radiation exposures during refurbishment	3.8.2
Socioeconomics	
Public services: public safety, social services, and tourism and recreation	3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6
Aesthetic impacts (refurbishment)	3.7.8

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53 (c)(3)(ii) Subparagraph
Terrestrial Resources		
Refurbishment impacts	3.6	E
Threatened or Endangered Species (for all plants)		
Threatened or endangered species	3.9	E
Air Quality		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
Socioeconomics		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services: education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services, transportation	3.7.4.2	J
Historic and archaeological resources	3.7.7	K
Environmental Justice		
Environmental justice[2]	Not addressed	Not addressed

The results of the evaluation of systems, structures, and components for CNS-1, as required by 10 CFR 54.21, do not identify the need to undertake any major refurbishment or replacement actions associated with license renewal to support the continued operation of CNS-1 beyond the end of the existing operating license.

[2] Guidance related to environmental justice was not in place at the time the U.S. Nuclear Regulatory Commission (NRC) prepared the GEIS and the associated revision to 10 CFR Part 51. If an applicant plans to undertake refurbishment activities for license renewal, the applicant's environmental report (ER) and the NRC staff's environmental impact statement must address environmental justice.

3.1 REFERENCES

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." 10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2, Office of Nuclear Regulatory Research, Washington, D.C. ADAMS Accession Nos. ML040690705 and ML040690738

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plant*. NUREG-1437, Volume 1, Addendum 1, Office of Nuclear Reactor Regulation, Washington, D.C.ADAMS Accession No. ML0400690720.

4.0 ENVIRONMENTAL IMPACTS OF OPERATION

This chapter addresses potential environmental impacts related to the period of extended operation of Cooper Nuclear Station, Unit 1 (CNS-1). These impacts are grouped and presented according to resource. Generic issues (Category 1) rely on the analysis provided in NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (May 1996) (GEIS) prepared by the U.S. Nuclear Regulatory Commission (NRC,1996) and are discussed briefly. NRC staff analyzed site-specific issues (Category 2) for CNS-1 and assigned them a significance level of SMALL, MODERATE, LARGE or not applicable to CNS-1 because of site characteristics or plant features. Section 1.4 of this report explains the criteria for Category 1 and Category 2 issues and defines the impact designations of SMALL, MODERATE, and LARGE.

4.1 LAND USE

Section 2.2.1 of this report describes the land use around CNS-1.

Table 4-1, “Land Use Issues” lists Category 1 issues (from 10 CFR Part 51, Subpart A, Appendix B, Table B–1), which are applicable to onsite land use and power line right-of-way impacts during the renewal term. As stated in the GEIS, the impacts associated with the Category 1 issues were determined to be SMALL, and plant-specific mitigation measures would not be sufficiently beneficial to be warranted.

The NRC staff reviewed and evaluated the CNS-1 environmental report (ER), scoping comments, other available information, and visited the CNS-1 in search of new and significant information that would change the conclusions presented in the GEIS. No new and significant information was identified during this review and evaluation. The staff did not identify any Category 2 issues for land use. Therefore, it is expected that there would be no impacts related to the Category 1 issues during the renewal term beyond those discussed in the GEIS.

Table 4-1. Land Use Issues

Issues	GEIS Section	Category
Onsite land use	4.5.3	1
Power line right-of-way	4.5.3	1

4.2 AIR QUALITY

Section 2.2.2 of this report describes air quality in the vicinity of CNS-1. One Category 1 air quality issue is applicable to CNS-1: air quality effects of transmission lines. No Category 2 issues have been identified for air quality. The NRC staff did not identify any new and significant information during the review of NPPD’s ER, the site audit, or during the scoping process. No major facility construction or refurbishments are planned to occur during the license renewal period. Therefore, there are no impacts related to this issue beyond those discussed in the GEIS. For these issues, the GEIS concluded that the impacts are designated as SMALL.

4.3 GROUND WATER

4.3.1 Generic Ground Water Issues

Section 2.2.3 of this report discusses ground water use and quality at CNS-1.The staff did not identify any new and significant information in regard to Category 1 or generic ground water issues during the review of the NPPD's ER, the site visit, or the scoping process. Therefore, no impacts are related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff in the GEIS concludes that the impacts are SMALL and additional site-specific mitigation measures are not warranted.

4.3.2 Ground Water Use Conflicts

The Category 2 ground water issue applicable to CNS-1 is ground water use conflicts (potable and service water, plants using >100 gpm). CNS-1 has two potable water supply wells completed in the alluvial aquifer that have a current combined pumping capacity of 250 gallons per minute (gpm) Normal operations require only one well to be pumped at a time, supplying 125 gallons per minute. The water is chlorinated, distributed onsite, and operated with preventive maintenance and cross connection or backflow prevention programs. The two drinking water wells are scheduled to be replaced with two similar new wells in the near future (NPPD, 2008).

A third alluvial aquifer well at CNS-1 is used for fire protection training and has a capacity of 750 gallons per minute. Two additional wells, River Wells A and B, are used to supply water for facility pump seals. These wells each have a capacity of 150 gallons per minute (NPPD, 2008).

As part of a hydrogeologic investigation for the study of radioisotopes in ground water and water use in the area surrounding the station, NPPD searched the Nebraska Department of Natural Resources (NDNR) water well database for all wells in Nemaha County. Three irrigation wells, completed in the shallow unconsolidated aquifer, are located between 2 and 3 miles southwest of CNS-1. Four farm wells within 1 mile of the station, all only 15 feet deep, produce a limited amount of ground water. None of these wells are impacted by ground water pumping at CNS-1 because the station wells are screened in an unconfined aquifer and have limited radii of influence. A search of wells by NPPD in Atchison County, Missouri, across the river from CNS-1, identified no wells within 2 miles of the station. In addition, the Missouri River serves as a ground water recharge and discharge boundary. Therefore, the NRC staff concludes no effect of pumping the shallow aquifer at CNS-1 would likely be measurable on the Missouri side of the river.

Because of the limited radius of influence of CNS-1 wells completed in the unconfined aquifer, no public ground water supplies are close enough to CNS-1 to be impacted by ground water use at the station. There are no well-head protection areas or EPA designated sole source aquifers in the vicinity of CNS-1 (CRA, 2007). Therefore, the impact of ground water use by CNS-1 is SMALL and no mitigation measures are warranted.

4.4 SURFACE WATER

4.4.1 Generic Surface Water Issues

The following sections discuss the surface water quality issues applicable to CNS-1, which are listed in Table 4-2. The staff did not identify any Category 2 issues related to surface water issues in the GEIS. In addition, the staff did not identify any new and significant information with respect to the Category 1 issues below during the review of NPPD's ER, the site audit, or the scoping process. Therefore, no impacts are related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff in the GEIS concludes that the impacts are SMALL, and additional site-specific mitigation measures are not warranted.

Table 4-2. Category 1 Surface Water Issues

Issues	GEIS Section	Category
Altered current patterns at intake and discharge structures	4.2.1.2.1	1
Temperature effects on sediment transport capacity	4.2.1.2.3	1
Scouring caused by discharged cooling water	4.2.1.2.3	1
Discharge of chlorine or other biocides	4.2.1.2.4	1
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4	1
Discharge of other metals in wastewater	4.2.1.2.4	1
Water use conflicts for plants with once-through cooling systems	4.2.1.3	1

The following briefly describes the GEIS conclusions for these issues:

Altered current patterns at intake and discharge structures. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

Temperature effects on sediment transport capacity. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

Scouring caused by discharged cooling water. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.

Discharge of chlorine or other biocides. The effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.

Discharge of sanitary wastes and minor chemical spills. Effects are readily controlled through the National Pollutant Discharge Elimination System (NPDES) permit. Periodic modifications are granted, if needed, and are not expected to be a problem during the license renewal term.

Discharge of other metals in wastewater. These discharges have not been found to be a problem at operating nuclear power plants and are permitted through the NPDES system. They are not expected to be a problem during the license renewal term.

With respect to "water use conflicts for plants with once through cooling systems" the NRC staff notes that continuing operation of CNS-1 depends on the availability of water from the Missouri River. The volume of water available may be susceptible to droughts and to competing water uses within the basin. In cases of extreme drought, these facilities may be required to curtail operations if the volume of water available is not sufficient. As described in Section 2.0, the flow in the Missouri River is not expected to decrease to the point cooling water restrictions would be imposed. This remains a Category 1 issue with SMALL impact.

For all of these Category 1 issues in Table 4-2, the NRC staff has not identified any new and significant information during its review of the NPPD's ER, the staff's site visit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there were no other surface water issues.

4.4.2 Water Use Conflicts

There were no Category 2 surface water issues identified for the CNS-1 license renewal term.

4.5 AQUATIC RESOURCES

Section 2.1.6 of this report describes the CNS-1 cooling water system; Section 2.2.5 describes the aquatic resources. The Category 1 and Category 2 issues related to aquatic resources applicable to CNS-1 are discussed below and listed in Table 4-3.

Table 4-3. Aquatic Resources Issues

Issues	GEIS Sections	Category
For All Plants		
Accumulation of contaminants in sediments or biota	4.2.1.2.4	1
Entrainment of phytoplankton and zooplankton	4.2.2.1.1	1
Cold shock	4.2.2.1.5	1
Thermal plume barrier to migrating fish	4.2.2.1.6	1
Distribution of aquatic organisms	4.2.2.1.6	1
Premature emergence of aquatic insects	4.2.2.1.7	1
Gas supersaturation (gas bubble disease)	4.2.2.1.8	1
Low dissolved oxygen in the discharge	4.2.2.1.9	1
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10	1
Stimulation of nuisance organisms	4.2.2.1.11	1
For Plants with Once-Through and Cooling Pond Heat Dissipation Systems		
Entrainment of fish and shellfish in early life stages	4.1.2	2
Impingement of fish and shellfish	4.1.3	2
Heat shock	4.1.4	2

4.5.1 Generic Aquatic Ecology Issues

The NRC staff did not identify any new and significant information related to the Category 1 issues listed above during the review of the NPPD's ER, the site audit, or the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the GEIS concludes that the impacts are designated as SMALL, and additional site-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

4.5.2 Entrainment and Impingement

4.5.2.1 *Introduction*

Entrainment and impingement of aquatic organisms are site-specific (Category 2) issues for assessing impacts of license renewal at plants with once-through cooling systems. Entrainment is the taking in of organisms with the cooling water. The organisms involved are generally of small size, dependent on the screen mesh size, and include phyto- and zooplankton, fish eggs and larvae, shellfish larvae, and many other forms of aquatic life. Impingement is the entrapment of organisms against the cooling water intake screens.

A particular life stage of a species can be subject to both entrainment and impingement if some individuals are impinged on screens while others pass through and are entrained (EPA, 1977). Section 316(b) of the Clean Water Act (33 *United States Code* (U.S.C.) §1326(b)) requires that:

> Any standard established pursuant to section 1311 of this title or section 1316 of this title and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact available for minimizing adverse environmental impact.

The adverse environmental impacts of cooling water intake occur through both impingement and entrainment. Exhaustion, starvation, asphyxiation, descaling, and physical stresses may kill or injure impinged organisms. Heat, physical stress, or chemicals used to clean the cooling system may kill or injure the entrained organisms.

4.5.2.2 *History of Cooper Nuclear Station's 316(b) Compliance*

The ER section 4.2.5 provides the history of CNS-1's compliance with the Section 316(a) and 316(b) of the Clean Water Act (33 *United States Code* (U.S.C.) §1326(a) and1326(b)). NDEQ (1977) found, after reviewing CNS-1's revised 316(b) documentation on the effects of the intake structure on fish populations, that the structure met the minimum requirements of Section 316(b) of the CWA. NDEQ (1977) also voiced concerns regarding the fate of fish entrapped in the forebay area, however, and noted that "should problems develop in this area in the future, more adequate fish protection devices may be warranted." NPPD (2008, pages 4–25) discontinued entrapment monitoring at CNS-1 about a year later in January 1978.

CNS-1 conducted impingement sampling from 1974 through 1978. NPPD (2008) lists the annual impingement rates from 1975, 1976, and 1977, respectively, as follows: 45,990 fish, 63,245 fish, and 40,296 fish. NPPD (2008) does not present the annual impingement rate for 1974, but gives the daytime and nighttime rates as 19.8 and 38.1 fish/hour. Assuming 12-hour day and night sampling periods (Hazleton, 1979) and extrapolating to 365 days per year, the NRC staff calculated a yearly rate of 253,600 fish impinged in 1978. NPPD (2008) also did not present the annual rate for 1978. The total impingement for 27 hours of sampling in 1978 was 266 fish (Hazleton, 1979). Extrapolating to 365 days per year, the NRC staff calculated a yearly rate of about 86,300 fish impinged in 1978. These annual rates can only be rough estimates accompanied by a moderate degree of uncertainty, but they are useful for understanding the order of magnitude of impingement.

NPPD (2008) reports that gizzard shad, freshwater drum, and river carpsucker make up the majority of impinged fish in the 1974 through 1978 studies. Based on data from the ER (NPPD, 2008, Table 1.3-1), the contribution of these three species to total impingement numbers ranged from 73 to 91 percent for the period of 1974 through 1978. Hazleton (1979, Table 7.1) categorizes the occurrence of gizzard shad, freshwater drum, and river carpsucker in the area around the CNS-1 as “common” based on electroshocking and seining during the pre- and post-operational period, 1970 through 1978. The age class of the majority of fish impinged each year was young of the year, and most impingement occurred at night (NPPD, 2008, page 4–24).

According to NPPD’s (NPPD, 2008d) 316(b) Compliance Strategy Report for 2007, “to help address the 316(b) requirements, NPPD installed Brackett-Green dual flow screens with modified Ristroph fish buckets in 2005 and 2006.” CNS-1 has not completed the fish protection system and plans to install, during a 2011 refueling outage, a fish handling system consisting of inside and outside sprays to wash fish from the screens and a separate fish return trough (NPPD, 2008, pgs 4–11). The plant’s service water system would supply water for the spray wash. The new screens, fish handling system, and fish return trough primarily affect impingement but not entrainment.

CNS-1’s original 316(a) and 316(b) demonstration (Nalco, 1975, Tables 4.4-48 through 4.4-50) reported entrainment mortality (intake vs. discharge and after an unspecified holding period) but not the number of fish entrained, both of which are necessary for a full assessment of the effects of entrainment. Nalco (1975, Tables 4.4-50 and 4.451) also reported mortality of fish larvae after an unspecified holding period, after passage through the thermal plume. Following NDEQ’s (1977) review of CNS-1’s revised 316(b) documentation, NPDES permits have not required subsequent entrainment monitoring and assessment (NPPD, 2008, page 4–11). U.S. Atomic Energy Commission (AEC) (1973, page V–15) found that it could describe the potential loss of fish eggs and larvae only in terms of the fraction of river flow taken by the plant, which in spring and early summer when many of the fish species spawned, was about 4 percent. During unusually low summer flows, this fraction would be greater and the fraction of river flow taken by the plant should be no more than 20 percent (NPPD, 2008). AEC (1973) found that the percentage loss of fish eggs and larvae originating upstream of the plant was probably much less than the fractional flow because the sampled fish species were spawning in protected areas.

In its guidelines for ecological risk assessment, the EPA (1998) recommends use of multiple lines of evidence for characterizing and describing risk. The use of lines of evidence can be quantitative or qualitative. The NRC staff adopted a qualitative approach for the impact analysis here. One line of evidence is the regulatory history itself. Although any final determinations regarding CNS-1’s 316(b) demonstration await the EPA’s publication of new Phase II rules. Phase II rules were published in 2004, suspended in 2007, and are awaiting new Phase II rules at the time this SEIS was developed.

The NRC staff find that the history of regulation reviewed above does not show regulatory concern that the potential effects of impingement and entrainment constitute adverse impacts.

4.5.2.3 *Analysis*

At NRC’s environmental audit at CNS-1 in 2009 and in scoping comments (EPA, 2009), the EPA voiced concern regarding the age of the data (over three and a half decades) used in the ER to support NPPD’s assertion in their ER that CNS-1’s impingement and entrainment produced a SMALL impact level on aquatic populations. To assess whether the Missouri River aquatic resources near CNS-1 are stable (as described in Section 2.2.5 of this SEIS), the NRC staff performed the following analysis.

The NRC staff examined the question of how the age of the data might affect the conclusions regarding entrainment and impingement at CNS-1. The NRC staff found that the argument used in the NPPD's ER is inconsistent because it assumed at different points that the aquatic resources are both stable and unstable, although in fact they cannot be both. In describing the aquatic resources, the ER stated that fish communities have long been responding to changes in the river brought on by man's activities.

The NRC staff reached the conclusion of resource instability from a review of literature (presented in Chapter 2) on the natural and human history of the watershed. The changes are well documented: The present Missouri River is relatively new in geological terms and was partly formed by the last glaciation. As a result, most species in the region have not evolved in place but have colonized from surrounding environments that may have had somewhat different ecologies. Man has changed the river almost constantly, particularly since European settlement. Particularly influential were the early impoundments and withdrawals for irrigation and later dams built for various purposes (e.g., flood control, hydroelectric power, transportation, irrigation). Numerous diversions now withdraw river water for both consumptive and non-consumptive uses. Dredging, bank stabilization, construction of levies, dikes, revetments, and other structures have changed the course of the river, its hydrological cycles, water current velocity, water levels, patterns of sediment suspension and deposition, suspended sediment levels, substrate types, and other aspects of fish habitat. Agriculture, industrialization, the CWA, and other regulations and associated activities have affected levels of contaminants in water and sediments, dissolved oxygen levels, and other water quality parameters that affect aquatic populations. Future changes to the Missouri River, for example, those flowing from the Missouri River Ecosystem Restoration Plan, can be foreseen. Aquatic populations respond to these habitat changes.

The effects of impingement and entrainment on fish populations depend in part on the identity, numbers, and population structure of the affected populations. But the reviews of aquatic resources in the NPPD's ER and Section 2.2.5 in this supplemental environmental impact statement (SEIS) show that the aquatic populations are not static or stable.

The observation that the aquatic resources of the Missouri River are not static or stable affects NRC's assignment of its level of impact in two ways. First is the concern voiced by the EPA (2009): the age of the impingement and entrainment data brings into question "whether these data are representative of current river condition and ecological impact." Second, NRC partially defines its levels of impact in terms of stability: for example, NRC's definition of a small impact level is that "environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource" and the definition of large impact is that "environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource." In applying its definitions of impact levels to effects of CNS-1 on Missouri River aquatic resources, NRC chose an approach that can accommodate the observations that the aquatic resources are changing constantly in response to many environmental variables and are not stable in the sense of unchanging or static.

Another line of evidence is the ecology of adult and juvenile fish living in the Missouri River. The ER reports that water velocity at CNS-1's intake screens is about 2 feet per second, whereas "historical river velocities were usually 0.98–2.62 feet per second, but downstream from Gavins Point Dam velocities between 2.62 feet per second and 4.27 feet per second occur more frequently than they did historically (Berry et al. p. 6)." These observations suggest that fish in the Missouri River should be adapted to living in water with velocities well in excess of the current that occurs at the intake screens. So while the identity, numbers, and population structure of the potentially affected fish populations may have changed over the last decades, present fish populations are most likely no less able to escape or avoid adverse impact than those present when the impingement and entrainment studies were performed.

A third line of evidence lies in the general ecology of fish eggs and larvae subject to entrainment. The generalities about the pattern of fish eggs and larvae in the Missouri River drift vulnerable to entrainment at CNS-1 are probably similar to those reported by Hergenrader et al. (1982) in the vicinity of CNS-1 in 1974 through 1976, although the relative and absolute abundances, and perhaps some species, may have changed. Fish eggs and juveniles are probably still a small part of all ichthyoplankton and most common from May through July. The numerically dominant fish larvae are probably still those of pelagic spawners such as freshwater drum, catastomids (e.g., suckers), cyprinids (e.g., minnows), common carp (*Cyprinus carpio*), gizzard shad (*Dorosoma cepedianum*), and goldeneye (*Hiodon alosoides*). The larvae of fish that build nests or spawn randomly, have adhesive and demersal (sinking) eggs, or provide parental care of the eggs and larvae, such as centrarchids (e.g., white bass (*Morone chrysops*), sunfish (*Lepomis* spp.), and crappie (*Pomoxis* spp.)), percids (e.g., sauger (*Stizostedion canadense*) and walleye (*Sander vitreus*)), and channel catfish (*Ictalurus punctatus*) are probably still relatively under-represented.

Another line of evidence is the fraction of Missouri River flow withdrawn by CNS-1. AEC (1973, page V–15) found that it could describe the potential loss of fish eggs and larvae only in terms of the fraction of river flow taken by the plant, which in spring and early summer when many of the fish species spawned was estimated at 4 percent. During unusually low summer flows, the fraction of river flow taken by the plant should be no more than 20 percent (NPPD, 2008). AEC (1973) also found that the percentage loss of fish eggs and larvae originating upstream of the plant was probably much less than this because of the protected areas that these species used for spawning. These are very general ways of analyzing impact, and, within their limitations, these generalities are probably still true today, although once again, the identity of the species affected may have changed over time.

The available lines of evidence for assessing impact level for aquatic resources subject to impingement and entrainment at CNS-1 are as follows: (1) the lack of a history of regulatory action indicates no appreciable adverse impact; (2) while fish populations may have changed over the decades, present fish populations are most likely no less able to escape or avoid adverse impact than those present when the impingement and entrainment studies were performed; (3) the generalities about the pattern of fish eggs and larvae in the Missouri River drift vulnerable to entrainment at CNS-1 are probably similar to those reported in past studies that found little or no adverse effects of plant operation; (4) the relative fraction of river flow withdrawn by the plant remains small, and most fish species still have refugia that protect the populations from adverse effects of impingement and entrainment; (5) CNS-1 now has dual flow screens with modified Ristroph fish buckets and NPPD plans to install a fish handling system consisting of inside and outside sprays to wash fish from the screens and a separate fish return trough to mitigate adverse effects of impingement, and (6) the NDEC conclusion based on monitoring and studies conducted by the Omaha Public Power District near both Fort Calhoun Station and CNS-1that losses due to entrainment were within the acceptable range.

Although the NRC staff reached the conclusion that aquatic resources are not stable, the NRC staff finds that, although these changes may have occurred, the impact on aquatic resources due to impingement and entrainment at CNS-1 is SMALL. The NRC staff has reviewed the available information, including that provided by the applicant, the staff’s site visit, the State of Missouri, the 316(b) demonstration, and other public sources. Although no recent impact studies have been performed, the NRC staff concludes that the weight of evidence from past studies, biological inference, and regulatory history indicates a SMALL level of impact on aquatic resources due to impingement and entrainment at CNS-1. NPPD has implemented some impingement mitigation measures and plans to implement others.

4.5.3 Thermal Effects

For plants with once-through cooling systems and cooling pond heat dissipation systems, NRC's GEIS (1996) lists the effects of heat shock as an issue requiring plant-specific evaluation before license renewal (Category 2). NRC (1996) made impacts on fish and shellfish resources resulting from heat shock a site-specific issue because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions.

Information considered includes the type of cooling system (once-through in this case), evidence of a CWA Section 316(a) variance or equivalent State documentation, and other information. To perform this evaluation, the staff reviewed the CNS-1's ER to NRC (NPPD, 2008); visited the CNS-1 site; reviewed the facility's 316(a) demonstration (Nalco, 1975) dated October 23, 1975 and submitted to the NDEQ; and reviewed the applicant's State of Nebraska NPDES Permit No. NE0001244 issued on July 1, 2007 and in force until July 30, 2012 (found in Attachment C of NPPD, 2008).

The latest fact sheet for the NPDES permit summarizes the thermal limits for the effluent and the bases of the limits. The EPA assisted NDEQ in conducting the assessment of mixing cooling water from CNS-1 with ambient Missouri River water for the permit. The permit limits are based on a modeled limit of a 90 °F "heat cap" or maximum at the end of the 5,000-foot mixing zone. According to the fact sheet: "Based on a ΔT of 23.9°F, the permit limit for the Cooper Nuclear power plant is 109.4 °F. The maximum instream river temperature where the heat cap is met is 85.54 °F (29.7 °C)" (NDEQ, 2007).

The NPDES permit limits are set for the protection of aquatic life (NDEQ, 2007). In addition to upper thermal limits, shutdown of the plant in winter could cause sudden decreases of temperature that could cause thermal shock and mortality in fish attracted to or living in the thermal discharge and discharge canal (NPPD, 2008), although these events would probably be rare.

After reviewing the available information, NRC concludes that the level of thermal impacts to the aquatic community due to renewing CNS-1's operating license is designated as SMALL.

4.5.4 Total Impacts on Aquatic Resources

In addition to the information presented for impingement, entrainment, and thermal effects individually, the results of some field studies performed in the past and summarized in section 2.2.5 provide information on the total impacts of CNS-1's cooling water system operation on aquatic resources. Field studies comparing aquatic communities at locations upstream and downstream from CNS-1 reflect the total impact of entrainment, impingement, and thermal effects.

Reetz (1982) reported that initial (7-hour) differences in carbon fixation rates of phytoplankton at CNS-1 between intake and discharge sampling locations ranged from an average of about 17 percent inhibition during summer to no change during winter. The inhibition in the summer months appeared to depend on absolute discharge temperature: the highest inhibition rates (above 26 percent) occurred when absolute discharge temperatures exceeded 38.5 °C (101 °F). Recovery from initial inhibition at CNS-1 occurred within 48 hours. While the river would carry phytoplankton far downstream in 48 hours so that a substantial part of the river would be affected, Reetz (1982) concluded that the low rate of water use by CNS-1 compared to river flow combined with the rapid mixing of the thermal plume would make the effects relatively unnoticeable.

Periphytic algae are those algae that are attached to solid surfaces under water such as rocks, logs, pilings, and other structures. Farrall and Tesar (1982) reported results of periphytic algae studies conducted in the Missouri River in the vicinity of CNS-1 from 1972 through 1977. Because they remain in one place, periphytic algae colonizing natural and artificial substrata are used as indicators of environmental effects. Farrell and Tesar (1982) did not detect changes in the diversity, density, and biovolume of periphytic algae related to water temperature in the vicinity of CNS-1, although species composition did reflect water temperature. Although these results may generally be indicative of periphyton responses and processes at CNS-1 today, species composition and magnitude of response, which depends on the species involved, may have changed over the decades since Ferral and Tesar’s (1982) studies.

Repsys and Rogers (1982) investigated the effects of CNS-1 on zooplankton populations in 1974 through 1978. High absolute discharge temperatures (≥ 35 °C or 95 °F) critically affected zooplankton survival, as did duration of exposure. Repsys and Rogers (1982) concluded that entrainment losses were small when compared to the large downstream decreases in zooplankton. Without further studies, NRC concludes that these general patterns and processes most likely still occur, although species composition and magnitude of response, which depends on the species involved, may have changed over the decades since Repsys and Rogers’ (1982) studies.

Carter et al. (1982) reported results of benthic infaunal and epifaunal invertebrate studies conducted in the Missouri River in the vicinity of CNS-1 and Fort Calhoun Station (FCS) from 1973 through 1977. Benthic infauna refers to the organisms that live in underwater sediments, and benthic epifauna refers to organisms that live on underwater surfaces. Like periphyton, benthic invertebrates are often used as indicators of impacts because they are relatively immobile and sensitive to local environmental conditions. Carter et al. (1982) were not able to detect consistent changes in the epifaunal invertebrate community due to operation of CNS-1.

Hergenrader et al. (1982) reported the results of both field and entrainment studies on larval fish in the vicinity of CNS-1 in 1974 through 1976. In order to determine if entrainment (and impingement) were having an effect on the fish populations in the area, Hergenrader et al. (1982) looked for changes in adult fish populations resulting from impacts to larval fish, but detected none. They concluded that either no significant changes occurred or “Too few resources (financial, technical, equipment, labor) were applied over too small a time frame in too restricted an area to detect the changes which had occurred.”

The aquatic community, particularly the fish community, may not be stable and may still be changing in response to historical changes in land use, river regulation, and other human activities. For example, the U.S. Army Corps of Engineers (USACE) (2004) reports that the benthic fish community appears to be changing based on 1996 and 1997 studies. Whatever the total effects of CNS-1 on the fish community were in the past, the installation of the modified dual-flow traveling screens in 2006 and future installation of a low-pressure screen wash and fish return trough would mitigate those impacts.

While the species and their numbers would have changed over the last decades, the results summarized above reflect general ecological responses.

The NRC staff concludes level of impact on aquatic resources due to all aspects of CNS-1's cooling system operation is SMALL.

4.6 TERRESTRIAL RESOURCES

Section 2.2.6 of this document provides a description of the terrestrial resources at CNS-1 and in the surrounding area. The issues related to terrestrial resources applicable to CNS-1 are discussed below and listed in Table 4-4. No Category 2 issues are related to terrestrial resources for license renewal. The NRC staff did not identify any additional new and significant information during review of the NPPD ER, the site audit, the scoping process, or the evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts related to these issues beyond those discussed in the GEIS (NRC, 1996). The GEIS concludes that the impacts are SMALL and additional site-specific mitigation measures are not likely to be sufficiently beneficial to implement.

Table 4-4. Terrestrial Resources Issues

Issues	GEIS Section	Category
Power line right-of-way management (cutting herbicide application)	4.5.6.1	1
Bird collisions with power lines	4.5.6.1	1
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3	1
Floodplains and wetlands on power line right-of-way	4.5.7	1

4.7 PROTECTED SPECIES

4.7.1 Aquatic Species

Section 2.2.7 of this document describes the threatened or endangered species on or near CNS-1.The impact to threatened and endangered species is a Category 2 issue and is discussed below.

One Federally-listed aquatic species may occur in the Missouri River near CNS-1: pallid sturgeon. NPPD (2008) summarizes interactions between NPPD and both State and Federal agencies regarding conservation of pallid sturgeon.

In March 2006, before filing a license renewal application with NRC, NPPD voluntarily participated in meetings with the U.S. Fish and Wildlife Service (USFWS), the Nebraska Game and Parks Commission (NGPC), the NDEQ, the NDNR, the EPA, and the USACE regarding conservation actions to improve the habitat of pallid sturgeon. NPPD (2008) summarizes those meetings. Early in the discussions, the USFWS and NGPC showed interest in developing existing habitat on a parcel of property south of CNS-1 at Langdon Bend and later also on CNS-1 property on the Nebraska side of the Missouri River adjacent to Langdon Bend. They hoped to enhance pallid sturgeon habitat by building a chute to connect the active river channel with the old river area.

NPPD had problems with this proposal. Implementing the proposal would reduce CNS-1's mixing zone, which now extends 5,000 feet south of CNS-1 along the Nebraska side of the Missouri River, to less than 2,500 feet. Reducing the mixing zone would reduce CNS-1's capacity to generate electricity, particularly during summer. The proposal also posed other negative safety and environmental concerns for CNS-1. As an alternative, NPPD then offered to contribute funds toward other new or existing projects on the Missouri River. The USFWS rejected this funding alternative in favor of increasing the amount of land for habitat development.

To meet the goal of improving habitat for pallid sturgeon, NPPD offered a conservation easement of about 230 acres of land that it owns on the Missouri side of the Missouri River, opposite CNS-1, for the purposes of habitat development. USFWS indicated interest in the proposal, and asked NPPD to also acquire an adjacent property of about 150 acres so that the entire bend in the river could be developed into better habitat. When the property owner refused to sell the land, NPPD offered a revised, final proposal to participate in and promote habitat development along the Missouri River. It proposed to revisit the USFWS's and NGPC's interest in a suitable conservation easement and Memorandum of Understanding to enable habitat development on NPPD's approximately 230 acre parcel on the Missouri side of the river. Further, because NPPD recognized that this parcel alone would not meet USFWS's and NGPC's conservation habitat development goals, NPPD indicated its willingness to make an additional payment of $250,000 to be applied toward another conservation habitat development project on the Missouri River at the direction of USFWS and NGPC. At the time of writing this SEIS, the involved parties are discussing details of the conservation agreement.

Plans for and construction of a chute on the parcel may also involve the owners of the transmission lines and supports that cross the property.

NPPD does not own these lines, although CNS-1 provides power to them.

The probability that CNS-1 will entrain, impinge, or otherwise affect pallid sturgeon eggs or larvae is low. Hazleton (1979) collected adult and juvenile fish from seven locations in the vicinity of CNS-1 from 1970 through 1978 and reported no pallid sturgeon captured. They also conducted impingement sampling from 1974 through 1978 and reported no pallid sturgeon impinged. Based on 374 trawl hauls that captured over 21,735 fish in a 1998 through 2000 survey, Hrabik et al. (2007) concluded pallid sturgeon may reproduce in the lower Missouri River and the upper and lower Mississippi River, although no fish may survive to recruitment. NPPD's involvement in the conservation agreement for pallid sturgeon; however, could have a positive impact on the population.

The information available indicates that NRC level of impact associated with license renewal is SMALL. Although NRC also concludes that the continued operation of CNS-1 for an additional 20 years may affect, but is not likely to adversely affect, the pallid sturgeon, the NRC staff prepared a biological assessment, which appears in Appendix D.

4.7.2 Terrestrial Species

An evaluation of impacts to threatened and endangered terrestrial species requires consultation with appropriate agencies to determine whether or not such species are present and whether or not these species would be adversely affected by continued operation of the CNS-1 site during the license renewal term.

NPPD has coordinated efforts with the USFWS to address the potential risk of Federally-listed migratory birds colliding with transmission line NPPD TL3502, as discussed in section 2.2.7.

Four Federally-listed endangered and threatened species, the Indiana bat (*Myotis sodalis*), the western prairie fringed orchid (*Platanthera praeclara*), the piping plover, and the interior least tern are potentially found in the vicinity of the CNS-1 site (NPPD, 2008). Seven Federally-listed species are also found or potentially found within the counties spanning the transmission line corridor, including the western prairie fringed orchid, the Salt Creek tiger beetle (*Cincindela nevadica lincolniana*), the black-footed ferret (*Mustela nigripes*), the interior least tern, the piping plover, the Eskimo curlew (*Numenius borealis*), and the only known wild population of whooping cranes (USFWS 2007; USFWS 2008; USFWS 2009). The Eskimo curlew is listed as extirpated from Nebraska, and is globally extinct or near-extinct (NatureServe, 2009).

There are 115 State-listed threatened or endangered species that occur or have the potential to occur in the vicinity of CNS-1 in Nemaha County, within the counties spanning the transmission line corridor in Nebraska, and in Atchison County, Missouri (NGPC, 2008; MDC, 2009b). These 115 species are listed in Table 2.2.7-1 along with information on their habitat requirements. No longer included in this list is the American bald eagle (*Halieatus leucocephalus*), which was formerly a Federally-listed bird. There is an active bald eagle's nest on the Missouri side of the CNS-1 property with a breeding pair of eagles that have produced a number of chicks over the past several years (NPPD, 2008). Although no longer protected under the Endangered Species Act (ESA), the bald eagle is still protected under the Migratory Bird Treaty Act, and is also protected under the Bald and Golden Eagle Protection Act from any take of a bald eagle without a permit. According to the ER, NPPD attempts to minimize disturbance to the eagles during the infrequent site activities performed on the Missouri side of the CNS-1 site (NPPD, 2008).

The staff requests that NPPD report the existence of any Federally-listed or State-listed endangered or threatened species within the CNS-1 site or near the transmission line corridor to NGPC, MDC, and the USFWS, if any such species are identified during the license renewal term. In addition, the NPPD is required to promptly report to the appropriate wildlife management agencies and to NRC, any evidence of injury to, or mortality of, migratory birds or threatened or endangered species observed within the transmission line corridor, especially injury to, or mortality of, Federally-listed whooping cranes, interior least terns, and piping plovers along the Platte River near the western limit of CNS-1 transmission line NPPD TL3502, near Grand Island, NE.

From the review of the available information, NRC staff finds that operation of the CNS-1 site and its associated transmission lines has not been known to, nor is it expected to, adversely affect any threatened or endangered species during the license renewal term. Mitigation measures currently in place at the CNS-1 site include bird flight diverters on the transmission lines within the CNS-1 facility, minimization of activity near the eagle's nest on the Missouri side of the CNS-1 site, a right-of-way (ROW) vegetation management program, and best management practices. The NPPD is also coordinating with USFWS staff to install bird diverters on transmission line NPPD TL3502 where it traverses the Platte River. These bird flight diverters will minimize potential impacts to whooping cranes, interior least terns, piping plovers, and other migratory birds. All of these current and proposed mitigation measures minimize the effects of plant operation on terrestrial species, and are found to be adequate. Therefore, the NRC staff concludes that adverse impacts to threatened or endangered species during the license renewal term would be SMALL.

4.8 HUMAN HEALTH

Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 contains more information on these issues. The human health issues applicable to CNS-1 are discussed below and listed in Table 4-5 for Category 1, Category 2, and uncategorized issues.

Table 4-5. Human Health Issues

Issues	GEIS Section	Category
Microbiological organisms (occupational health)	4.3.6	1
Microbiological organisms (public health, for plants using small rivers)	4.3.6	2
Noise	4.3.7	1
Radiation exposures to public (license renewal term)	4.6.1, 4.6.2	1
Occupation radiation exposures (license renewal term)	4.6.3	1
Electromagnetic fields – acute effects (electric shock)	4.5.4.1	2
Electromagnetic fields – chronic effects	4.5.4.2	Uncategorized

4.8.1 Generic Human Health Issues

The staff did not identify any new and significant information during its review of the NPPD's ER, the site audit, or the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff in the GEIS concluded that the impacts are SMALL, and additional site-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

CNS-1 conducts an annual radiological environmental monitoring program (REMP) in which radiological impacts to the employees, the public, and the environment in the environs around the CNS-1 site are documented. The report contains a discussion of the data relative to pre-plant operation baseline data. The objectives of the REMP include the following:

- Measure and evaluate the levels of radiation and radioactive material in the environs around the CNS-1 site to assess the radiological impacts, if any, of plant operation on the environment.
- Supplement the results of the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive material and levels of radiation are not higher than expected based on the measurement of radioactive effluents and modeling for the applicable exposure pathways.
- Demonstrate compliance with the requirements of applicable Federal regulatory agencies.

Two reports summarize radiological information about the CNS-1 site; the annual radiological environmental operating report and the annual radioactive effluent release report. The media samples are intended to be representative of the radiation exposure pathways to the public from all plant radioactive effluents. The REMP measures the aquatic, terrestrial, and atmospheric environment, as well as the ambient gamma radiation, for radioactivity. Ambient gamma radiation pathways include radiation from buildings and plant structures and airborne material that may be released from the plant. In addition, the REMP also measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon). Thermoluminescent dosimeters (TLDs) are used to measure direct radiation. The atmospheric environmental monitoring consists of sampling the air for particulates and radioiodine. Terrestrial environmental monitoring consists of analyzing samples of milk and food products. The aquatic environmental monitoring consists of analyzing samples of surface water, drinking water, ground water, fish, and sediment from the Missouri River. There is also an onsite ground water protection program designed to monitor the onsite plant environment for indications of leaks from plant systems and pipes carrying radioactive liquid.

The NRC staff reviewed the CNS-1 radioactive environmental operating reports for 2003 through 2007 to look for any significant impacts to the environment or any unusual trends in the data (NPPD 2004, 2005, 2006, 2007, 2008e). The staff's review of the REMP reports showed no unusual trends in the data and showed no measurable impact from the operations at CNS-1 on the environment.

Historical data on radioactive releases from CNS-1 and the resultant dose calculations demonstrate that the amount of radiation received to a hypothetical maximally exposed individual in the vicinity of CNS-1 is a small fraction of the dose limits specified in 10 CFR Part 20, the as low as reasonably achievable (ALARA) dose design objectives in Appendix I to 10 CFR Part 50, and the EPA's radiation standards in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." Dose estimates for members of the public are calculated based on liquid and gaseous effluent release data and atmospheric and aquatic transport models. The CNS-1 2007 annual radioactive effluent release report (NPPD, 2008f) contains a detailed presentation of the radioactive discharges and the resultant calculated doses. The following summarizes the calculated hypothetical maximum dose to an individual located at the CNS-1 site boundary from radioactive liquid and gaseous effluents released during 2007:

- The maximum whole-body dose to an offsite member of the general public from liquid effluents was 0 milliroentgen equivalent man (mrem) (0 mSv (milli-siervert)) because there were no radioactive liquid discharges during 2007. In 2006, the maximum whole-body dose to an offsite member of the general public from liquid effluents was 0.1326 mrem (0.0031mSv), which is below the 3 mrem (0.03 mSv) dose criteria in Appendix I to 10 CFR Part 50.

- The maximum air dose at the site boundary from gamma radiation in gaseous effluents was 6.22 E-04 milliradiation absorbed dose (mrad) (6.22 E-6 mGy), which is below the 10 mrad (0.05 mGy (milligray)) dose criteria in Appendix I to 10 CFR Part 50.

- The maximum air dose at the site boundary from beta radiation in gaseous effluents was 4.03 E-04 mrad (4.03 E-06 mGy), which is below the 20 mrad dose criteria in Appendix I to 10 CFR Part 50.

- The maximum whole-body dose to an offsite member of the general public from direct radiation shine was approximately 0.5 mrem (0.005 mSv). (NPPD; 2009a)

The NRC staff's reviewed and assessed the CNS-1 radioactive waste system performance in controlling radioactive effluents and the resultant doses to members of the public in conformance with the ALARA criteria. The NRC staff found that the 2007 radiological data for CNS-1 are consistent, with reasonable variation attributable to operating conditions and outages and with the 5-year historical radiological effluent releases and resultant doses (NPPD, 2004a, 2005a, 2006a, 2007a, 2008f). These results demonstrate that CNS-1 is operating in compliance with Federal radiation protection standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190. Continued compliance with regulatory requirements is expected during the license renewal term; therefore, the impacts from radioactive effluents are not expected to change during the license renewal term.

The applicant has no plans to conduct refurbishment activities during the license renewal term. The applicant is expected to maintain radiological releases in accordance with its Offsite Dose Assessment Manual (ODAM) and regulatory requirements as it has in the past. Thus, their radiological effluent releases are not expected to be significantly different from the historical radiological effluent releases. The dose to a maximally exposed individual in the vicinity of CNS-1 for the refurbishment period is expected to continue to be a small fraction of the limits and standards specified in 10 CFR Part 20, Appendix I to 10 CFR Part 50, and 40 CFR Part 190.

4.8.2 Microbiological Organisms

The effects of thermophilic microbiological organisms on human health, listed in Table B-1 of Appendix to Subpart A of 10 CFR Part 51, are categorized as a Category 2 issue and require plant-specific evaluation during license renewal process for the plants located on the small river, that use closed-cycle cooling. The average annual flow of the Missouri River at the nearest point to a CNS-1 measuring station is approximately 1.2×10^{12} ft^3/yr (3.4×10^{10} m^3/yr), which is less than 3.15x1012 ft3/year (9x1010m3/year), the rate for which an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water is required by 10 CFR 51.53(c)(3)(ii)(G). Therefore, the effects on public health must be addressed.

The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of the enteric pathogens such as *Salmonella* spp. and *Shigella* spp., the *Pseudomonas aeruginosa* bacterium, the pathogenic strain of the free-living amoebae *Naegleria* spp., and *Legionella* spp. bacteria (NRC, 1996). Thermophilic microorganisms generally occur at temperatures of 77 °F to 176 °F (25 °C to 80 °C) with an optimal growth temperature range of 122 °F–150 °F (50 °C– 66 °C), minimum and maximum temperature tolerances of 68 °F (20 °C) and 158 °F (70 °C), respectively; however, thermal preferences and tolerances vary across bacterial groups. Pathogenic thermophilic microbiological organisms that are of concern during nuclear power reactor operation typically have optimal growing temperatures of approximately 99 °F (37 °C) (Joklik and Smith, 1972).

Pseudomonas aeruginosa is an opportunistic pathogen that causes serious and sometimes fatal infections in immunocompromised individuals. The organism produces toxins harmful to humans and animals. It has an optimal growth temperature of 99 °F (37 °C) (Todar, 2007) *Legionella* spp. consists of at least 46 species and 70 serogroups. It is responsible for Legionnaires' disease, with the onset of pneumonia in the first two weeks of exposure. Risk groups for *Legionella* spp. include elderly, cigarette smokers, persons with chronic lung or immunocompromising diseases, and persons receiving immunosuppressive drugs.

The ambient temperatures of the Missouri River near CNS-1 vary from freezing (approximately 32 °F (0 °C)) in the winter to 87 °F–89 °F (30.5 °C–31.6 °C) in the summer; therefore, ambient river conditions are not likely to support the proliferation of the pathogenic organisms of concern. According to the data submitted by NPPD to the NDEQ for the period January 2003 to September 2005, the mean monthly average temperature of the thermal discharge at outfall 001 was 75.7 °F (24.3 °C). The reported maximum daily temperature, which occurs temporarily for the short time during periodic condenser backwash, was 109.2 °F (42.9 °C). The highest monthly average discharge temperature was 101.7 °F (38.7 °C) in August 2003 and 101.3 °F (38.5 °C) in July 2005, which is consistent with the historical data showing that monthly average discharge temperatures at or above 95 °F (35 °C) occur only during July and August. Ambient temperatures of the Missouri River stay below 77 °F (25 °C) from October to April; therefore, ambient river conditions are not likely to support the proliferation of pathogenic organisms of concern.

NPPD consulted the Nebraska Department of Public Health and Human Services (DHHS) and the Missouri Department of Public Safety (DPS) to determine if there was any concern about the potential occurrence of thermophilic microbiological organisms in the Missouri River at the CNS-1 location. Nebraska DHHS and Missouri DPS stated that no occurrences of infections caused by *Naegleria fowleri* from the Missouri River in the CNS-1 vicinity were documented (NPPD, 2008).

Available data assembled into biannual reports by the Center for Disease Control (CDC) for the years 1999 to 2006 (CDC 2000, 2002, 2004, 2006) indicate no occurrence of waterborne disease outbreaks in the State of Nebraska resulting from exposure to the thermophilic microbiological organisms *Naegleria fowleri* and *Pseudomonas aeruginosa* from the operation of CNS-1.

The NRC staff reviewed all documents, applicable to this Category 2 issue, including NPPD's ER, NPDES permit, and CDC reports. The NRC staff concludes that, thermophilic microbiological organisms are not likely to present a public health hazard as a result of CNS-1 discharges to the Missouri River.

The NRC staff concludes that impacts on public health from thermophilic microbiological organisms from continued operation of CNS-1 in the license renewal period would be SMALL.

4.8.3 Electromagnetic Fields – Acute Shock

Based on the GEIS, the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been a problem at most operating plants and generally is not expected to be a problem during the period of extended operation; however, a site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines within the scope of the SEIS.

The GEIS states that it is not possible to determine the significance of the electric shock potential without a review of the conformance of each nuclear plant transmission line with National Electric Safety Code (NESC) (Institute of Electrical and Electronics Engineers (IEEE) 2007) criteria. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents.

All transmission lines associated with CNS-1 were constructed in accordance with NESC and industry guidance in effect at that time (1973). The transmission facilities are maintained to ensure continued compliance with current standards. The transmission line assessment program, implemented at CNS-1, ensures continued monitoring and documenting of current conditions of the transmissions lines, along with maintenance, and compliance with current standards. Bimonthly aerial patrols and additional special patrols after severe storms are performed in order to identify any ground clearance problems and the integrity of the transmission line structures. Ground inspections are conducted by transmission line technicians on an annual basis (NPPD, 2008).

Since the lines were constructed, a new criterion has been added to the NESC for power lines with voltages exceeding 98 kV. NPPD has reviewed the transmission line clearances and configurations for compliance with this criterion (NPPD, 2008) and determined that all transmission lines within the scope of this review meet the NESC code. No induced shock hazard to the public should occur, since the lines are operating within original design specifications and meet current NESC clearance standards.

The NRC staff has reviewed the available information, including the applicant's evaluation and computational results. Based on this information, the NRC staff evaluated the potential impacts for electric shock resulting from the operation of CNS-1 and its associated transmission lines. NRC staff concludes that the potential impacts from electric shock during the renewal period would be SMALL.

4.8.4 Electromagnetic Fields–Chronic Effects

In the GEIS, the chronic effects of 60-Hz EMFs from power lines were not designated as Category 1 or 2, and will not be until a scientific consensus is reached on the health implications of these fields. The Commission rules do not require the license renewal application to include information on this issue.

4.9 SOCIOECONOMICS

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-6. As stated in the GEIS, the impacts associated with these Category 1 issues were determined to be SMALL, and plant-specific mitigation measures would not be sufficiently beneficial to be warranted.

NRC staff reviewed and evaluated the CNS-1 ER, scoping comments, other available information, and visited CNS-1 in search of new and significant information that would change the conclusions presented in the GEIS. No new and significant information was identified during this review and evaluation. Therefore, it is expected that there would be no impacts related to these Category 1 issues during the renewal term beyond those discussed in the GEIS.

Table 4-6. Category 1 Issues Applicable to Socioeconomics during the Renewal Term

Issues	GEIS Section	Category
Public Services: public safety, social services, and tourism and recreation	4.7.3.3; 4.7.3.4; 4.7.3.6	1
Public Services: education (license renewal)	4.7.3.1	1
Aesthetic Impacts (license renewal term)	4.7.6	1
Aesthetic impacts of transmission lines (license renewal term)	4.5.8	1

4.9.1 Generic Socioeconomic Issues

The following briefly describes the GEIS conclusions, as stated in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, for each of the socioeconomic Category 1 issues:

> Public services: public safety, social services, and tourism and recreation**.** Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

> Public services: education (license renewal term). Only impacts of small significance are expected.

> Aesthetic impacts (license renewal term). No significant impacts are expected during the license renewal term.

> Aesthetic impacts of transmission lines (license renewal term). No significant impacts during the license renewal term.

No new and significant information was identified for these issues during the review. Therefore, it is expected that there would be no impacts during the renewal term beyond those discussed in the GEIS.

Table 4-7 lists the Category 1 socioeconomic issues, which require plant-specific analysis, and an environmental justice impact analysis, that was not addressed in the GEIS.

Table 4-7. Category 1 Issues Applicable to Socioeconomics and Environmental Justice during the Renewal Term

Issues	GEIS Section	Category
Public Services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6	1
Public Services: education (license renewal)	4.7.3.1	1
Aesthetic Impacts (license renewal term)	4.7.6	1
Aesthetic impacts of transmission lines (license renewal term)	4.5.8	1
Environmental Justice	Not addressed[a]	Uncategorized[a]

[a] Guidance related to environmental justice was not in place at the time the GEIS was prepared. Environmental justice must be addressed in plant-specific reviews.

4.9.2 Housing Impacts

According to the 2000 Census, approximately 18,318 people lived within 20 miles of CNS-1, which equates to a population density of 15 persons per square mile (NPPD, 2008). The NRC staff defined in the GEIS this density to be most sparse (less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles) and determined it to be Category 1. Approximately 160,211 people live within 50 miles of CNS-1 (NPPD, 2008). This equates to a population density of 20 persons per square mile. Applying the GEIS proximity measures, CNS-1 is classified as proximity. Category 1 (no city with 100,000 or more persons and less than 50 persons per square mile within 50 miles). Therefore, according to the sparseness and proximity matrix presented in the GEIS, rankings of sparseness Category 1 and proximity Category 1 result in the conclusion that CNS-1 is located in a low population area.

Since Nemaha, Otoe, Richardson, and Atchison counties are not subject to growth control measures that would limit housing development, any changes in employment at CNS-1 would have little noticeable effect on housing availability in these counties. Since NPPD has no plans to add non-outage employees during the license renewal period, employment levels at CNS-1 would remain relatively constant with no additional demand for permanent housing during the license renewal term. Based on this information, there would be no additional impact on housing during the license renewal term.

4.9.3 Public Services: Public Utility Impacts

In Section 4.7.4 of the GEIS, the staff defined impacts on public utility services as SMALL if the existing infrastructure could accommodate any plant-related demand without a noticeable effect on the level of service. Impacts are defined as MODERATE if the demand for service or use of the infrastructure is sizeable and would noticeably decrease the level of service or require additional resources to maintain the level of service. Impacts are defined as LARGE when new programs, upgraded or new facilities, or substantial additional staff is needed because of plant-related demand. In the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant would be impacts on public water supplies.

Analysis of impacts on the public water systems considered both plant demand and plant-related population growth. Section 2.1.3 describes the permitted withdrawal rate and actual use of water for reactor cooling at CNS-1.

Since NPPD has no plans to add non-outage employees during the license renewal period, employment levels at CNS-1 would remain relatively unchanged with no additional demand for public water services. Public water systems in the region would be adequate to meet the demands of residential and industrial customers in the area. Therefore, there would be no additional impact to public water services during the license renewal term.

4.9.4 Offsite Land Use – License Renewal Period

Offsite land use during the license renewal term is a Category 2 issue (10 CFR Part 51, Subpart A, Appendix B, Table B-1). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B notes that “significant changes in land use may be associated with population and tax revenue changes resulting from license renewal.”

In Section 4.7.4 of the GEIS, the NRC staff defines the magnitude of land-use changes as a result of plant operation during the license renewal term as SMALL when there will be little new development and minimal changes to an area's land-use pattern, as MODERATE when there will be considerable new development and some changes to the land-use pattern, and LARGE when there will be large-scale new development and major changes in the land-use pattern.

Tax revenue can affect land use because it enables local jurisdictions to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land-use impacts during the license renewal term should consider (1) the size of the plant's tax payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax driven land-use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided public services to support and guide development. Section 4.7.2.1 of the GEIS states that if new tax payments are less than 10 percent of the taxing jurisdiction's revenue, the significance level would be SMALL. If tax payments are 10 to 20 percent of the community's total revenue, new tax-driven land-use changes would be MODERATE. If tax payments are greater than 20 percent of the community's total revenue, new tax-driven land-use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has limited public services available to support and guide development.

4.9.4.1 *Population-Related Impacts*

Since NPPD has no plans to add non-outage employees during the license renewal period, there would be no plant operations-driven population increase in the vicinity of CNS-1. Therefore, there would be no additional population-related offsite land use impacts during the license renewal term.

4.9.4.2 *Tax Revenue-Related Impacts*

As previously discussed in Chapter 2, NPPD makes annual payments in lieu of taxes (PILOT) to the municipalities and 91 counties in Nebraska where NPPD sells power. Since NPPD started making payments to local jurisdictions, population levels and land use conditions have not changed significantly, which might indicate that these tax revenues have had little or no affect on land use activities within the county. PILOT payments are based upon the gross revenues NPPD receives from electricity sales in the 91 counties, regardless of where the power is generated. The magnitude of the PILOT payments relative to the county's total revenues is not relevant in assessing tax revenue-related offsite land use impacts since NPPD is responsible for producing and distributing electricity and PILOT payments even if the CNS-1 does not produce electricity or the operating license is not renewed.

Since NPPD has no plans to add non-outage employees during the license renewal period, employment levels at the CNS-1 would remain relatively unchanged. Annual PILOT payments would also remain relatively unchanged throughout the license renewal period. Based on this information, there would be no additional tax-revenue-related offsite land use impacts during the license renewal term.

4.9.5 Public Services: Transportation Impacts

Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 states the following:

> Transportation impacts (level of service) of highway traffic generated...during the term of the renewed license are generally expected to be of SMALL significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of MODERATE or LARGE significance at some sites.

All applicants are required by 10 CFR 51.53(c)(3)(ii)(J) to assess the impacts of highway traffic generated by the proposed project on the level of service of local highways during the term of the renewed license and during refurbishment activities.

Since NPPD has no plans to add non-outage employees during the license renewal period and does not plan any refurbishment activities, there would be no noticeable change in traffic volume and levels of service on roadways in the vicinity of CNS-1; therefore, there would be no additional transportation impacts during the license renewal term.

4.9.6 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects of their undertakings on historic properties. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places (NRHP). The criteria for eligibility are listed in 36 CFR 60.4 and include (1) association with significant events in history,(2) association with the lives of persons significant in the past, (3) embodies distinctive characteristics of type, period, or construction, and (4) sites or places that have yielded or are likely to yield important information (ACHP 2009). The historic preservation review process (Section 106 of the NHPA) is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800.

The issuance of a renewed operating license for a nuclear power plant is a Federal action that could affect historic properties on or near the nuclear plant site and transmission lines. In accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to identify historic properties included in or eligible for inclusion in the NRHP in the area of potential effect. The area of potential effect (APE) for license renewal is the nuclear power plant site, transmission lines, and immediate environs. If historic properties are present, the NRC is required to contact the State Historic Preservation Office (SHPO), assess the potential impact, and resolve any possible adverse effects of the undertaking (license renewal) on historic properties. NRC is also required to notify the SHPO if historic properties would not be affected by license renewal or if no historic properties are present.

NPPD contacted the Missouri SHPO and the Nebraska State Historical Society (NSHS) in January 2008, requesting information on historic and archaeological resources in the vicinity of CNS-1 and described the proposed action (license renewal) (NPPD, 2008). The NSHS responded in February 2008 that the proposed action (license renewal) would have no effect on historic structures (NPPD, 2008). The Missouri SHPO requested that an “historic architectural and archaeological survey” be conducted at the CNS-1 (NPPD, 2008). In response to the Missouri SHPO’s request, NPPD conducted a survey and submitted a Phase 1A Literature Review and Archeological Sensitivity Assessment along with NPPD’s “Cultural Resources Protection Plan” in May 2008 (NPPD, 2008). In June 2008, the Missouri SHPO concurred with the conclusions in NPPD’s archaeological assessment (NPPD, 2008).

In accordance with 36 CFR 800.8(c), the NRC contacted the Missouri SHPO (NRC, 2008a), the NSHS (NRC, 2008b), the Advisory Council on Historic Preservation (NRC, 2008c), and Federally-recognized American Indian Tribes to initiate Section 106 consultation. These letters are presented in Appendix D.

In April 2007 and March 2008, NPPD contracted with Enercon Services, Inc. to conduct an "historic architectural and archaeological survey" of the CNS-1 site. A report, *Phase 1A Literature Review and Archeological Sensitivity Assessment of the Cooper Nuclear Station, Nemaha County, Nebraska, Atchison County Missouri*, prepared by Enercon Service for NPPD (did not conduct any subsurface testing. The survey determined that 55 acres of the site were heavily disturbed by construction of the CNS-1 facility and some of the lands have and continue to be farmed. The study identified one prehistoric site (Whitten) adjacent to CNS-1 property, two prehistoric lithic scatters, and three former house (farm) sites. All surface structures associated with the earlier house sites have been demolished; however, remnants of these buildings remain as historic archaeological sites and could be eligible for inclusion to the NRHP under Criteria A and D pending further research. Additionally, Lewis and Clark were known to have camped in the vicinity of CNS-1. The exact location of this campsite has never been determined.

As discussed in Section 2.2.9, a search of the NSHS site files identified no previously recorded historic properties on CNS-1 property; however, the Enercon report indicates that portions of the Whitten site could extend onto CNS-1 property. A formal archaeological survey of the CNS-1 site has not been completed; however, a number of archaeological and historical research studies have been conducted in both Nemaha and Atchison counties. These surveys identified several historic and archaeological sites within a 6-mile radius of CNS-1. The resources found during these surveys tend to occur on the same landforms that occur on the CNS-1 property suggesting that there is a potential for deeply buried undiscovered historic and archaeological resources on the plant property.

The Whitten archeological site (25NH4) is a prehistoric mound (Plains Woodland) site excavated in the late 1930s. It is unclear from the archaeological site description if the Whitten site was located entirely on private property north of CNS-1, or if the site extended onto the CNS-1 property. Human remains, grave goods, and other artifacts were recovered from this site. Artifacts recovered from the site suggest an affiliation with the Sterns Creek variant of the Plains Woodland tradition (Gibbon and Ames, 1998). The NSHS site form noted that some of the remains were sent to the U.S. National Museum in accordance with a Works Progress Administration contract (NSHS, 1937). Historic records indicate that the entire bluff was surveyed from CNS-1 property to the city of Nemaha. During Enercon's 2007 and 2008 walkovers, no additional burial mounds were identified; however, there remains a potential for additional prehistoric sites (camp sites) to be in the area. During NRC's walkover survey, the staff noted the presence of prehistoric and historic artifacts on CNS-1 property.

The William Dawson House (Site # NH00-69), located in the southwest corner of the site near the bluff, was recorded in Nebraska historic archives but not included on the NRHP. The Dawson House was torn down shortly after it was recorded. No visible remnants of the house remain; however, subsurface portions of the house could remain.

During the environmental site visit, the NRC staff discovered that archaeological surveys were not conducted prior to the construction of the firing range. At that time, NPPD did not have corporate procedures (Cultural Resources Protection Plan) in place. In preparation for license renewal, NPPD contracted with Enercon to survey the site and established a Cultural Resources Protection Plan to acknowledge and improve the protection of archaeological resources at CNS-1. In its plan, NPPD calls for surveys to be conducted by a qualified archaeologist in areas deemed sensitive prior to work commencing.

In addition, during the construction of the independent spent fuel storage installation (ISFSI) pad, soil was removed from the top of the bluff (with consent of the landowner). Archaeological surveys were not conducted prior to this activity. NPPD has since taken corrective actions to ensure that all aspects of its Cultural Resources Protection Plan are followed.

NPPD currently has no planned changes or ground disturbing activities associated with license renewal at CNS-1; however, given the high potential for the discovery of additional historic and archaeological resources at the CNS-1 site, NPPD needs to ensure that these resources are considered during future plant operations and maintenance activities. The CNS-1 is situated in an area where historic and archaeological resources could be located several feet beneath the ground surface. NPPD has instituted a stop work order within its Cultural Resources Protection Plan to ensure that proper notification is taken to protect these resources should they be discovered.

Based on review of NSHS files, archaeological surveys, assessments, and other information, the potential impacts of continued operations and maintenance on historic and archaeological resources at CNS-1 would be SMALL. NPPD could further reduce potential impacts to historic and archaeological resources located at the CNS-1 by training NPPD staff in the Section 106 consultation process and cultural awareness training to ensure that informed decisions are made prior to any ground disturbing activities. In addition, NPPD could also forward its Cultural Resources Protection Plan to the NSHS and the Missouri SHPO for review and comment. This will ensure that historic and archaeological resources are protected at the CNS-1 site. Any revisions to the Cultural Resources Protection Plan should be developed in consultation with the NRC, NSHS, and Missouri SHPO. In addition, lands not surveyed should be investigated by a qualified archaeologist prior to any ground disturbing activity.

4.9.7 Environmental Justice

Under Executive Order (E.O.) 12898 (59 *Federal Register* (FR) 7629) as amended by 60 FR 6381, January 30, 1995, Federal agencies are responsible for identifying and addressing potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. In 2004, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040), which states “The Commission is committed to the general goals set forth in E.O. 12898, and strives to meet those goals as part of its National Environmental Policy Act of 1969 (NEPA) review process.”

The Council on Environmental Quality (CEQ) provides the following information in Environmental Justice: Guidance under the National Environmental Policy Act (NEPA) (1997):

> **Disproportionately High and Adverse Human Health Effects.** When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent

practicable: (a) Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death; and (b) Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and (c) Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards. (CEQ, 1997).

Disproportionately High and Adverse Environmental Effects. When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable: (a) Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment; and (b) Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and (c) Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards. (CEQ, 1997).

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from the operation of CNS-1 during the renewal term. In assessing the impacts, the following CEQ (1997) definitions of minority individuals and populations and low-income population were used:

Minority. Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

Minority populations. Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.

Low-income population. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the U. S. Census Bureau's (USCB) Current Population Reports, Series PB60, on Income and Poverty.

4.9.7.1 *Minority Population in 2000*

The 50-mile radius around CNS-1 includes 24 counties with nine in Nebraska, six in Kansas, five in Iowa, and four in Missouri. The geographic area includes any census block with all or part of its area within the 50-mile radius. According to 2000 census data, 4.3 percent of the population (approximately 160,248 individuals) residing within a 50-mile (80 km) radius of CNS-1 identified themselves as minority individuals. The largest minority group was Hispanic or Latino (2,295 persons or 1.4 percent), followed by American Indian (2,366 or about 1.5 percent) (USCB, 2003 – LandView 6). About 2.9 percent of the Nemaha County population identified themselves as minorities, with Hispanic or Latino being the largest minority group (1.0 percent) followed by some other race (0.7 percent) (USCB, 2009) (see Table 2.2.8.5–2).

Populations within each state were considered individually and as a four-state geographic area. A combined or aggregate population of the four-state area was calculated based on these state populations.

Approximately 370 (individual state method) to 380 (four-state combined method) blocks within 50 miles of CNS-1 were determined to have high density minority population percentages that exceeded the state average by 20 percentage points or more. The largest number of high density minority blocks was Hispanic or Latino, with 160 (four-state combined) to 170 (individual state) blocks that exceed the state average by 20 percent or more. The greatest concentrations of high density minority population blocks are located nearly 50 miles south of CNS-1 in Brown County, Kansas, and approximately 30 miles south-southeast of CNS-1 where the Nebraska-Kansas-Missouri state borders come together. The closest high density minority population is located approximately 10 miles west of CNS-1, near Nemaha (NPPD, 2008).

The Sac and Fox and Iowa Indian Reservations straddle the border of Nebraska (Richardson County) and Kansas (Brown and Doniphan counties). The Kickapoo Indian Reservation is located south of CNS-1 in Brown County, Kansas.

Based on 2000 census data, Figure 4-1 (individual state method) and Figure 4-2 (four-state combined method) show the locations of high density minority blocks within a 50-mile radius of CNS-1.

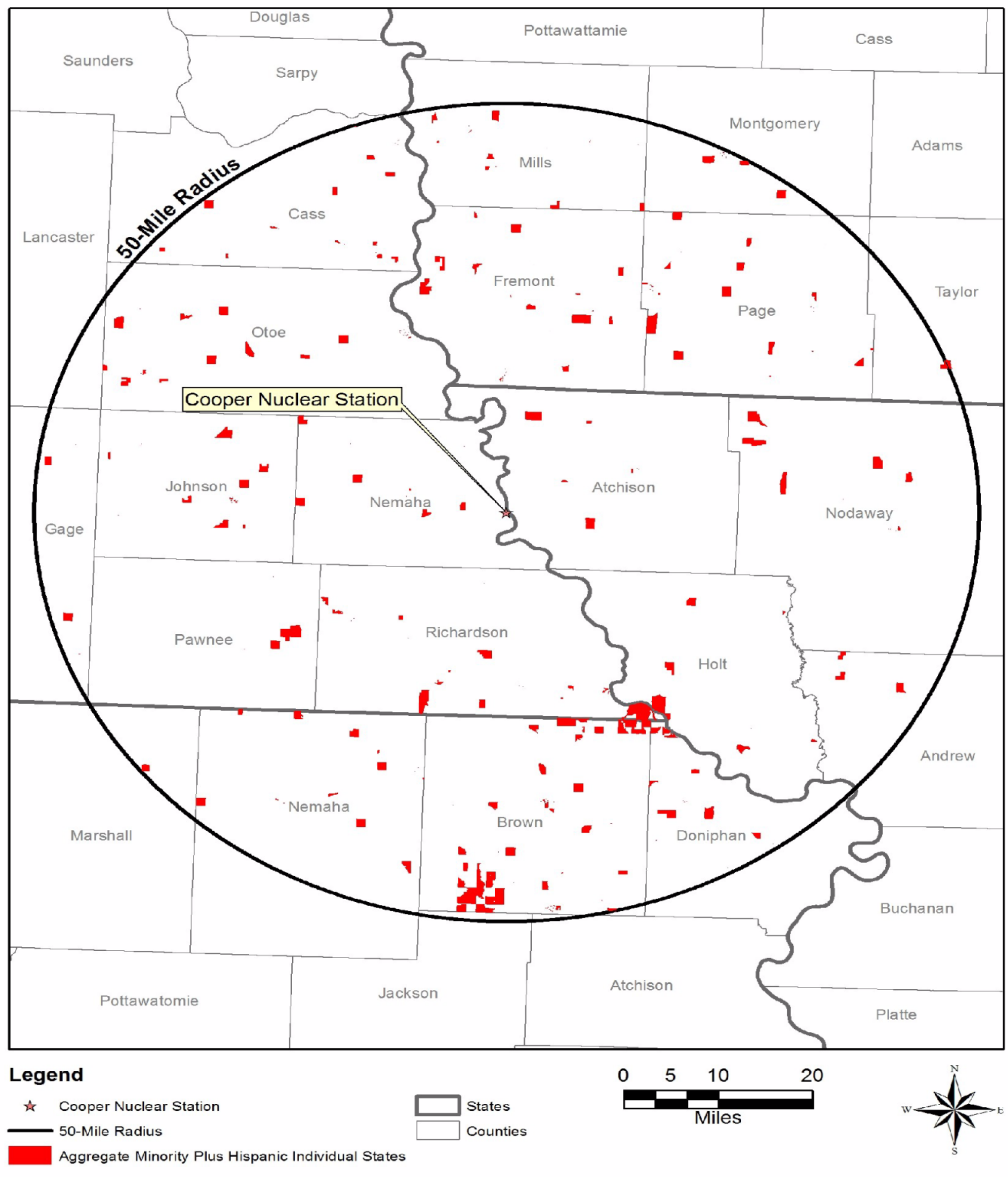

Figure 4-1. Minority Blocks in 2000 within a 50-Mile Radius of Cooper Nuclear Station (Individual State) *(Source: USCB, 2008)*

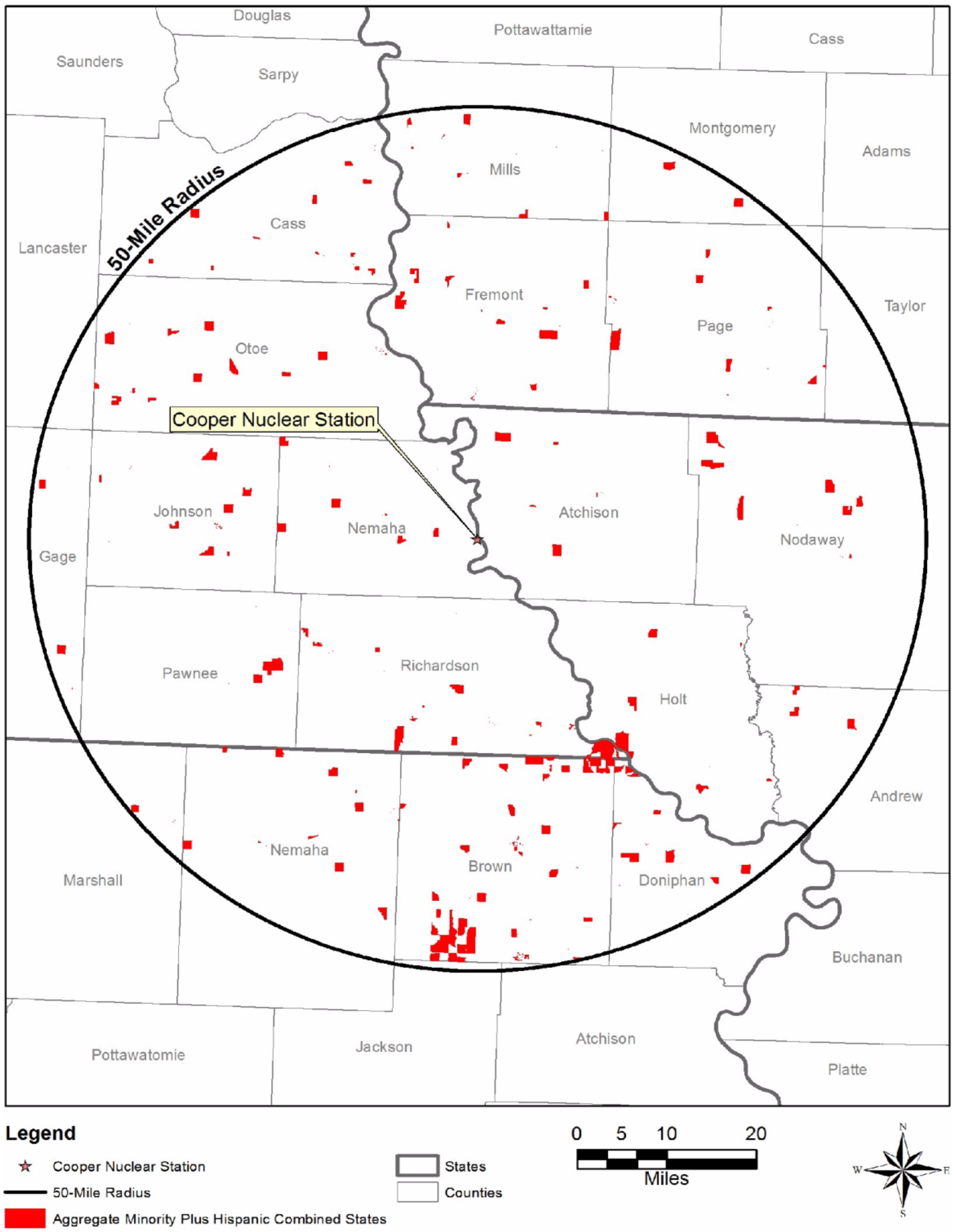

Figure 4-2. Minority Blocks in 2000 within a 50-Mile Radius of Cooper Nuclear Station (Combined State) *(Source: USCB, 2008)*

4.9.7.2 *Low-Income Population in 2000*

According to 2000 census data, approximately 3,100 families and 16,000 individuals (approximately 7.3 and 10.1 percent, respectively) residing within a 50-mile radius of CNS-1 were identified as living below the Federal poverty threshold in 1999 (USCB, 2003-LandView 6). The 1999 Federal poverty threshold was $17,029 for a family of four.

According to census data estimates, the median household income for Nebraska in 2007 was $47,072, with 11.1 percent of the state population living below the Federal poverty threshold.

Nemaha County had a lower median household income average ($41,024) and a higher percentage (13.3 percent) of individuals living below the poverty level when compared to the state average. Richardson County had the lowest median household income of the four counties ($36,092) and a higher percentage (13.4 percent) of individuals living below the poverty level when compared to the state. Otoe County had the highest median household income ($45,018) and the lowest percentage (9.4 percent) of individuals living below the poverty level among the four counties (USCB, 2008). Atchinson County, Missouri, had a lower median household income average ($38,114) than the state and the highest percentage (14.0 percent) of individuals living below the poverty level among the four counties. The median household income for Missouri in 2007 was $45,012, with 13.3 percent of the state population living below the Federal poverty threshold (USCB, 2009).

Census block groups were considered high density low-income block groups if the percentage of households below the Federal poverty threshold exceeded the state average by 20 percent or more. Based on 2000 census data, there were 192 block groups within the 50-mile radius of CNS-1 that exceeded the state average for low income households by 20 percent or more. The majority of census block groups with low-income populations were located in two counties, Page County and Nodaway County in Missouri (NPPD, 2008). Figure 4-3 (individual state method) and Figure 4-4 (four-state combined method) show the location of high density low-income census block groups within a 50-mile radius of CNS-1.

Figure 4-3. Low-Income Block Groups with a 50-Mile Radius of Cooper Nuclear Station (Individual States) *(Source: USCB, 2008)*

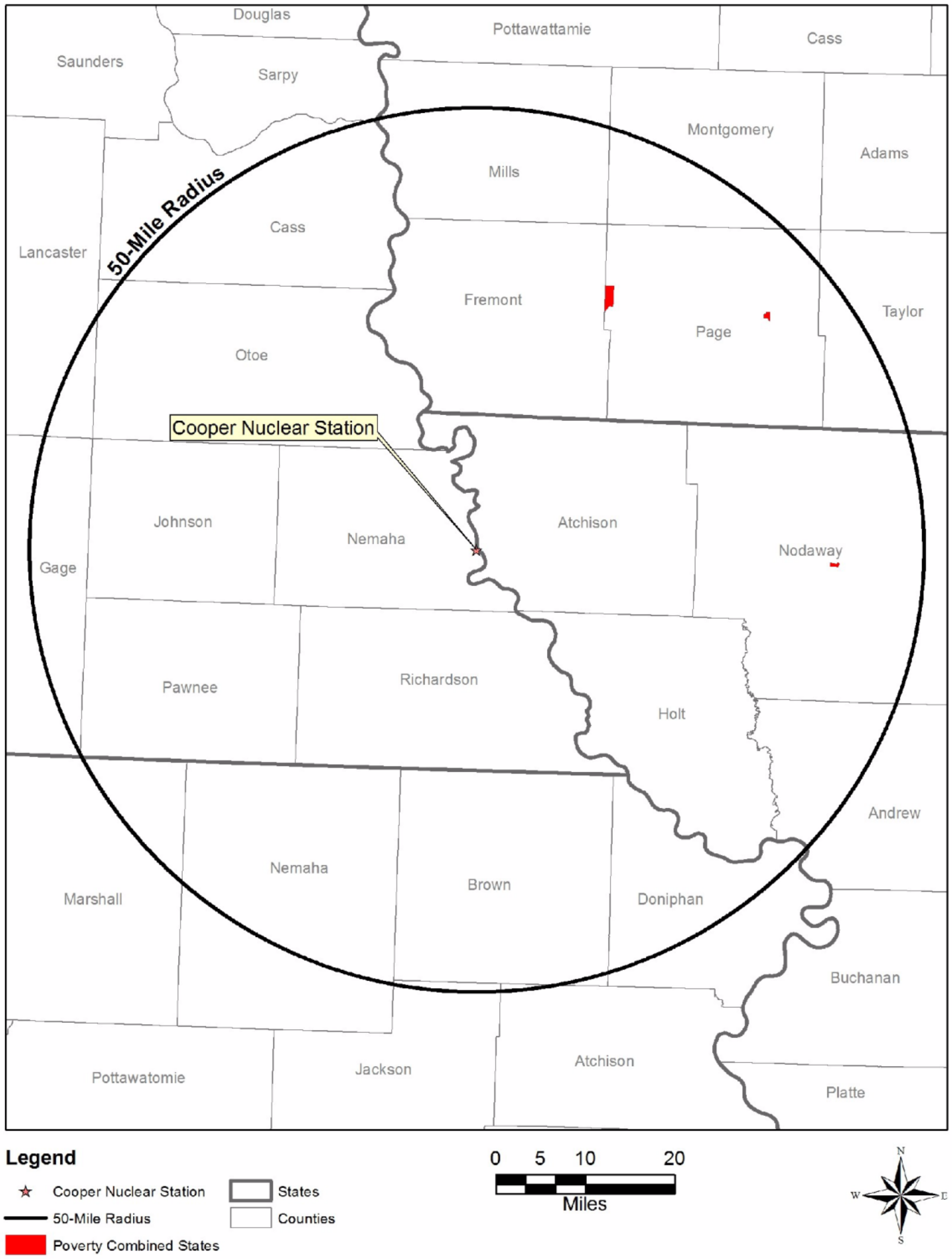

Figure 4-4. Low-Income Block with a 50-Mile Radius of Cooper Nuclear Station (Combined States) *(Source: USCB, 2008)*

4.9.7.3 *Analysis of Impacts*

Consistent with the impact analysis for the public and occupational health and safety, the affected populations are defined as minority and low-income populations who reside within a 50-mile radius of the CNS-1. Based on the analysis of environmental health and safety impacts presented in Chapter 4 of this SEIS for other resource areas, there would be no disproportionately high and adverse impacts to minority and low-income populations from the continued operation of the CNS-1 during the license renewal period.

NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area. This analysis is presented below.

4.9.7.4 *Subsistence Consumption of Fish and Wildlife*

Section 4-4 of Exec. Order No. 12898 (1994) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations that rely principally on fish and wildlife for subsistence and to communicate the risks of these consumption patterns to the public. NRC considered whether or not there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. Special pathways that took into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals in the vicinity of CNS-1 were considered.

NPPD has an ongoing comprehensive REMP at CNS-1 that assesses the radiological impact of site operations on the environment. Radiological environmental monitoring began at CNS-1 in 1971 before the plant became operational. The REMP program monitors radiation levels in air, terrestrial, and aquatic environments. All samples are collected by NPPD personnel and are shipped to a laboratory for analysis.

To assess the radiological impact of the plant on the environment, the monitoring program at CNS-1 uses indicator-control sampling. Samples are collected at nearby indicator locations downwind and downstream from the plant and at distant control locations upwind and upstream from the plant. A plant effect would be indicated if the radiation level at an indicator location was significantly larger than at the control location. The difference would also have to be greater than could be accounted for by typical fluctuations in radiation levels arising from other naturally-occurring sources.

Samples are collected from the aquatic and terrestrial pathways in the vicinity of CNS-1. The aquatic pathways include fish, Missouri River surface water, ground water, and shoreline sediment. The terrestrial pathways include airborne particulates, milk and food product garden (leaf) vegetation, and direct radiation. During 2007, analyses performed on collected samples of environmental media showed no significant or measurable radiological impact from CNS-1 operations (NPPD, 2008)

Aquatic sampling at the CNS-1 consists of semi-annual upstream and downstream collections of fish and shoreline sediments. All samples are analyzed for gamma-emitting isotopes. River water is collected monthly at two locations, one upstream of the plant and one downstream.

Quarterly composites are analyzed for tritium. All results were below the required lower limit of detection (NPPD, 2008).

Sediment samples collected during June and October 2007 were analyzed by gamma spectrometry. A number of naturally occurring radionuclides were detected in these samples. Naturally occurring potassium-40 and thorium-228 were observed in all samples. All other gamma emitters were below their detection limits (NPPD, 2008).

Eight samples of fish were collected during the summer and fall of 2007. A middle-top feeding fish (carp) and a bottom feeding fish (catfish) were collected in June and October**.** These samples were analyzed by gamma ray spectroscopy. Only naturally occurring potassium-40 was detected (NPPD, 2008).

According to the 2007 CNS-1 REMP, 17 milk samples from the nearest producers were collected and analyzed by gamma ray spectroscopy and for low-level iodine-131 by radiochemical separation. Naturally occurring potassium-40 was measured in all samples. Thorium-228 was measured in one sample. All other gamma emitters were below their detection levels. Four milk samples were collected from other producers. Naturally occurring potassium-40 was detected in all four samples. All other gamma emitters were below their detection levels (NPPD, 2008).

Ground water was collected from two stations quarterly and analyzed for tritium and for gamma emitting radionuclides. One station is located 0.15 miles from the plant and another station 25.8 miles from the plant. Naturally occurring potassium-40 was detected in 2 of 24 samples analyzed. Naturally occurring thorium-228 was detected in 2 of 24 samples analyzed. All other gamma emitters were below their detection levels.

There were 26 broadleaf vegetation samples were collected June through September from three locations during 2007. The samples were analyzed by gamma ray spectroscopy and for low-level iodine-131 by radiochemical separation. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation, was measured in 24 of 26 samples analyzed. Naturally occurring potassium-40 was measured in all 26 samples analyzed. All other gamma emitters were below their detection levels (NPPD, 2008).

The results of the CNS-1 2007 REMP sampling demonstrate that the routine operation at CNS-1 has had no significant or measurable radiological impact on the environment. No elevated radiation levels were detected in the offsite environment as a result of plant operations and the storage of radioactive waste. The results of the REMP continue to demonstrate that the operation of the CNS-1 did not result in a significant measurable dose to a member of the general population or adversely impact the environment as a result of radiological effluents. The REMP continues to demonstrate that the dose to a member of the public from the operation of CNS-1 remains significantly below the Federally required dose limits specified in 10 CFR Part 20, 10 CFR Part 72, and 40 CFR Part 190.

Based on recent monitoring results, concentrations of contaminants in native leafy vegetation, soils and sediments, surface water, and fish in areas surrounding CNS-1 have been quite low (at or near the threshold of detection) and seldom above background levels. Consequently, no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

4.10 EVALUATION OF NEW AND POTENTIALLY SIGNIFICANT INFORMATION

New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is different from the finding presented in the GEIS and codified in 10 CFR Part 51.

In preparing to submit its application to renew the CNS-1 operating license, NPPD developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for CNS-1 would be properly reviewed before submitting the ER, and to ensure that such new and potentially significant information would be identified, reviewed, and assessed during the NRC review period. NPPD reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to CNS-1. This review was performed by personnel from CNS-1 and its support organization that were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal ER. NRC also has a process for identifying new and significant information. That process is described in detail in NUREG-1555, Supplement 1, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC, 2000). The search for new information includes (1) review of an applicant's ER and the process for discovering and evaluating the significance of new information; (2) review of records of public comments; (3) review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the NRC staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of the relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information.

The NRC staff has not identified any new and significant information on environmental issues listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, related to the operation of CNS-1 during the period of license extension. The NRC staff also determined that information provided during the public comment period did not identify any new issues that require site-specific assessment. The NRC staff reviewed the discussion of environmental impacts in the GEIS (NRC, 1996) and conducted its own independent review (including the public scoping meetings held in February 2009) to identify new and significant information.

4.11 CUMULATIVE IMPACTS

The NRC staff considered potential cumulative impacts in the environmental analysis of continued operation of CNS-1. For the purposes of this analysis, past actions are those related to the resources at the time of the power plant licensing and construction. Present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of plant operation including the period of extended operation. Therefore, the analysis considers potential impacts through the end of the current license terms as well as the 20-year renewal license term. The geographic area over which past, present, and future actions would occur is dependent on the type of action considered and is described below for each impact area.

The impacts of the proposed action, as described in Sections 4.1–4.9, are combined with other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

4.11.1 Cumulative Impacts on Water Resources

NRC staff divided the description and discussion of water resources in previous sections into ground water and surface water issues in order to follow the regulatory structure presented in 10 CFR Part 51 (2009). Hydrologic conditions at CNS-1 and elsewhere within the Missouri River Valley, however, indicate a hydraulic connection between surface and ground water, particularly between the Missouri River and the alluvial aquifer underlying the valley. This connection reveals the possible impact of reduced river flow on ground water levels.

NPPD (2008) reviewed well records and identified 1,400 registered wells within the Nemaha River Basin, which includes the Missouri River below its confluence with the Platte River. Of the wells identified, very few are close to CNS-1. The NGPC installed three wells about 1.5 miles (2.4 kilometers) south of CNS-1, and the city of Auburn, NE has a public water supply well about 1.9 miles (3 kilometers) south. NPPD (2008) also identified some local shallow farm wells within 2 miles (3.2 kilometers) of the plant property. All of the water supply wells in the area are completed either in the Missouri River Valley Aquifer or Glacial Drift Aquifer, which are under unconfined conditions and in hydraulic contact with the Missouri River.

Enercon conducted an operations study of the CNS-1 potable wells which showed an equilibrium radius of influence of between 100 to 1,250 feet (46 to 381 meters) from each well. Enercon's analysis of the drawdown data from the study indicated the radius of influence of CNS-1's wells does not extend outside the CNS-1 property boundary. Because all the CNS-1 wells are in hydraulic connection with the Missouri River, recharge from the river is likely induced by pumping operations. The total maximum pumping rate at CNS-1 of over 1,500 gallons per minute (5,678 liters per minute) is less than one percent of the average flow in the river. Likewise, the influence of offsite pumping should have no measurable effect on ground water levels onsite. Because the cumulative effects of pumping ground water on river flow and vice versa are insignificant, the cumulative impact on water resources in the CNS-1 area is SMALL.

4.11.2 Cumulative Impacts on Electromagnetic Fields and Thermophilic Microbiological Organisms

The continued operation of CNS-1 has a low risk of causing outbreaks from thermophilic microbiological organisms associated with thermal discharges. Available data compiled by the CDC into biannual reports for the years 1999 to 2006 (CDC 2000, 2002, 2004, 2006) indicates no occurrence of the waterborne disease outbreaks in the State of Nebraska resulting from exposure to the thermophilic microbiological organisms *Naegleria fowleri* and *Pseudomonas aeruginosa* due to the operation of CNS-1.

As part of its evaluation of cumulative impacts, the NRC staff also considered the effects of thermal discharges from other facilities on the Missouri River, located within one mile upstream of CNS-1, that are also producing thermal effluents. Such facilities could promote the growth of thermophilic microbiological organisms. The NRC staff did not find any such facilities.

Potential cumulative effects of climate change on the Missouri River basin and local climate, whether or not from natural cycles or anthropogenic activities, could result in a variety of changes to the surface and ground water resources in the Missouri River basin. Nebraska is a part of the Great Plains Region. As projected in the "Global Climate Change Impacts in the United States" report by United States Global Change Research Program (USGCRP) (2009), the temperatures in southeastern Nebraska, where CNS-1 is located, are expected to rise 6 °F (14 °C) by 2080–2099 at minimum and maximum over 10 °F (12 °C), causing more frequent extreme weather events. Increases in average annual temperatures, higher probabilities of extreme heat events, and higher occurrences of extreme rainfall (intense rainfall or drought) could increase Missouri River temperatures and cause degradation of the water supply and its quality. Such conditions could support the proliferation of pathogenic organisms of concern and affect the burden of water-related diseases. The extent and the magnitude of the climate change on human health could be significant (Intergovernmental Panel on Climate Change (IPCC), 2009).

The NRC staff concludes that the thermophilic microbiological organisms are not likely to present a public health hazard as a result of CNS-1 discharges to the Missouri River. The NRC staff concludes that the cumulative impacts on public health from thermophilic microbiological organisms from continued operation of CNS-1 during the license renewal period would be SMALL.

The NRC staff determined that the CNS-1 transmission lines are operating within original design specifications and meet current NESC clearance standards; therefore, the CNS-1 transmission lines do not detectably affect the overall potential for electric shock from induced currents within the analysis area. With respect to the chronic effects of electromagnetic fields, although the GEIS finding of "not applicable" is appropriate to CNS-1, the transmission lines associated with CNS-1 are not likely to detectably contribute to the regional exposure to extremely low frequency electromagnetic fields. Therefore, the NRC staff has determined that the cumulative impacts of continued operation of the CNS-1 transmission lines would be SMALL.

4.11.3 Cumulative Impacts on Aquatic Resources

This section addresses the direct and indirect effects of license renewal when added to the aggregate effects of past, present, and reasonably foreseeable future actions (CEQ, 2005). The direct effects on aquatic resources from an additional 20 years of CNS-1 operation accrue primarily from impingement, entrainment, and heat shock to natural populations and the populations on which they depend through predator-prey, competitive, and other interactions. The cumulative impact is the total effect on the aquatic resources of all actions taken, no matter who has taken the actions (the second principle of cumulative effects analysis in CEQ, 1997). The geographic boundary for assessing cumulative aquatic impacts is somewhat variable and depends on the specific resource, but is generally the lower biological zone of the Missouri River, which extends from Gavins Point Dam to the confluence with the Mississippi River (Galat et al., 2005a and 2005b).

The benchmark for assessing cumulative impacts on aquatic resources takes into account the pre-operational environment as recommended by the EPA (1999) for its review of NEPA documents:

> Designating existing environmental conditions as a benchmark may focus the environmental impact assessment too narrowly, overlooking cumulative impacts of past and present actions or limiting assessment to the proposed action and future actions. For example, if the current environmental condition were to serve as the condition for assessing the impacts of relicensing a dam, the analysis

> would only identify the marginal environmental changes between the continued operation of the dam and the existing degraded state of the environment. In this hypothetical case, the affected environment has been seriously degraded for more than 50 years with accompanying declines in flows, reductions in fish stocks, habitat loss, and disruption of hydrologic functions. If the assessment took into account the full extent of continued impacts, the significance of the continued operation would more accurately express the state of the environment and thereby better predict the consequences of relicensing the dam.

Section 2.2.5 presents an overview of the condition of the Missouri River ecosystem and the history and factors that led to its condition. At present, the Missouri River is a degraded ecosystem that the National Research Council (NRCC) (2002) has said may be close to or perhaps past the point of irreparable change. To determine and illustrate the environmental changes that affect resources in cumulative impact analysis, CEQ (1997) recommends a conceptual model. We present a simple conceptual model for the Missouri River ecosystem in Figure 2.2.5-1 that shows how some environmental factors affect aquatic resources.

The NRCC (2002) identified the following man-induced changes in the Missouri River ecosystem that jeopardize its fundamental natural processes: “the loss of natural flood pulses; the loss of natural low flows; straightening of stream meanders and the elimination of cut-and-fill alluviation; losses of natural riparian vegetation; reductions in water temperature variation; introduction of nonnative species; and extensive bank stabilization and stream channelization.” These changes are due to activities like dam construction that alters flow and water temperature patterns, amplitude and frequency of natural peak flows used by some species as environmental cues for biological processes, and sediment transport and deposition. Land use changes; channelization; and construction of levees and dikes have altered almost three million acres of natural riverine and floodplain habitat. These changes, and more, influence primary productivity and the energy sources for aquatic communities, alter or eliminate natural habitat and habitat diversity required to support some species, and change invertebrate communities and food webs to fish. The NRCC (2002) found that “Of the 67 native fish species living along the mainstem, 51 are now listed as rare, uncommon, or decreasing across all or part of their ranges” and that one of these fish, the pallid sturgeon, is on the Federal Endangered Species List.

In addition to these historic impacts, this section focuses on other facilities that withdraw Missouri River water and introduced species. CNS-1 directly affects Missouri River aquatic communities primarily through impingement, entrainment, and heat shock. Other facilities that withdraw water also impact aquatic communities through at least impingement and entrainment, and for some, also heat shock. The impact of introduction and stocking of native and introduced fish species is also somewhat similar to the impact of CNS-1, because the effect of a power plant that impinges and entrains aquatic organisms is somewhat similar to that of a large predator introduced into an aquatic system.

The number of water consumptive and non-consumptive water intakes that withdraw water from the Missouri River is relatively large (Table 4-8). The cumulative stress from this large number of intakes, of which CNS-1 is one, spread across the length of the river depends on many factors that NRC staff cannot quantify, but which may be significant when added to all the other stresses on aquatic communities.

The States have stocked and released a number of native and introduced game fish into the Missouri River, primarily for sport fishing. Game fish tend to be predators, which may, through predation, affect aquatic communities in a manner somewhat similar to impingement and entrainment. For example, Nelson-Stastny (2004) compiled a list of selected introduced and native fish species stocked or released into the Missouri River in South Dakota in relation to their potential as predators of pallid sturgeon (Table 4-9). That author notes that:

> South Dakota made several stocking attempts with other fish species to try to utilize the newly created reservoir habitat in the South Dakota portion of the Missouri River. The fish species that were previously stocked, but for which stocking was eventually discontinued, include lake whitefish (*Coregonus clupeaformis*), sockeye salmon/kokanee (*Oncorhyncus nerka*), cutthroat trout (*Oncorhyncus clarki*), lake trout (*Salvelinus namaycush*), Bonneville cisco (*Prosopium gemmiferu*), muskellunge (*Esox masquinongy*), and tiger muskellunge (*Esox lucius* x *masquinongy*). Of these, only lake whitefish and tiger muskellunge are occasionally sampled either by anglers or in fish population surveys and these fish are believed to be from original stocking events (i.e., large adults).

This example is from just one of the states in the Missouri River basin. As with water intakes, the cumulative stress from all these introductions spread across the length of the river depends on many factors, which NRC staff cannot quantify but which may be significant when added to all the other stresses on aquatic communities.

While the level of impact due to direct and indirect impacts of CNS-1 on aquatic communities is SMALL, the cumulative impact when combined with all other sources has resulted in the Missouri River aquatic ecosystem being unstable and close to, if not past, the point of reparable change. This condition meets NRC’s definition of a LARGE level of impact.

Table 4-8. Intakes. *Number of consumptive and non-consumptive water intakes that withdraw water from the Missouri River.*

		Number of intakes by location						
Reach	**Lower Boundary (RM)**	**Intakes**						**Total Intakes**
		Power	**Municipal**	**Industrial**	**Irrigation**	**Domestic**	**Public**	
Fort Peck Lake	1,771.60		1		5	101	2	109
Fort Peck	1,547.10		5 (1)	4	283 (94)	162 (14)	1	455 (109)
Lake Sakakawea	1,389.90	1	10 (5)	6 (1)	44 (10)	228 (63)	11	300 (79)
Garrison	1,317.40	6	3	6	77	28	3	123
Lake Oahe	1,072.30		8 (3)	2	179 (12)	21 (6)	8 (2)	218 (23)
Oahe	1,072.20							0
Lake Sharpe	987.40		3 (2)		91 (71)	19 (4)	2	115 (77)
Big Bend	987.30							0
Lake Francis Case	841.80		6		72	4	3	85
Fort Randall	836.10				8 (4)			8 (4)
Lewis and Clark Lake	811.10		2		27 (5)	6	2 (2)	37 (7)
Gavins Point	734.20		1		33	7	1	42
Sioux City	648.00	2	2	1	42 (3)		2	49 (3)
Omaha	597.20	3	2	1	8	2	5	21
Nebraska City	497.40	2			22	1		25
St. Joseph	374.00	3	4				2	9
Kansas City	249.90	5	4				1	10
Boonville	129.90		3				1	4
Hermann	0.00	3	3					6
Total		**25**	**57 (11)**	**20 (1)**	**891 (199)**	**579 (87)**	**44 (4)**	**1,616 (302)**
Above Gavins Point		7	38 (11)	18 (1)	786 (196)	569 (87)	32 (4)	
Below Gavins Point		18	*19*	2	105 (3)	10	12	

Numbers in parentheses refer to intakes located on reservation land.

Source: USACE, 2004a, page 3-112

Table 4-9. Stastny 2004. *Native and introduced fish species stocked in South Dakota into the Missouri River system that are to their potential as predators of pallid sturgeon. Species in this table were actively managed via stocking or other means in 2004 or had their status, whether native or nonnative, brought into question by others in litigation.*

Species Name	Common Name	Origin	Stocking Status	Years Stocked in Missouri River in South Dakota
Oncorhynchus mykiss	rainbow trout	I	EFS	1951, 56, 57, 64, 68, 69, 1972-2003
Oncorhynchus tshawytscha	Chinook salmon	I	EFS	1982-2000. 2003
Salmo trutt	brown trout	I	EFS	1964, 68, 79, 1981-2003
Morone chrysops	white bass	I	EPD	1960-62
Coregonus artedi	lake herring	I	EPD	1984, 88, 90-92
Polyodon spathula	paddlefish	N	NSA*	1974, 76-78, 1985-2003
Osmerus mordax	rainbow smelt	I	EPD**	-
Notropis hudsonius	spottail shiner	I	EPD	1973-75, 78, 79
Micropterus dolomieu	smallmouth bass	I	EPD	1972, 74, 80, 83-92, 94-98
Esox lucius	northern pike	PN, N	NSA	1957, 58, 71, 82, 83, 85, 86, 88-97
Perca flavescens	yellow perch	PN, N	NSA	-
Sander vitreum	walleye	N	NSA	1952, 53, 57, 58, 83-98, 2002

Table adapted from Nelson-Stastny (2004, Table 1)

*Paddlefish stocking in the last decade has only been in Lake Francis Case. An adult population exists in Lake Francis Case; however, natural reproduction has not been documented.

** Rainbow smelt in the South Dakota portion of the Missouri River originated from fish stocked in Lake Sakakawea in North Dakota.

Origin as a native (N), introduced (I) or probable native (PN).

Stocking status refers to one of the following:
- Established sport fishery – stocking required to maintain (EFS)
- Established population – stocking discontinued (EPD)
- Native – if stocked, additive to natural reproduction (NSA)

4.11.4 Cumulative Impacts on Terrestrial Resources

This section addresses past, present, and future actions that could result in adverse cumulative impacts to terrestrial resources, including wildlife populations, upland habitats, wetlands, riparian zones, invasive species, protected species, and land use. For purposes of this analysis, the geographic area considered in the evaluation includes the CNS-1 site, including the land on both the Nebraska and the Missouri sides of the Missouri River, the wetlands on and in the vicinity of the CNS-1 site, and the 145-mile long (233-kilometer) transmission line corridor identified in Section 2.1.5 of this report.

Prior to construction of the CNS-1 facilities and before its conversion to cropland, the region surrounding the CNS-1 property in Nemaha County, Nebraska, and Atchison County, Missouri, was historically part of a dynamic Missouri River floodplain system, located within the Missouri alluvial plain ecoregion (U.S. Geological Survey (USGS), 2001). Historically, the Missouri River meandered across the width of this relatively flat, 6-mile (10-kilometer) wide alluvial floodplain along the border of eastern Nebraska and western Missouri. The CNS-1 facilities are located near the western edge of this floodplain and adjacent to the western bank of the Missouri River.

The vegetation within this floodplain and its vicinity was historically dominated by tallgrass prairie and wooded wetlands along the riparian corridors (NGPC, 2005). Before the completion in 1950 of the Federal levee system along the Missouri River, most of the Missouri River floodplain was subjected to frequent overbank flooding and much soil deposition occurred over the entire width of the floodplain (NPPD, 2008; USGS, 2001). Wooded wetlands dominate the 239 acres of CNS-1 property on the Missouri side of the property, both today and prior to conversion of approximately 40 acres of the property to agriculture (NPPD, 2008). The Missouri CNS-1 property is also part of the Missouri alluvial plain ecoregion and much of the wooded wetland habitat historically flooded and continues to experience overbank flooding from the Missouri River (USGS, 2001).

Historically, over 70 percent of the land encompassing the 145-mile long (233-kilometer) transmission line corridor was comprised primarily of prairie grasses of the tallgrass prairie ecoregion (NPPD, 2008; NGPC, 2005). The remaining 30 percent of the land traversed by the transmission line corridor was historically comprised of numerous narrow stream valleys with woody vegetation and shallow intermittent streams with small pockets of wetlands (NPPD, 2008). The western half of the transmission line corridor traverses the Rainwater Basin Plains and historically contained the largest concentrations of natural wetlands found in Nebraska. Most of these wetlands have now been drained and converted to cropland and the historic prairie grass regions in the counties surrounding the transmission line corridor have likewise been converted to cropland (NGPC, 2005; USGS, 2001). Most of the noted stream valleys were too steep or too saturated to allow agriculture and still remain vegetated.

Currently, over 97 percent of the land in Nemaha County, Nebraska, is used for agriculture. In the adjacent Richardson County and Otoe County in Nebraska, and Atchison County in Missouri, over 90 percent of the land on average is used for agriculture. Very little residential, commercial, or industrial development has occurred in the counties surrounding the CNS-1 site, and cumulative impacts from such types of development are considered minor.

Current land use on the Nebraska CNS-1 property outside of the actual power plant facilities reflects the regional agricultural use. Approximately 900 acres (364 hectares) of the 1,121-acre (454 hectare) CNS-1 site is used for agriculture (NPPD, 2008). Much of the 90-acres (36 hectares) of land where the CNS-1 facilities have been constructed was cropland prior to construction of the facility, so disturbance to wildlife habitat had occurred prior to construction of CNS-1. Construction on some of the CNS-1 facility led to the loss of riparian habitat along the shoreline, as well as the loss of some wetlands habitat, which may have impacted wildlife habitat and water quality. NPPD was recently required by the USACE to restore 55 acres (22 hectares) of disturbed wetlands habitat onsite as mitigation for NPPD filling in other disturbed wetlands for construction of CNS-1 parking facilities.

Surface water drainage patterns have changed on the Nebraska CNS-1 property as a result of construction of the Federal levee system and from construction of the CNS-1 facility. A dike and ditch system was created on the Nebraska side of the CNS-1 site during initial construction of the facilities to protect them from flooding events of the Missouri River (NPPD, 2008). Over 120 acres (49 hectares) of the CNS-1 site on the Nebraska side contain wooded, scrub-shrub, and emergent wetlands, riparian habitat along the Missouri River, and several small intermittent streams (NPPD, 2008). Construction of the ditch, dike, and levee systems on the CNS-1 site have in some cases led to additional flooding on portions of the farm fields, forested areas, and these wetland areas. The intermittent streams and some surface water drains south into the adjacent USACE Langdon Bend Wetlands Restoration Project, which may benefit wetlands restoration on the Corps' site (NDNR, 2009; USACE, 2004b).

Approximately 40 acres (16 hectares) of the 239-acre (97 hectare) CNS-1 property on the Missouri side are cropland, and the remaining acres are primarily wooded wetlands. Two transmission line corridors that are not in scope cut through this land and contain emergent vegetation. The Federal levee is located along the eastern border of this land, and reduces the threat of flooding of the farm fields beyond the CNS-1 property while retaining more water on the CNS-1 property. This CNS-1 property is still subject to occasional overbank flooding, as evidenced by water marks located several feet up on the trunks of trees. Thus, some flooding events on this land may be similar in degree of inundation to historic flooding events, helping to maintain this area as a bottomland hardwood, forested wetland. Based upon discussions with NPPD staff during the environmental site audit, NPPD is currently coordinating with Federal and State resource agencies to place this Missouri land into a conservation easement, which may lead to long-term protection of this land from any development as well as removal of the 40 acres of cropland from agricultural production. A pair of bald eagles has been actively nesting on this property for the past several years (NPPD, 2008).

Several exotic invasive plant species are located along the riverbank or in the vicinity of the CNS-1 site, and include purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and the common reed (*Phragmites australis*) (Natural Resources Conservation Services (NRCS), 2007; Nebraska Department of Agriculture (NDA), 2008). The NPPD does not manage invasive vegetative species on the CNS-1 site; therefore, a potential exists for these invasive species to increase in population on the CNS-1 site and compete with native vegetation for resources and degrade areas of terrestrial habitat. Invasive species may also be introduced on the associated transmission line ROW, with potentially similar impacts.

The land traversed by the transmission line corridor and most of the land in the surrounding counties has been converted primarily from prairie grasses to cropland. There is currently less than two percent remaining of the historic prairie grass habitat in Nebraska (NGPC, 2005; USGS, 2001). Conversion from prairie grassland to cropland will affect wildlife species composition and behavior, and may have a cumulative adverse impact on nutrient discharges into the Missouri River and its tributaries. Farming occurs under the transmission lines and immediately adjacent to the transmission line poles, so little land is lost from agricultural production. Most of the narrow stream valleys now traversed by the transmission line corridor remain as vegetated riparian corridors annually maintained by NPPD, primarily as scrub-shrub wooded areas (NPPD, 2008). ROW maintenance of these riparian corridors has likely had some minor impacts in the past and is likely to have present and future impacts on these areas from their conversion from primarily forested riparian communities to scrub-shrub riparian communities; however, any future maintenance activities are estimated to be minor based on NPPD’s plan to conduct only necessary clearing to prevent obstruction of the lines.

NPPD has consulted with the USFWS to address the potential risk of bird collisions with NPPD transmission line NPPD TL3502 which crosses the Platte River near the end of the CNS-1 transmission line corridor, approximately 4 miles (6 kilometers) east of Grand Island, NE. The Federally-endangered whooping crane (*Grus Americana*) and interior least tern (*Sterna antillarum athalassos*), and the Federally-threatened piping plover (*Charadrius melodius*) use the Platte River and associated wetlands around Grand Island for different portions of their lifecycle (e.g., for migration, resting, feeding, and nesting) and risk collisions with the NPPD transmission line. The USFWS has indicated that collisions with transmission lines are the main cause of whooping crane mortality during their migrations (USFWS, 2009a); however, there are no data to indicate that transmission line NPPD TL3502 has caused any injury or mortality to whooping cranes, least terns, piping plovers, or to other species of Federally-protected migratory birds where the transmission line crosses the Platte River. On May 8, 2009, the NPPD informed the USFWS that NPPD had agreed to mark that portion of the NPPD transmission line that crosses the Platte River with bird flight diverters to increase the visibility of the transmission line and reduce the risk of collisions (NPPD, 2009). The USFWS replied to NPPD on June 8, 2009, informing them that NPPD had satisfactorily addressed the concerns of the USFWS regarding bird collisions (USFWS, 2009b). This voluntary mitigation measure by NPPD will help to reduce current and future potential impacts to whooping cranes, interior lest terns, piping plovers, and other migratory birds that use the Platte River and associated wetlands of the Rainwater Basin Wetland Management District (USFWS, 2009c).

The Missouri River ecosystem has been dramatically transformed since the beginning of the 20th century. Historically, the Missouri River was free-flowing with regular overbank flooding along its entire length, and the channel meandered across the entire floodplain. The construction of seven dams upriver from CNS-1, bank stabilization, channelization of the river for improved navigation by barge traffic, and a levee and dike system constructed along most of the entire length of the floodplain have led to significant changes to the terrestrial habitat of the ecosystem. There has also been a reduction of the amount and type of deciduous vegetation, grasslands, and wetlands present within the floodplain. Within the Missouri River itself, there has also been a reduction in the number of river islands (89 percent), a reduction in the surface area of these islands (98 percent), and a reduction in the number of sandbars (97 percent) along the river (NPPD, 2008). With the implementation of Federal aquatic and terrestrial habitat restoration projects along the entire Missouri River ecosystem and the adjacent USACE Langdon Bend Wetlands Restoration Project, restoration of Missouri River terrestrial habitat is beginning to improve ecological conditions from their current state (USACE, 2004b).

Agriculture continues to be the overwhelming dominant land use in the region and with a declining human population in Nemaha County, additional impacts from new residential, commercial, or industrial development are not anticipated to increase terrestrial impacts. Continued runoff of nutrients from agricultural fields and bioaccumulation of pesticides or herbicides poses a threat to terrestrial and riparian habitats as well as to wildlife species; however, the Federal wetlands mitigation projects discussed above and in Section 2.2.6 will help to reduce impacts to both the aquatic and terrestrial environment.

The NRC staff concludes that the minimal terrestrial impacts expected from the continued CNS-1 operations, including the operation and maintenance of the 145-mile (233-kilometer) long transmission line corridor, would not contribute to the overall decline in the condition of terrestrial resources; however, the cumulative impacts on terrestrial resources resulting from all past, present, and reasonably foreseeable future actions, including non-CNS-1 activities, would be moderate.

4.11.5 Cumulative Air Quality Impacts

CNS-1 is located in Nemaha County, Nebraska, which belongs to the EPA Region 7. There are no counties designated by the EPA as nonattainment or maintenance counties for any of the criteria pollutants in the 50-mile (81-kilometer) vicinity of CNS-1. Douglas County, Nebraska, located approximately 72 miles (116 kilometers) from CNS-1, is the closest maintenance county for lead.

As discussed in Air Quality Impacts Section 2.2.2.2, Nebraska Division of Air Quality of the NDEQ has primary responsibility for regulating air emission sources within the State of Nebraska, and, with the assistance from Lincoln-Lancaster County Health Department and Douglas County Health Department, NDEQ conducts ambient air monitoring in the State, operating 28 sites throughout the state with the 34 monitors. The EPA and National Atmospheric Deposition Program also monitor air quality in Nebraska, which participates in the EPA's AIRNow Network which continuously monitors some of the criteria pollutants and informs the public of the current environmental conditions.

In April 2009, the EPA published the official U.S. inventory of the greenhouse gas (GHG) emissions that identifies and quantifies the primary anthropogenic sources and sinks of GHG. The EPA GHG inventory is an essential tool for addressing climate change and participating with the United Nations Framework Convention on Climate Change to compare the relative global contribution of different emission sources and GHGs to climate change. The EPA estimates that energy-related activities in the United States accounts for three-quarters of human-generated GHG emissions, mostly in the form of carbon dioxide emissions from burning fossil fuels. More than half of the energy-related emissions come from major stationary sources like power plants, and approximately one-third comes from transportation. Industrial processes (production of cement, steel, and aluminum), agriculture, forestry, other land use, and waste management are also important sources of greenhouse gas emissions in the United States (EPA, 2009).

Potential cumulative effects of climate change in southeastern Nebraska, where CNS-1 is located, and local climate, whether or not from natural cycles or anthropogenic activities, could result in a variety of changes to the air quality of the area. Nebraska is a part of the Great Plains Region. As projected in the "Global Climate Change Impacts in the United States" report by USGCRP (2009), the temperatures in southeastern Nebraska are expected to rise 6 °F (14 °C) by 2080–2099 at minimum and maximum over 10 °F (12°C), causing more frequent extreme weather events. Increases in average annual temperatures, higher probabilities of extreme heat events, higher occurrences of extreme rainfall (intense rainfall or drought), and changes in the wind patterns could affect concentrations of the air pollutants and their long-range transport because their formation partially depends on the temperature and humidity, and is a result of the interactions between hourly changes in the physical and dynamic properties of the atmosphere, atmospheric circulation features, wind, topography, and energy use (IPCC, 2009).

Nebraska is a participant of Western Governors Association (WGA) that encourages the participating regions to utilize its diverse resources for the production of affordable, sustainable, and environmentally responsible energy. Nebraska is also a part of WGA Western Regional Air Partnership which established a multi-state and tribal GHG registry and developed the GHG emissions inventories.

As discussed in Nonradioactive Waste Management Section 2.1.3, NPPD is committed to the EPA's Reduce, Reuse, Recycle program at its major and minor facilities, with a growing Green Team, that focuses on pollution prevention, waste minimization, education and training of the personnel, and incorporates EPA recommendations on the national implementation of the climate change energy conservation techniques (EPA, 2009a).

In the 2008 Integrated Resource Plan, NPPD outlined the environmental goals of the company with emphasis on lowering GHG emissions and obtaining 10 percent of the energy supply from renewable resources by 2020 (NPPD, 2008).

CNS-1 is exempt from the NDEQ operating permit requirements and holds a Low Emitter Status from NDEQ, based on the CNS-1 actual quantities of emissions that meet criteria and do not exceed thresholds, defined in Chapter 5, Title 129 of Nebraska Administrative Code, for the emissions of particulate matter PM_{10}, carbon monoxide volatile organic compounds, oxides of nitrogen (NO_x), SO_2 or SO_3, or any combination of the two (SO_x), single Hazardous Air Pollutant or HAPs, and lead. As discussed in Air Quality Impacts Section 2.2.2.2, actual total emissions from all sources at CNS-1 for the period from 2004–2008 were 11.52 tons (10.45 MetricTons) per year, 10.73 tons (9.73 MetricTons) per year, 13.21 tons (11.98 MetricTons) per year, 11.43 tons (10.37 MetricTons) per year and 9.85 tons (8.94 MetricTons) per year, respectively. Highest emissions for the period from 2004–2008 were reported in 2006: 0.16 tons (0.15 MetricTons) per year of PM_{10}, 2.41 tons (2.19 MetricTons) per year of CO, 0.22 tons (0.20 MetricTons) per year of VOC, 9.0 tons (8.16 MetricTons) per year of NO_x, 1.41 tons (1.28 MetricTons) per year of SO_x, and 0.01 tons (0.009 MetricTons) per year of single HAP (NPPD, 2009).

NPPD stated in the environmental report (NPPD, 2008) and NRC staff confirmed that no refurbishment is planned at CNS-1 during the license renewal period.

Based on all of the above, the staff concludes The Staff concludes that combined with the emissions from other past, present, and reasonably foreseeable future actions, cumulative hazardous and criteria air pollutants emissions on air quality from CNS-1 related actions would be SMALL. When considered with respect to an alternative of building a fossil-fuel powered plant, continuing the operation of the CNS-1 could constitute a net cumulative beneficial environmental impact in terms of reducing hazardous, criteria, and GHG air emissions; only the Combined Alternative (described in Chapter 6) would be equivalent to or would contribute less cumulative emissions than the option of license renewal.

4.11.6 Cumulative Human Health Impacts

NRC and the EPA developed radiological dose limits for protection of the public and workers to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. This analysis includes the area within a 50-mile (80-kilometer) radius of the CNS-1 site. The REMP conducted by NPPD in the vicinity of the CNS-1 site measures the cumulative impact of radiation and radioactive materials from all sources.

As discussed in Section 4.8.1 of this report, the staff reviewed the radiological environmental radiation monitoring results for the five-year period from 2003–2007 as part of the cumulative impacts assessment. Cumulative radiological impacts from all uranium fuel cycle facilities within a 50-mile (80 km) radius of the CNS-1 site, are limited by the dose limits codified in 10 CFR Part 20 and 40 CFR Part 190. In Section 4.8 of this report, the NRC staff concluded that the impacts of radiation exposure to the public from the operation of CNS-1 during the renewal term would be SMALL. NRC and the EPA will regulate any future actions in the vicinity of the CNS-1 site that could contribute to cumulative radiological impacts; therefore, the NRC concludes that the cumulative impacts from continued operations of CNS-1 would be SMALL.

4.11.7 Cumulative Socioeconomic Impacts

As discussed in Section 4.4, continued operation of CNS-1 during the license renewal term would have no impact on socioeconomic conditions in the region beyond those already experienced. Since NPPD has no plans to hire additional workers during the license renewal term, overall expenditures and employment levels at CNS-1 would remain relatively constant with no additional demand for permanent housing and public services. In addition, since employment levels and tax payments would not change, there would be no population or tax revenue-related land use impacts. There would also be no disproportionately high and adverse health and environmental impacts on minority and low-income populations in the region. Based on this and other information presented in this chapter, there would be no cumulative socioeconomic impacts from the continued operation of CNS-1 during the license renewal term beyond what is currently being experienced.

Any ground disturbing activities during the license renewal term, however, could result in the cumulative loss of historic and archaeological resources. Historic and archaeological resources are non-renewable; therefore, the loss of archaeological resources is cumulative. The continued operation of CNS-1 during the license renewal term has the potential to impact unknown historic and archaeological resources.

As discussed in Section 4.9.6, continued operation of the CNS-1 during the license renewal term would have a SMALL impact on archaeological resources at the CNS-1 site. NPPD has no plans to alter the CNS-1 site for license renewal. Any future land disturbing activities would be carried out under corporate procedures. Should plans change, further consultation would be initiated by NPPD with the NRC and SHPO. Because impacts to historic and archaeological resources from the continued operation of CNS-1 would be SMALL, the cumulative environmental impacts to historic and archaeological resources would be SMALL.

4.11.8 Summary of Cumulative Impacts

We considered the potential impacts resulting from the operation of CNS-1 during the period of extended operation and other past, present, and future actions in the vicinity of CNS-1. The preliminary determination is that the potential cumulative impacts resulting from CNS-1 operation during the period of extended operation would be SMALL to MODERATE.

1 **Table 4-10. Summary of Cumulative Impacts on Resources Areas**

Resource Area	Impact	Discussion
Water Resources	SMALL	The total maximum pumping rate at CNS-1 of over 1,500 gallons per minute (5,678 liters per minute) is less than one percent of the average flow in the river. Likewise, the influence of offsite pumping should have no measurable effect on ground water levels onsite. Because the cumulative effects of pumping ground water on river flow and vice versa are insignificant, the cumulative impact on water resources in the CNS-1 area is SMALL.
Aquatic Resources	LARGE	While the level of impact due to direct and indirect impacts of CNS-1 on aquatic communities is SMALL, the cumulative impact when combined with all other sources has resulted in the Missouri River aquatic ecosystem being unstable and close to, if not past, the point of reparable change. This condition meets NRC’s definition of a LARGE level of impact.
Terrestrial Resources	MODERATE	Agriculture continues to be the overwhelming dominant land use in the region, and with a declining human population in Nemaha County, additional impacts from new residential, commercial, or industrial development are not anticipated to increase terrestrial impacts. Continued runoff of nutrients from agricultural fields and bioaccumulation of pesticides or herbicides poses a threat to terrestrial and riparian habitats, as well as to wildlife species. However, the Federal wetlands mitigation projects discussed above and in Section 2.2.6 will help to reduce impacts to both the aquatic and terrestrial environment. The NRC staff concludes that the minimal terrestrial impacts expected from the continued CNS-1 operations, including the operation and maintenance of the 145-mile (233 km) long transmission line corridor, would not contribute to the overall decline in the condition of terrestrial resources. The cumulative impacts, however, on terrestrial resources resulting from all past, present, and reasonably foreseeable future actions, including non-CNS-1 activities, would be MODERATE.
Air Quality	SMALL	NPPD is committed to the EPA's Reduce, Reuse, Recycle program at its major and minor facilities, with a growing Green Team, that focuses on pollution prevention, waste minimization, education and training of the personnel, and incorporates EPA recommendations on the national implementation of the climate change energy conservation techniques. CNS- 1 holds a Low Emitter Status from NDEQ, based on the CNS-1 actual quantities of emissions that meet criteria and do not exceed thresholds. The NRC staff concludes that the minimal air quality impacts expected from the continued CNS-1 operation would not destabilize the air quality in the vicinity of CNS-1; therefore, the NRC staff concludes that the cumulative impacts on the air quality from the continued operation of CNS-1 during the license renewal period would be SMALL
Socioeconomics	SMALL	In Section 4.8 of this report, the NRC staff concluded that the impacts of radiation exposure to the public from the operation of CNS-1 during the renewal term would be SMALL. NRC and the EPA will regulate any future actions in the vicinity of the CNS-1 site that could contribute to cumulative radiological impacts; therefore, the NRC concludes that the cumulative impacts from continued operations of CNS-1 would be SMALL

Resource Area	Impact	Discussion
Human Health	SMALL	Cumulative radiological impacts from all uranium fuel cycle facilities within a 50-mile (80-kilometer) radius of the CNS-1 site are limited by the dose limits codified in 10 CFR Part 20 and 40 CFR Part 190. In Section 4.8 of this report, the staff concluded that the impacts of radiation exposure to the public from the operation of CNS-1 during the renewal term would be SMALL. NRC and Nebraska will regulate any future actions in the vicinity of the CNS-1 site that could contribute to cumulative radiological impacts; therefore, the NRC concludes that the cumulative impacts from continued operations of CNS-1 would be SMALL
Archaeological Resources	SMALL	NPPD has no plans to alter the CNS-1 site for license renewal. Any future land disturbing activities would be carried out under corporate procedures. Archaeological surveys would be conducted in areas identified as archaeologically sensitive prior to any ground disturbing activities. Should plans change, further consultation would be initiated by NPPD with NRC, NSHS, and Missouri SHPO. Because impacts to historic and archaeological resources from the continued operation of CNS-1 would be SMALL, the cumulative environmental impacts to historic and archaeological resources would be SMALL.
Electromagnetic Fields and Thermophilic Microbiological Organisms	SMALL	The NRC staff concludes that the thermophilic microbiological organisms are not likely to present a public health hazard as a result of CNS-1 discharges to the Missouri River. The staff concludes that the cumulative impacts on public health from thermophilic microbiological organisms from continued operation of CNS-1 during the license renewal period would be SMALL. The NRC staff determined that the CNS-1 transmission lines are operating within original design specifications and meet current NESC clearance standards; therefore, the CNS-1 transmission lines do not detectably affect the overall potential for electric shock from induced currents within the analysis area. With respect to the chronic effects of EMFs, although the GEIS finding of "not applicable" is appropriate to CNS-1, the transmission lines associated with CNS-1 are not likely to detectably contribute to the regional exposure of ELF-EMFs; therefore, the NRC staff has determined that the cumulative impacts of the continued operation of the CNS-1 transmission lines would be SMALL.

4.12 REFERENCES

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5.0 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

This chapter describes the environmental impacts from postulated accidents that might occur during the period of extended operation. The term “accident” as defined in the Generic Environmental Impact Statement (GEIS) (NRC, 1996) refers to any unintentional event outside the normal plant operational envelope that results in a release or the potential for release of radioactive materials into the environment. Two classes of postulated accidents are evaluated under the National Environmental Policy Act (NEPA) in the license renewal review: design-basis accidents (DBAs) and severe accidents. In the GEIS, the NRC staff categorized accidents as “design basis” when the plant was designed specifically to accommodate these accidents or as “severe” for those accidents involving multiple failures of equipment or function whose likelihood is generally lower than design-basis accidents but where consequences may be higher” (NRC, 1996). These issues are evaluated in Chapter 5 of GEIS, “Environmental Impacts of Postulated Accidents.”

5.1 DESIGN-BASIS ACCIDENTS

As described in 10 CFR 50.34(b), in order to receive NRC approval for an operating license, an applicant for an initial operating license must submit a final safety analysis report (FSAR) as part of its application. The FSAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The FSAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether or not the plant design meets the NRC’s regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

The environmental impacts of postulated accidents were evaluated for the license renewal period in Chapter 5 of the GEIS. Section 5.5.1 states:

> All plants have had a previous evaluation of the environmental impacts of design-basis accidents. In addition, the licensee will be required to maintain acceptable design and performance criteria throughout the renewal period. Therefore, the calculated releases from design-basis accidents would not be expected to change. Since the consequences of these events are evaluated for the hypothetical maximally exposed individual at the time of licensing, changes in the plant environment will not affect these evaluations. Therefore, the staff concludes that the environmental impacts of design-basis accidents are of small significance for all plants. Because the environmental impacts of design basis accidents are of small significance and because additional measures to reduce such impacts would be costly, the staff concludes that no mitigation measures beyond those implemented during the current term license would be warranted. This is a Category 1 issue.

No new and significant information related to DBAs was identified during the review of Nebraska Public Power District’s (NPPD’s) environmental report (ER), site audit, scoping process, or evaluation of other available information. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS.

5.2 SEVERE ACCIDENTS

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, whether or not there are serious offsite consequences. In the GEIS, the staff assessed the impacts of severe accidents during the license renewal period, using the results of existing analyses and information from various sites to predict the environmental impacts of severe accidents for plants during the renewal period.

Severe accidents initiated by external phenomena such as tornadoes, floods, earthquakes, fires, and sabotage have not traditionally been discussed in quantitative terms in the final environmental impact statements and were not specifically considered for the Cooper Nuclear Station, Unit 1 (CNS-1) site in the GEIS (NRC, 1996). The GEIS, however, did evaluate existing impact assessments performed by the NRC staff and by the industry at 44 nuclear plants in the United States and segregated all sites into six general categories and then estimated that the risk consequences calculated in existing analyses bound the risks for all other plants within each category. The GEIS further concluded that the risk from beyond design-basis earthquakes at existing nuclear power plants is designated as SMALL. The Commission believes that NEPA does not require the NRC to consider the environmental consequences of hypothetical terrorist attacks on NRC-licensed facilities. However, the NRC staff's GEIS for license renewal contains a discretionary analysis of terrorist acts in connection with license renewal. The conclusion in the GEIS is that the core damage and radiological release from such acts would be no worse than the damage and release to be expected from internally initiated events.

In the GEIS, the NRC staff concludes that the risk from sabotage and beyond design-basis earthquakes at existing nuclear power plants is designated as SMALL, and additionally, that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents (NRC, 1996).

Based on information in the GEIS, the staff found that:

> The generic analysis…applies to all plants and that the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts of severe accidents are of small significance for all plants. However, not all plants have performed a site-specific analysis of measures that could mitigate severe accidents. Consequently, severe accidents are a Category 2 issue for plants that have not performed a site-specific consideration of severe accident mitigation and submitted that analysis for Commission review.

The staff identified no new and significant information related to postulated accidents during the review of NPPD's environmental report, the site audit, the scoping process, or evaluation of other available information. Therefore, there are no impacts related to postulated accidents beyond those discussed in the GEIS. In accordance with 10 CFR 51.53(c)(3)(ii)(L), however, the NRC staff has reviewed severe accident mitigation alternatives (SAMAs) for CNS-1. Review results are discussed in Section 5.3.

5.3 SEVERE ACCIDENT MITIGATION ALTERNATIVES

Regulations under Section 51.53(c)(3)(ii)(L) of 10 CFR requires an ER to contain an analysis of alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS), related supplement, or in an environmental assessment. The Commission's reconsideration of the issue of severe accident mitigation for license renewal is based on the Commission's NEPA regulations that require a consideration of mitigation alternatives in its environmental impact statements (EISs) and supplements to EISs, as well as a previous court decision that required a review of sever mitigation alternatives at the operating license stage.

5.3.1 Introduction

This section presents a summary of the SAMA evaluation for CNS-1 conducted by NPPD Energy Company, LLC (NPPD) and the staff's review of that evaluation. The NRC staff performed its review with contract assistance from Pacific Northwest National Laboratory. Subsequent to the ER, NPPD discovered a problem with the process they used to numerically average the site-specific meteorological data. NPPD performed a sensitivity analysis of the population dose risk and offsite economic cost risk using corrected meteorological data, and found that the population dose and offsite economic cost values for each of the release categories would be slightly less than reported in the ER, and that the conclusions of the SAMA remain valid (NPPD, 2009b). The NRC staff's review is available in Appendix F; the SAMA evaluation is available in NPPD's ER and the supplement submitted in December 2009.

The SAMA evaluation for CNS-1 was conducted with a four-step approach. In the first step, NPPD quantified the level of risk associated with potential reactor accidents using the plant specific probabilistic risk assessment (PRA) and other risk models.

In the second step, NPPD examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. NPPD identified 33 potential SAMAs for CNS-1. NPPD performed an initial screening to determine if any SAMAs could be eliminated because they are not applicable to CNS-1 due to design differences, or have estimated implementation costs that would exceed the dollar-value associated with completely eliminating all severe accident risk at CNS-1. No SAMAs were eliminated based on this screening, leaving all 33 for further evaluation.

In the third step, NPPD estimated the benefits and the costs associated with each of the SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC, 1997). The cost of implementing the proposed SAMAs was also estimated.

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost benefit). NPPD concluded in its ER that several of the SAMAs evaluated are potentially cost-beneficial (NPPD, 2008).

The potentially cost-beneficial SAMAs do not relate to adequately managing the effects of aging during the period of extended operation (e.g., none of the potentially cost-beneficial

SAMAs would reduce the frequency or risk associated with aging-related failures). Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54. NPPD's SAMA analysis and the NRC staff's review are discussed in more detail below.

5.3.2 Estimate of Risk

NPPD submitted an assessment of SAMAs for CNS-1 as part of the ER. This assessment was based on the most recent CNS-1 probabilistic safety assessment (PSA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the CNS-1 Individual Plant Examination (IPE) (NPPD, 1993) and Individual Plant Examination of External Events (IPEEE) (NPPD, 1996). As mentioned above, NPPD discovered an error in the method used to average their wind data. NPPD performed a sensitivity analysis using the corrected meteorological data. Their analysis found that the error was conservative relative to the average population dose and economic cost, and that no SAMAs were inappropriately excluded from consideration in the LRA as a result of the error in wind direction. NPPD submitted their analysis and changes to the LRA in a letter dated December 7, 2009 (NPPD, 2009b).

The CNS-1 core damage frequency (CDF) is approximately 9.3×10^{-6} per year for internal events as determined from the quantification of the Level 1 PSA model. When determined from the sum of the containment event tree sequences, or Level 2 PSA model, the release frequency is approximately 1.2×10^{-5} per year. The latter value was used as the baseline CDF in the SAMA evaluations. The CDF value is based on the risk assessment for internally-initiated events. NPPD did not include the contributions from external events within the CNS-1 risk estimates; however, it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of 3. The breakdown of CDF by initiating event is provided in 1.

Table 5-1. Cooper Nuclear Station, Unit 1, Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)	% Contribution to CDF
Transients	3.0 × 10–6	32
Loss of DC Power	2.1 × 10–6	22
Loss of Coolant Accidents (LOCA)	1.4 × 10–6	15
Loss of Feedwater	1.0 × 10–6	11
Loss of Offsite Power	6.5 × 10–7	7
Loss of Service Water	6.0 × 10–7	7
Loss of AC Buses	2.6 × 10–7	3
Internal Flood	2.6 × 10–7	3
Interfacing System LOCA	5.1 × 10–8	<1
Total CDF (Internal Events)	**9.3 × 10–6**	**100**

As shown in this table, events initiated by transients, loss of DC power, LOCA, and loss of feedwater are the dominant contributors to the CDF.

NPPD estimated the dose to the population within 50 miles (80 km) of the CNS-1 site to be approximately 0.021 person-sievert (person-Sv) (2.1 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-2.

Containment failures within the early time frame (less than 3.7 hours following event initiation) dominate the population dose risk at CNS-1, with failures in the intermediate time frame (3.7 to 24 hours following event initiation) contributing most of the remaining population dose.

Table 5-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] Per Year)	% Contribution
Early Containment Failure	1.67	78
Intermediate Containment Failure	0.47	22
Late Containment Failure	<0.1	<1
Intact Containment	Negligible	negligible
Total	**2.14**	**100**

[1]One person-rem = 0.01 person-Sv

The NRC staff has reviewed NPPD's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDFs and offsite doses reported by NPPD in their December 2009 letter (NPPD, 2009b).

5.3.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, NPPD searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, NPPD considered insights from the plant-specific PSA, and SAMA analyses performed for other operating plants that have submitted license renewal applications. NPPD identified 244 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

NPPD removed all but 80 of the SAMAs from further consideration because they are not applicable at CNS-1 due to design differences, have already been implemented at CNS-1, or are similar in nature and could be combined with another SAMA candidate. A detailed cost-benefit analysis was performed for each of the remaining SAMAs.

The staff concludes that NPPD used a systematic and comprehensive process for identifying potential plant improvements for CNS-1, and that the set of potential plant improvements identified by NPPD is reasonably comprehensive and, therefore, acceptable.

5.3.4 Evaluation of Risk Reduction and Costs of Improvements

NPPD evaluated the risk-reduction potential of the remaining 80 SAMAs. The majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement.

NPPD estimated the costs of implementing the candidate SAMAs through the application of engineering judgment and use of other licensee’s estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include maintenance and surveillance costs of the installed equipment.

The staff reviewed NPPD's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on NPPD's risk reduction estimates.

The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensee's analyses of SAMAs for operating reactors and advanced light-water reactors. The staff found the cost estimates to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The staff concludes that the risk reduction and the cost estimates provided by NPPD are sufficient and appropriate for use in the SAMA evaluation.

5.3.5 Cost-Benefit Comparison

The cost-benefit analysis performed by NPPD was based primarily on NUREG/BR-0184 (NRC, 1997) and was executed consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the agency's revised policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed – one at 3 percent and the other at 7 percent (NRC, 2004). NPPD provided both sets of estimates (NPPD, 2008).

NPPD identified eight potentially cost-beneficial SAMAs in the baseline analysis contained in the ER. The potentially cost-beneficial SAMAs are:

- SAMA 25 – Develop procedures to allow bypass of the reactor core isolation cooling (RCIC) turbine exhaust pressure trip, extending the time available for RCIC operation.

- SAMA 30 – Revise procedures to allow manual alignment of the fire water system to the residual heat removal (RHR) heat exchangers, providing improved ability to cool the RHR heat exchangers in a loss of service water (SW).

- SAMA 33 – Provide for the ability to establish an emergency connection of existing or new water sources to feedwater and condensate systems, increasing availability of feedwater.

- SAMA 40 – Revise procedures to provide additional space cooling to the emergency diesel generator (EDG) room via the use of portable equipment, increasing availability of the EDG.

- SAMA 45 – Provide an alternate means of supplying the instrument air header, increasing availability of instrument air.

- SAMA 68 – Revise procedures to allow the ability to cross-connect the circulating water pumps and the service water going to the turbine equipment cooling (TEC) heat exchangers, which allow continued use of the power conversion system after service water is lost.

- SAMA 78 – Improve training on alternate injection via the fire water system, increasing the availability of alternate injection.

- SAMA 79 – Revise procedures to allow use of the residual heat removal service water (RHRSW) system without a service water booster pump, increasing availability of the RHRSW system.

NPPD performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (NPPD, 2008). If the benefits are increased by an additional factor of 3 to account for uncertainties, three additional SAMA candidates were determined to be potentially cost-beneficial:

- SAMA 14 – Provide a portable generator to supply DC power to individual panels during a station blackout (SBO), increasing the time available for AC power recovery.

- SAMA 64 – Revise procedures to allow use of a fire pumper truck to pressurize the fire water system, increasing availability of the fire water system.

- SAMA 75 – Implement Generation Risk Assessment (trip and shutdown risk modeling) into plant activities, decreasing the probability of trips/shutdown.

NPPD indicated that detailed engineering project cost-benefit analyses have been initiated for the 11 potentially cost-beneficial SAMAs (NPPD 2008, 2009).

NRC staff reviewed NPPD's re-analysis as submitted by NPPD and agrees that the error was conservative relative to the average population dose and offsite economic cost and that no SAMAs were inappropriately excluded from consideration in the LRA as a result of the error.

Based on the staff's review and the supplemental information provided by NPPD, the NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

5.3.6 Conclusions

The staff reviewed NPPD's analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by NPPD are reasonable and sufficient for the license renewal submittal.

Based on its review of the SAMA analysis, the staff concurs with NPPD's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all, or a subset of potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the staff considers that further consideration of these SAMAs by NPPD is warranted. However, none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation e.g., none of the potentially cost-beneficial SAMAs would reduce the frequency or risk associated with aging-related failures). Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

5.4 REFERENCES

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6.0 ENVIRONMENTAL IMPACTS OF THE URANIUM FUEL CYCLE, AND SOLID WASTE MANAGEMENT, AND GREENHOUSE GASEOUS EMISSIONS

6.1 THE URANIUM FUEL CYCLE

This section addresses issues related to the uranium fuel cycle and solid waste management during the period of extended operation. The uranium cycle includes uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level wastes and high-level wastes related to uranium fuel cycle activities. The Generic Environmental Impact Statement (GEIS) (NRC 1996, 1999) details the potential generic impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle including transportation of nuclear fuel and wastes. The GEIS is based, in part, on the generic impacts provided in Table S-3, "Table of Uranium Fuel Cycle Environmental Data," in Title 10 of the *Code of Federal Regulations* (CFR), Section 51.51(a), and in Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor," in 10 CFR 51.52(b). The GEIS also addresses the impacts from radon-222 and technetium-99.

For these Category 1 issues, the GEIS concludes that the impacts are designated as SMALL, except for the collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, where no significance level was assigned to these two impacts. For the collective offsite radiological impacts, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. The staff of the U.S. Nuclear Regulatory Commission (NRC) did not identify any new and significant information related to the uranium fuel cycle during the review of Nebraska Public Power District's (NPPD) environmental report (ER) (NPPD, 2008), the site audit, and the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS.

Nine generic issues are related to the fuel cycle and solid waste management. These are shown in Table 6-1. There are no site-specific issues.

Table 6-1. Issues Related to the Uranium Fuel Cycle and Solid Waste Management

Issues	GEIS Section	Category
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	6.1, 6.2.1, 6.2.2.1, 6.2.2.3, 6.2.3, 6.2.4, 6.6	1
Offsite radiological impacts (collective effects)	6.1, 6.2.2.1, 6.2.3, 6.2.4, 6.6	1
Offsite radiological impacts (spent fuel and high-level waste disposal)	6.1, 6.2.2.1, 6.2.3, 6.2.4, 6.6	1
Nonradiological impacts of the uranium fuel cycle	6.1, 6.2.2.6, 6.2.2.7, 6.2.2.8, 6.2.2.9, 6.2.3, 6.2.4, 6.6	1
Low-level waste storage and disposal	6.1, 6.2.2.2, 6.4.2, 6.4.3, 6.4.3.1, 6.4.3.2, 6.4.3.3, 6.4.4, 6.4.4.1, 6.4.4.2, 6.4.4.3, 6.4.4.4, 6.4.4.5, 6.4.4.5.1, 6.4.4.5.2, 6.4.4.5.3, 6.4.4.5.4, 6.4.4.6, 6.6	1
Mixed waste storage and disposal	6.4.5.1, 6.4.5.2, 6.4.5.3, 6.4.5.4, 6.4.5.5, 6.4.5.6, 6.4.5.6.1, 6.4.5.6.2, 6.4.5.6.3, 6.4.5.6.4, 6.6	1
Onsite spent fuel	6.1, 6.4.6, 6.4.6.1, 6.4.6.2, 6.4.6.3, 6.4.6.4, 6.4.6.5, 6.4.6.6, 6.4.6.7, 6.6	1
Nonradiological waste	6.1, 6.5, 6.5.1, 6.5.2, 6.5.3, 6.6	1
Transportation	6.1, 6.3.1, 6.3.2.3, 6.3.3, 6.3.4, 6.6, Addendum 1	1

6.2 GREENHOUSE GAS EMISSIONS

This section provides a discussion of potential impacts from greenhouse gases (GHGs) emitted from the nuclear fuel cycle. The GEIS does not directly address these emissions, and its discussion is limited to an inference that substantial carbon dioxide (CO_2) emissions may occur if coal- or oil-fired alternatives to license renewal are implemented.

6.2.1 Existing Studies

Since the development of the GEIS, the relative volumes of GHGs emitted by nuclear and other electricity generating methods have been widely studied. However, estimates and projections of the carbon footprint of the nuclear power lifecycle vary depending on the type of study conducted. Additionally, considerable debate also exists among researchers regarding the relative impacts of nuclear and other forms of electricity generation on GHG emissions. Existing studies on GHG emissions from nuclear power plants generally take two different forms:

(1) Qualitative discussions of the potential to use nuclear power to reduce GHG emissions and mitigate global warming; and

(2) Technical analyses and quantitative estimates of the actual amount of GHGs generated by the nuclear fuel cycle or entire nuclear power plant life cycle and comparisons to the operational or life cycle emissions from other energy generation alternatives.

6.2.1.1 *Qualitative Studies*

The qualitative studies consist primarily of broad, large-scale public policy or investment evaluations of whether an expansion of nuclear power is likely to be a technically, economically, and/or politically feasible means of achieving global GHG reductions. Studies identified by the NRC staff during the subsequent literature search include:

- Evaluations to determine whether investments in nuclear power in developing countries should be accepted as a flexibility mechanism to assist industrialized nations in achieving their GHG reduction goals under the Kyoto Protocols (Schneider, 2000; IAEA, 2000; NEA, 2002; NIRS/WISE, 2005). Ultimately, the parties to the Kyoto Protocol did not approve nuclear power as a component under the Clean Development Mechanism (CDM) due to safety and waste disposal concerns (NEA, 2002).

- Analyses developed to assist governments, including the United States, in making long-term investment and public policy decisions in nuclear power (Keepin, 1988; Hagen et al., 2001; MIT, 2003).

Although the qualitative studies sometimes reference and critique the existing quantitative estimates of GHGs produced by the nuclear fuel cycle or life cycle, their conclusions generally rely heavily on discussions of other aspects of nuclear policy decisions and investment such as safety, cost, waste generation, and political acceptability. Therefore, these studies are typically not directly applicable to an evaluation of GHG emissions associated with the proposed license renewal for a given nuclear power plant.

6.2.1.2 *Quantitative*

A large number of technical studies, including calculations and estimates of the amount of GHGs emitted by nuclear and other power generation options, are available in the literature and were useful to the NRC staff's efforts in addressing relative GHG emission levels. Examples of these studies include – but are not limited to – Mortimer (1990), Andseta et al. (1998), Spadaro (2000), Storm van Leeuwen and Smith (2005), Fritsche (2006), Parliamentary Office of Science and Technology (POST) (2006), Atomic Energy Authority (AEA) (2006), Weisser (2006), Fthenakis and Kim (2007), and Dones (2007).

Comparing these studies and others like them is difficult because the assumptions and components of the lifecycles the authors evaluate vary widely. Examples of areas in which differing assumptions make comparing the studies difficult include:

- Energy sources that may be used to mine uranium deposits in the future;
- Reprocessing or disposal of spent nuclear fuel;
- Current and potential future processes to enrich uranium and the energy sources that will power them;
- Estimated grades and quantities of recoverable uranium resources;
- Estimated grades and quantities of recoverable fossil fuel resources;
- Estimated GHG emissions other than CO_2, including the conversion to CO_2 equivalents per unit of electric energy produced;
- Performance of future fossil fuel power systems;
- Projected capacity factors for alternatives means of generation; and
- Current and potential future reactor technologies.

In addition, studies may vary with respect to whether all or parts of a power plant's lifecycle are analyzed, i.e., a full lifecycle analysis will typically address plant construction, operations, resource extraction (for fuel and construction materials), and decommissioning, whereas, a partial lifecycle analysis primarily focus on operational differences.

In the case of license renewal a GHG analysis for that portion of the plant's lifecycle (operation for an additional 20 years) would not involve GHG emissions associated with construction because construction activities have already been completed at the time of relicensing. In addition, the proposed action of license renewal would also not involve additional GHG emissions associated with facility decommissioning, because that decommissioning must occur whether the facility is relicensed or not. However, in some of the aforementioned studies, the specific contribution of GHG emissions from construction, decommissioning, or other portions of a plant's lifecycle cannot be clearly separated from one another. In such cases, an analysis of GHG emissions would overestimate the GHG emissions attributed to a specific portion of a plant's lifecycle. Nonetheless, these studies provide some meaningful information with respect to the relative magnitude of the emissions among nuclear power plants and other forms of electric generation, as discussed in the following sections.

In Tables 6-2, 6-3, and 6-4 the NRC staff presents the results of the aforementioned quantitative studies to provide a weight-of-evidence evaluation of the relative GHG emissions that may result from the proposed license renewal as compared to the potential alternative use of coal-fired, natural gas-fired, and renewable generation. Most studies from Mortimer (1990) onward suggest that uranium ore grades and uranium enrichment processes are leading determinants in the ultimate GHG emissions attributable to nuclear power generation. These studies indicate that the relatively lower order of magnitude of GHG emissions from nuclear power when compared to fossil-fueled alternatives (especially natural gas) could potentially disappear if available uranium ore grades drop sufficiently while enrichment processes continued to rely on the same technologies.

6.2.1.3 *Summary of Nuclear Greenhouse Gas Emissions Compared to Coal*

Considering that coal fuels the largest share of electricity generation in the United States and that its burning results in the largest emissions of GHGs for any of the likely alternatives to nuclear power generation, including Cooper Nuclear Station, Unit 1 (CNS-1), most of the available quantitative studies focused on comparisons of the relative GHG emissions of nuclear to coal-fired generation. The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle (and, in some cases, the nuclear lifecycle), as compared to an equivalent coal-fired plant, are presented in Table 6-2. The following chart does not include all existing studies, but provides an illustrative range of estimates developed by various sources.

Table 6-2. Nuclear Greenhouse Gas Emissions Compared to Coal

Source	GHG Emission Results
Mortimer (1990)	Nuclear—230,000 tons CO_2 Coal—5,912,000 tons CO_2 Note: Future GHG emissions from nuclear to increase because of declining ore grade.
Andseta et al. (1998)	Nuclear energy produces 1.4 percent of the GHG emissions compared to coal. Note: Future reprocessing and use of nuclear-generated electrical power in the mining and enrichment steps are likely to change the projections of earlier authors, such as Mortimer (1990).
Spadaro (2000)	Nuclear—2.5 to 5.7 g C_{eq}/kWh Coal—264 to 357 g C_{eq}/kWh
Storm van Leeuwen and Smith (2005)	Authors did not evaluate nuclear versus coal.
Fritsche (2006) (Values estimated from graph in Figure 4)	Nuclear—33 g C_{eq}/kWh Coal—950 g C_{eq}/kWh
POST (2006) (Nuclear calculations from AEA, 2006)	Nuclear—5 g C_{eq}/kWh Coal—>1000 g C_{eq}/kWh Note: Decrease of uranium ore grade to 0.03 percent would raise nuclear to 6.8 g C_{eq} /kWh. Future improved technology and carbon capture and storage could reduce coal-fired GHG emissions by 90 percent.
Weisser (2006) (Compilation of results from other studies)	Nuclear—2.8 to 24 g C_{eq}/kWh Coal—950 to 1250 g C_{eq}/kWh
Fthenakis and Kim (2007)	Authors did not evaluate nuclear versus coal.
Dones (2007)	Author did not evaluate nuclear versus coal.

6.2.1.4 *Summary of Nuclear Greenhouse Gas Emissions Compared to Natural Gas*

The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle (and, in some cases, the nuclear lifecycle), as compared to an equivalent natural gas-fired plant, are presented in Table 6-3. The following chart does not include all existing studies, but provides an illustrative range of estimates developed by various sources.

Table 6-3. Nuclear Greenhouse Gas Emissions Compared to Natural Gas

Source	GHG Emission Results
Mortimer (1990)	Author did not evaluate nuclear versus natural gas.
Andseta (1998)	Author did not evaluate nuclear versus natural gas.
Spadaro (2000)	Nuclear—2.5 to 5.7 g C_{eq}/kWh Natural Gas—120 to 188 g C_{eq}/kWh
Storm van Leeuwen and Smith (2005)	Nuclear fuel cycle produces 20 to 33 percent of the GHG emissions compared to natural gas (at high ore grades). Note: Future nuclear GHG emissions to increase because of declining ore grade.
Fritsche (2006) (Values estimated from graph in Figure 4)	Nuclear—33 g C_{eq}/kWh Cogeneration Combined Cycle Natural Gas—150 g C_{eq}/kWh
POST (2006) (Nuclear calculations from AEA, 2006)	Nuclear—5 g C_{eq}/kWh Natural Gas—500 g C_{eq}/kWh Note: Decrease of uranium ore grade to 0.03 percent would raise nuclear to 6.8 g C_{eq}/kWh. Future improved technology and carbon capture and storage could reduce natural gas GHG emissions by 90 percent.
Weisser (2006) (Compilation of results from other studies)	Nuclear—2.8 to 24 g C_{eq}/kWh Natural Gas—440 to 780 g C_{eq}/kWh
Fthenakis and Kim (2007)	Authors did not evaluate nuclear versus natural gas.
Dones (2007)	Author critiqued methods and assumptions of Storm van Leeuwen and Smith (2005), and concluded that the nuclear fuel cycle produces 15 to 27 percent of the GHG emissions of natural gas.

6.2.1.5 *Summary of Nuclear Greenhouse Gas Emissions Compared to Renewable Energy Sources*

The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle, as compared to equivalent renewable energy sources, are presented in Table 6-4. Calculation of GHG emissions associated with these sources is more difficult than the calculations for nuclear energy and fossil fuels because of the large variation in efficiencies due to their different sources and locations. For example, the efficiency of solar and wind energy is highly dependent on the location in which the power generation facility is installed. Similarly, the range of GHG emissions estimates for hydropower varies greatly depending on the type of dam or reservoir involved (if used at all). Therefore, the GHG emissions estimates for these energy sources have a greater range of variability than the estimates for nuclear and fossil fuel sources. As noted in Section 6.2.1.2, the following chart does not include all existing studies, but provides an illustrative range of estimates developed by various sources.

Table 6-4. Nuclear Greenhouse Gas Emissions Compared to Renewable Energy Sources

Source	GHG Emission Results
Mortimer (1990)	Nuclear—230,000 tons CO_2 Hydropower—78,000 tons CO_2 Wind power—54,000 tons CO_2 Tidal power—52,500 tons CO_2 Note: Future GHG emissions from nuclear to increase because of declining ore grade.
Andseta (1998)	Author did not evaluate nuclear versus renewable energy sources.
Spadaro (2000)	Nuclear—2.5 to 5.7 g C_{eq}/kWh Solar PV—27.3 to 76.4 g C_{eq}/kWh Hydroelectric—1.1 to 64.6 g C_{eq}/kWh Biomass—8.4 to 16.6 g C_{eq}/kWh Wind—2.5 to 13.1 g C_{eq}/kWh
Storm van Leeuwen and Smith (2005)	Author did not evaluate nuclear versus renewable energy sources.
Fritsche (2006) (Values estimated from graph in Figure 4)	Nuclear—33 g C_{eq}/kWh Solar PV—125 g C_{eq}/kWh Hydroelectric—50 g C_{eq}/kWh Wind—20 g C_{eq}/kWh
POST (2006) (Nuclear calculations from AEA, 2006)	Nuclear—5 g C_{eq}/kWh Biomass—25 to 93 g C_{eq}/kWh Solar PV—35 to 58 g C_{eq}/kWh Wave/Tidal—25 to 50 g C_{eq}/kWh Hydroelectric—5 to 30 g C_{eq}/kWh Wind—4.64 to 5.25 g C_{eq}/kWh Note: Decrease of uranium ore grade to 0.03 percent would raise nuclear to 6.8 g C_{eq}/kWh.
Weisser (2006) (Compilation of results from other studies)	Nuclear—2.8 to 24 g C_{eq}/kWh Solar PV—43 to 73 g C_{eq}/kWh Hydroelectric—1 to 34 g C_{eq}/kWh Biomass—35 to 99 g C_{eq}/kWh Wind—8 to 30 g C_{eq}/kWh
Fthenakis and Kim (2007)	Nuclear—16 to 55 g C_{eq}/kWh Solar PV—17 to 49 g C_{eq}/kWh
Dones (2007)	Author did not evaluate nuclear versus renewable energy sources.

6.2.2 Conclusions: Relative GHG Emissions

The sampling of data presented in Tables 6-2, 6-3, and 6-4 above demonstrates the challenges of any attempt to determine the specific amount of GHG emission attributable to nuclear energy production sources, as different assumptions and calculation methodology will yield differing results. The differences and complexities in these assumptions and analyses will further increase when they are used to project future GHG emissions. Nevertheless, several conclusions can be drawn from the information presented.

First, the various studies indicate a general consensus that nuclear power currently produces fewer GHG emissions than fossil-fuel-based electrical generation, e.g., the GHG emissions from a complete nuclear fuel cycle currently range from 2.5 to 55 g C_{eq}/kWh, as compared to the use of coal plants (264 to 1250 g C_{eq}/kWh) and natural gas plants (120 to 780 g C_{eq}/kWh). The studies also provide estimates of GHG emissions from five renewable energy sources based on current technology. These estimates included solar-photovoltaic (17 to 125 g C_{eq}/kWh), hydroelectric (1 to 64.6 g C_{eq}/kWh), biomass (8.4 to 99 g C_{eq}/kWh), wind (2.5 to 30 g C_{eq}/kWh), and tidal (25 to 50 g C_{eq}/kWh). The range of these estimates is wide, but the general conclusion is that current GHG emissions from the nuclear fuel cycle are of the same order of magnitude as from these renewable energy sources.

Second, the studies indicate no consensus on future relative GHG emissions from nuclear power and other sources of electricity. There is substantial disagreement among the various authors regarding the GHG emissions associated with declining uranium ore concentrations, future uranium enrichment methods, and other factors, including changes in technology. Similar disagreement exists regarding future GHG emissions associated with coal and natural gas for electricity generation. Even the most conservative studies conclude that the nuclear fuel cycle currently produces fewer GHG emissions than fossil-fuel-based sources, and is expected to continue to do so in the near future. The primary difference between the authors is the projected cross-over date (the time at which GHG emissions from the nuclear fuel cycle exceed those of fossil-fuel-based sources) or whether cross-over will actually occur.

Considering the current estimates and future uncertainties, it appears that GHG emissions associated with the proposed CNS-1 relicensing action are likely to be lower than those associated with fossil-fuel-based energy sources. The NRC staff bases this conclusion on the following rationale:

(1) As shown in Tables 6-2 and 6-3, the current estimates of GHG emissions from the nuclear fuel cycle are far below those for fossil-fuel-based energy sources;

(2) CNS-1 license renewal will involve continued GHG emissions due to uranium mining, processing, and enrichment, but will not result in increased GHG emissions associated with plant construction or decommissioning (as the plant will have to be decommissioned at some point whether the license is renewed or not); and

(3) Few studies predict that nuclear fuel cycle emissions will exceed those of fossil fuels within a timeframe that includes the CNS-1 periods of extended operation. Several studies suggest that future extraction and enrichment methods, the potential for higher grade resource discovery, and technology improvements could extend this timeframe.

With respect to comparison of GHG emissions among the proposed CNS-1 license renewal action and renewable energy sources, it appears likely that there will be future technology improvements and changes in the type of energy used for mining, processing, and constructing facilities of all types. Currently, the GHG emissions associated with the nuclear fuel cycle and renewable energy sources are within the same order of magnitude. Because nuclear fuel production is the most significant contributor to possible future increases in GHG emissions from nuclear power, and because most renewable energy sources lack a fuel component, it is likely that GHG emissions from renewable energy sources would be lower than those associated with CNS-1 at some point during the period of extended operation.

The NRC staff also provides an additional discussion about the contribution of GHG to cumulative air quality impacts in Section 4.11.5 of this SEIS,

6.3 REFERENCES

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 63. *Code of Federal Regulations*, Title 10, *Energy*, Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

40 CFR Part 191. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

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7.0 ENVIRONMENTAL IMPACTS OF DECOMMISSIONING

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586, Supplement 1 (NRC, 2002). The staff's evaluation of the environmental impacts of decommissioning presented in NUREG-0586, Supplement 1, identifies a range of impacts for each environmental issue.

The incremental environmental impacts associated with decommissioning activities resulting from continued plant operation during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).

7.1 DECOMMISSIONING

Category 1 issues in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B that are applicable to Cooper Nuclear Station, Unit 1 (CNS-1) decommissioning following the renewal term are listed in Table 7-1.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of CNS-1 Following the Renewal Term

ISSUE	GEIS Section
Radiation doses	7.3.1
Waste management	7.3.2
Air quality	7.3.3
Water quality	7.3.4
Ecological resources	7.3.5
Socioeconomic impacts	7.3.7

A brief description of the staff's review and the conclusions, as stated in Table B-1, 10 CFR Part 51, for each of the issues follows:

- Radiation doses. Based on information in the GEIS, the Commission found that:

  Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.

- Waste management. Based on information in the GEIS, the Commission found that:

  Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.

- Air quality. Based on information in the GEIS, the Commission found that:

Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.

- Water quality. Based on information in the GEIS, the Commission found that:

  The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.

- Ecological resources. Based on information in the GEIS, the Commission found that:

  Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

- Socioeconomic Impacts. Based on information in the GEIS, the Commission found that:

  Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

The NRC staff has not identified any new and significant information during the review of the Nebraska Public Power District (NPPD) environmental report (ER), the site audit, or the scoping process; therefore, there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996, 1999). For the issues listed in Table 7-1 above, the GEIS concluded that the impacts are SMALL.

7.2 REFERENCES

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8.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The National Environmental Policy Act (NEPA) mandates that each environmental impact statement (EIS) consider alternatives to any proposed major Federal action. U.S. Nuclear Regulatory Commission (NRC) regulations (Title 10 of the *Code of Federal Regulations* (CFR) Section 51.71(d)) implementing NEPA for license renewal require that a supplemental environmental impact statement (SEIS) do the following:

> Consider and weigh the environmental effects of the proposed action; the environmental impacts of alternatives to the proposed action; and alternatives available for reducing or avoiding adverse environmental effects and consideration of the economic, technical, and other benefits and costs of the proposed action.

In this case, the proposed Federal action is issuing a renewed license for Cooper Nuclear Station, Unit 1 (CNS-1), which will allow the plant to operate for 20 years beyond its current license expiration date. In this chapter, the NRC staff examines potential environmental impacts of alternatives to issuing a renewed operating license for CNS-1 as well as alternatives that may reduce or avoid adverse environmental impacts from license renewal, including when and where these alternatives are applicable**.**

While the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*, NUREG-1437 (NRC 1996, 1999), reached generic conclusions regarding many environmental issues associated with license renewal, it did not determine which alternatives are reasonable or reach conclusions about site-specific environmental impact levels. As such, the NRC staff must evaluate environmental impacts of alternatives on a site-specific basis.

Alternatives to the proposed action of issuing a renewed CNS-1 operating license must meet the purpose and need for issuing a renewed license; they must "provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers (NRC, 1996)."

The NRC staff ultimately makes no decision as to which alternative (or the proposed action) to implement, since that decision falls to utility, or State officials. Comparing the environmental effects of these alternatives will assist the NRC in deciding whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. If the NRC acts to issue a renewed license, all of the alternatives, including the proposed action, will be available to energy-planning decision makers. If NRC decides not to renew the license (or takes no action at all), then energy-planning decision makers may no longer elect to continue operating CNS-1 and will have to resort to another alternative—which may or may not be one of the alternatives the NRC staff considers in this section—to meet their energy needs.

In evaluating alternatives to license renewal, the NRC staff first selects energy technologies or options currently in commercial operation as well as some technologies not currently in commercial operation but likely to be commercially available by the time the current CNS-1 operating license expires.

Second, the NRC staff screens the alternatives to remove those that cannot meet future system needs. Then, the staff screens the remaining options to remove those whose costs or benefits do not justify inclusion in the range of reasonable alternatives. Any alternatives remaining, then, constitute alternatives to the proposed action that the staff evaluates in-depth throughout this section. At the end of the section, the staff will briefly address each alternative removed during screening.

The NRC staff initially considers 19 discrete alternatives to the proposed action.

Once the staff identifies the in-depth alternatives, the staff refers to generic environmental impact evaluations in the GEIS. The GEIS provides overviews of some energy technologies available at the time of its publishing in 1996, though it does not reach any conclusions regarding which alternatives are most appropriate, nor does it precisely categorize impacts for each site. Since 1996, many energy technologies have evolved significantly in capability and cost, while regulatory structures have changed to either promote or impede development of particular alternatives.

As a result, our analyses include updated information from sources like the Energy Information Administration (EIA), other organizations within the Department of Energy (DOE), the Environmental Protection Agency (EPA), industry sources and publications, and information submitted by the applicant (Nebraska Public Power District (NPPD)) in the environmental report (ER).

For each in-depth analysis, the staff analyzes environmental impacts across seven impact categories: (1) air quality, (2) ground water use and quality, (3) surface water use and quality, (4) ecology, (5) human health, (6) socioeconomics, and (7) waste management. As in earlier chapters of this draft SEIS, the staff uses NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—to indicate the intensity of environmental effects for each alternative that is evaluated in depth. By placing the detailed alternative analyses in this order, the NRC staff does not mean to imply that one alternative would have the least impact, or that an energy-planning decision maker would be most likely to implement one or another alternative.

Sections 8.1 through 8.3 contain analyses of environmental impacts of alternatives to license renewal. These include a supercritical coal-fired plant in Section 8.1, a natural gas-fired combined-cycle power plant in 8.2, and a combination of alternatives in 8.3, that

Energy Outlook:
Each year the Energy Information Administration (EIA), part of the U.S. Department of Energy (DOE), issues its updated *Annual Energy Outlook (AEO)*. *AEO, 2009,* indicates that natural gas, coal, and renewables are likely to fuel most new electrical capacity through 2030, with some growth in nuclear capacity (EIA, 2009a), though all projections are subject to future developments in fuel price or electricity demand.

> *"Natural-gas-fired plants account for 53 percent of capacity additions in the reference case, as compared with 22 percent for renewables, 18 percent for coal-fired plants, and 5 percent for nuclear. Capacity expansion decisions consider capital, operating, and transmission costs. Typically, coal-fired, nuclear, and renewable plants are capital-intensive, whereas operating (fuel) expenditures account for most of the costs associated with natural-gas-fired capacity."* (EIA, 2009c)

includes some natural gas-fired capacity, energy conservation, and a wind power component. In Section 8.4, the NRC staff explains why it dismissed many other alternatives from in-depth consideration. Finally, in Section 8.5, the staff considers the environmental effects that may occur if NRC takes no action and does not issue a renewed license for CNS-1.

8.1 SUPERCRITICAL COAL-FIRED GENERATION

Coal-fired generation accounts for a greater share of U.S. electrical power generation than any other fuel (EIA, 2009a). Furthermore, the EIA projects that coal-fired power plants will account for the greatest share of capacity additions through 2030—more than natural gas, nuclear or renewable generation options. While coal-fired power plants are widely used and likely to remain widely used, the staff acknowledges that future additions to coal capacity may be affected by perceived or actual efforts to limit greenhouse gas (GHG) emissions. For now, the staff considers a coal-fired alternative to be a feasible, commercially available option for providing electrical generating capacity beyond CNS-1's current license expiration.

Supercritical technologies are increasingly common in new coal-fired plants. Supercritical facilities operate at higher temperatures and pressures than most existing coal-fired plants. At the critical point, there is no change of state when pressure is increased or if heat is added. For states above the critical point the steam is supercritical. Operating at higher temperatures and pressures allows the supercritical coal-fired alternative to operate at a higher thermal efficiency than subcritical coal-fired power plants. While supercritical facilities are more expensive to construct, they consume less fuel for a given output, reducing environmental impacts. Based on technology forecasts from EIA (EIA, 2009), the NRC staff expects that a new, supercritical coal-fired plant that begins operation in 2014 would operate at a heat rate of 9,069 British thermal units/kilowatt hours (Btu/kWh), or approximately 38 percent thermally efficient (EIA, 2009).[3]

In a supercritical coal-fired power plant, burning coal heats pressurized water. As the supercritical steam/water mixture moves through plant pipes to a turbine generator, the pressure drops and the mixture flashes to steam. The heated steam expands across the turbine stages, which then spin and turn the generator to produce electricity. After passing through the turbine, any remaining steam is condensed back to water in the plant's condenser.

In most modern U.S. coal facilities, condenser cooling water circulates through cooling towers or a cooling pond system (either of which are closed-cycle cooling systems). Older plants often withdraw cooling water directly from existing rivers or lakes and discharge heated water directly to the same body of water (called open-cycle cooling). Though the NRC staff notes that a new facility could hypothetically continue to use the existing CNS-1 intake structure with a once-through cooling system as long as CNS-1 could continue to receive sufficient water to maintain cooling for those systems necessary for a shutdown plant and provided that no modifications would be necessary to the intake structure and associated pumps. In order to provide cooling water for the new facility, the NRC staff has chosen to evaluate a coal-fired alternative using closed-cycle cooling because it will result in lower impacts—primarily to aquatic ecology—over the life of the alternative. Construction impacts may, however, be slightly greater, and operational impacts to aesthetics may also be slightly more noticeable, depending on whether or not the replacement facility uses natural- or mechanical-draft cooling towers.

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[3] Thermal efficiency is a measure of the efficiency of converting a fuel to energy and useful work. Thermal efficiency of a nuclear plant is roughly 32 percent.

The plant would withdraw makeup water from and discharge blowdown (water containing concentrated dissolved solids and biocides) back to the Missouri River. Cooling towers could be either natural draft (tall towers powered only by the difference in density between heated, humid air, and surrounding cooler and usually drier air) or mechanical draft (shorter towers powered by mechanical fans). For this analysis, the NRC staff assumed that a new supercritical coal-fired power plant would use mechanical draft towers for its closed-cycle cooling system.

In order to replace the 816 net MWe that CNS-1 currently supplies, the coal-fired alternative would ideally produce roughly the same amount (NPPD, 2008). Onsite electricity usage includes scrubbers, cooling towers, coal-handling equipment, lights, communication, and other onsite needs. A supercritical coal-fired power plant equivalent in capacity to CNS-1 would require less cooling water than CNS-1 because of the switch from open-cycle to closed-cycle cooling and because the plant operates at a higher thermal efficiency.

This 816 net MWe power plant would consume 3.14 million tons (2.84 million metric tons (MT)) of coal annually assuming an average heat content of 8,570 British thermal unit/pound (BTU/lb) (EIA, 2006). EIA reported that most coal consumed in Nebraska originates in Wyoming. Given current coal mining operations in Wyoming, the coal used in this alternative would likely be mined in surface mines, then mechanically processed and washed, before being transported—likely by rail—to the power plant site. Limestone for scrubbers would also likely arrive by rail. This coal-fired alternative would then produce roughly 153,000 tons (138,800 MT) of ash, and roughly 49,500 tons (45,000 MT) scrubber sludge. As noted above, much of the coal ash and scrubber sludge (about 38,300 tons (34,800 MT)) could be recycled.

Environmental impacts from the coal-fired alternative will be greatest during construction. Site crews will clear the plant site of vegetation, prepare the site surface, and begin excavation before other crews begin actual construction on the plant and any associated infrastructure, including electricity transmission infrastructure connecting the plant to existing transmission lines.

8.1.1 Air Quality

Air quality impacts from coal-fired generation can be substantial because it emits a significant quantity of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide (CO), and hazardous air pollutants (HAPs) such as mercury; however, many of these pollutants can be effectively controlled by various technologies.

CNS-1 is located in Nemaha County, Nebraska. There are no areas designated by the EPA as nonattainment or maintenance for any of the criteria pollutants in the 50-mile (81 kilometer) vicinity of CNS-1. (EPA has defined six "criteria pollutants" as indicators of air quality, and has established for each of them a maximum concentration above which adverse effects on human health may occur). A new coal-fired generating plant would qualify as a new major-emitting industrial facility and would be subject to Prevention of Significant Deterioration of Air Quality Review under requirements of the Clean Air Act (CAA) (42 U.S.C. §7401 et seq.), adopted by Nebraska Department of Environmental Quality (NDEQ) in Title 129 of Nebraska Air Quality Regulations (NAQR) (EPA, 2008a). A new coal-fired generating plant would need to comply with the new source performance standards for coal-fired plants set forth in 40 CFR 60 Subpart Da. The standards establish limits for particulate matter (40 CFR 60.42Da), sulfur dioxide (SO_2) (40 CFR 60.43Da), and NO_x (40 CFR 60.44Da). Regulations issued by NDEQ adopt the EPA's CAA rules, with modifications, to limit power plant emissions of SO_x, NO_x, particulate matter, and HAPs, among other matters. The new coal-fired generating plant would qualify as a Class I major source as identified in Chapter 2 of Title 129 of the Nebraska Administrative Code and would be required to obtain Class I major source permits from NDEQ, (the EPA may also elect to review this aspect prior to issuance of the permits (NDEQ, 2003)).

Section 169A of the CAA (42 U.S.C. § 7491) calls for EPA to establish rules to remedy any existing visibility impairment and prevent any future impairment in mandatory Class I federal areas resulting from manmade air pollution. There are no mandatory Class I Federal areas in the State of Nebraska and the closest mandatory Class I Federal area is Hercules-Glades Wilderness Area, which is located 295 miles southeast from the CNS-1 in the State of Missouri. However, the State of Nebraska is among nine states (Nebraska, Kansas, Oklahoma, Texas, Minnesota, Iowa, Missouri, Arkansas, and Louisiana) that are members of the Central Regional Air Planning Association (CENRAP), along with tribes, Federal agencies, and other interested parties that identify regional haze and visibility issues and develop strategies to address them. The visibility protection regulatory requirements, contained in 40 CFR Part 51, Subpart P, include the review of the new sources that would be constructed in the attainment or unclassified areas and may affect visibility in any Federal Class I area (40 CFR § 51.307).

The emissions from the coal-fired alternative at the CNS-1 site, projected by the NRC staff based on published EIA data, EPA emission factors and based on performance characteristics for this alternative and likely emission controls, would be:

- Sulfur oxides (SO_x) – 923 tons (838 metric tones) per year
- Nitrogen oxides (NO_x) – 784 tons (711 metric tones) per year
- Total suspended particles (TSP) – 80 tons (72 metric tones) per year
- Particulate matter (PM) PM10 – 18 tons (17 metric tones) per year
- Particulate matter (PM) PM2.5 – 77 tons (69 metric tones) per year
- Carbon monoxide (CO) – 784 tons (711 metric tones) per year

8.1.1.1 *Sulfur Oxides*

The coal-fired alternative at the CNS-1 site would likely use wet, limestone-based scrubbers to remove SO_x. The EPA indicates that this technology can remove more than 95 percent of SO_x from flue gases. The staff projects total SO_x emissions would be 923 tons (838 MT) per year. SO_x emissions from a new coal-fired power plant would be subject to the part of the requirements of the CAA (42 U.S.C. §§7651 et seq.). These regulations were enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. The EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore purchase allowances from owners of other power plants or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, provided a new coal-fired power plant is able to purchase sufficient allowances to operate, it would not add to net regional SO_2 emissions, although it might do so locally.

8.1.1.2 *Nitrogen Oxides*

A coal-fired alternative at the CNS-1 site would most likely employ various available NO_x -control technologies, which can be grouped into two main categories: combustion modifications and post-combustion processes. Combustion modifications include low- NO_x burners, overfire air, reburning, flue gas recirculation, and operational modifications. Post-combustion processes include selective catalytic reduction, selective noncatalytic reduction, and hybrid processes. Effective combination of the combustion modifications and post-combustion processes allows reducing NO_x emissions by up to 95 percent (EPA, 1998). NPPD indicated in its ER that it would use a combination of low- NO_x burners, overfire air, and selective noncatalytic reduction technologies in order to reduce NO_x emissions from this alternative. Assuming the use of such technologies at the CNS-1 site, NO_x emissions after scrubbing are estimated to be in the range of 783.77 tons (711.04 MT) annually.

Section 407 of the CAA establishes technology-based emission limitations for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants as indicated in 40 CFR 60.44Da(1). This regulation, limits the discharge of any gases that contain NO_x to 200 nanograms (ng) of NO_x per joule (J) of gross energy output (equivalent to 1.6 pounds per megawatt hours (lb/MWh), based on a 30-day rolling average. Based on the projected emissions and proposed emissions controls, the coal-fired alternative would meet this regulation.

8.1.1.3 *Particulates*

The new coal-fired power plant would use fabric filters to remove particulates from flue gases. NPPD indicates that fabric filters would remove 99.9 percent of particulate matter (NPPD, 2008). The EPA notes that filters are capable of removing in excess of 99 percent of particulate matter, and that SO_2scrubbers further reduce particulate matter emissions (EPA, 2008); therefore, the NRC staff believes the NPPD removal factor is appropriate. Based on this, the new supercritical coal-fired plant would emit 79.68 tons (72.29 MT) per year of TSP and approximately 18.33 tons (16.63 MT) per year of particulate matter having an aerodynamic diameter less than, or equal to, 10 microns (PM10) annually. In addition, coal burning would also result in approximately 76.50 tons per year (69.40 MT) of particulate emissions with an aerodynamic diameter of 2.5 microns or less (PM2.5) and coal-handling equipment would introduce fugitive dust emissions when fuel is being transferred to onsite storage and then reclaimed from storage for use in the plant. During the construction of a coal-fired plant, onsite activities would also generate fugitive dust. Vehicles and motorized equipment would create exhaust emissions during the construction process. These impacts would be intermittent and short-lived; however, to minimize dust generation, construction crews could use applicable dust-control measures.

8.1.1.4 *Carbon Monoxide*

Based upon EPA emission factors (EPA, 1998), NRC staff estimates that total CO emissions would be approximately 783.77 tons (711.04 MT) per year.

8.1.1.5 *Carbon Dioxide*

A coal-fired plant would also have unregulated carbon dioxide (CO_2) emissions during operations, as well as during mining, processing, and transportation. The coal-fired plant would emit between 5,516,000 tons (5,004,000 MT) and 5,715,000 tons (5,184,600 MT) of CO_2 per year from coal combustion, depending on the type and quality of the coal burned.

8.1.1.6 *Summary of Air Quality*

While the GEIS analysis mentions global warming from unregulated CO_2 emissions and acid rain from SO_x and NO_x emissions as potential impacts, it does not quantify emissions from coal-fired power plants; however, the GEIS analysis does imply that air impacts would be substantial (NRC, 1996). The above analysis shows that emissions of air pollutants, including SO_x, NO_x, CO, and particulates, exceed those produced by the existing nuclear power plant, as well as those of the other alternatives considered in this section. Operational emissions of CO_2 are also much greater under the coal-fired alternative than under other alternatives, as reviewed by the staff in Section 6.2. Adverse human health effects such as cancer and emphysema have also been associated with air emissions from coal combustion, and are discussed further in Section 8.1.5.

The NRC analysis for a coal-fired alternative at an alternative site indicates that impacts from the coal-fired alternative would have clearly noticeable effects, but given existing regulatory regimens, permit requirements, and emissions controls, the coal-fired alternative would not destabilize air quality. Therefore, the appropriate characterization of air impacts from coal-fired plant located at CNS-1 site is MODERATE.

8.1.2 Ground Water Use and Quality

If the onsite coal-fired alternative continued to use ground water for drinking water and service water, the need for ground water at the plant would be minor. Total usage would likely be less than CNS-1 because fewer workers would be onsite, and the coal-fired unit would have fewer auxiliary systems requiring service water. No effect on ground water quality would likely be apparent.

Construction of a coal-fired plant could have a localized effect on ground water due to temporary dewatering and run-off control measures. Because of the temporary nature of construction and the likelihood of reduced ground water usage during operation, the impact of the coal-fired alternative would be designated as SMALL.

8.1.3 Surface Water Use and Quality

Because the alternative would draw water from the Missouri River, most of the approximately 12,000 gallons per minute (gpm) needed for maximum withdrawal would be taken from the river with an average consumptive loss of about 15 million gallons per day (mgd). Since the consumptive loss is less than 0.1 percent of the average annual flow of the Missouri River, the NRC staff concludes the impact of surface water use would be designated as SMALL. A new coal-fired plant would be required to obtain a National Pollutant Discharge and Elimination System (NPDES) permit from the NDEQ for regulation of industrial discharges such as wastewater and storm water. Assuming the plant operates within the limits of this permit, the impact from any cooling tower blowdown, site runoff, and other effluent discharges on surface water quality would be designated as SMALL.

8.1.4 Aquatic and Terrestrial Ecology

8.1.4.1 *Aquatic Ecology*

In Section 8.1, the NRC notes that it may be possible for a coal-fired alternative to rely on the existing CNS-1 cooling water intake and open cycle cooling, but in order to reduce potential impacts to aquatic organisms, the NRC staff has determined that the coal-fired alternative would use closed-cycle cooling. The number of fish and other aquatic organisms affected by impingement, entrainment, and thermal impacts will be less than those associated with license renewal because water consumption from, and heat rejected to, the Missouri River would be substantially lower than the current CNS-1 as closed cycle cooling requires less water and has less aquatic effects than once-through cooling. Some temporary impacts to aquatic organisms might occur as a result of construction or effluent discharges to the river. These activities would be monitored by the NDEQ under the project's NPDES permit. Although the number of affected organisms would be substantially less than for license renewal, the level of impact for continued CNS-1 operation is already small, and so NRC expects that the levels of impact for impingement, entrainment, and thermal effects would also be designated as SMALL.

8.1.4.2 *Terrestrial Ecology*

Coal-mining operation will also affect terrestrial ecology in offsite coal mining areas, although some of the land is most likely already disturbed by mining operations. Onsite and offsite land disturbances form the basis for impacts to terrestrial ecology.

Onsite impacts to terrestrial ecology will be minor because most of the site has been previously disturbed and is currently used for agricultural activities, aside from the 234 acres (95 ha) of woodland on the Missouri side of the river. The impact could change if additional railways or roads are constructed through less disturbed areas. It is likely that the coal-fired alternative would continue to use the existing transmission system and right-of-ways (ROWs). The construction of mechanical draft cooling towers for the closed-cycle cooling system may also result in additional land disturbances. These construction activities may fragment (in the case of roads or railways) or destroy habitats and could include a loss of onsite farmland and possibly wetlands. Construction could also affect current drainage patterns of water into and out of the wetlands on the CNS-1 site. These land disturbances could affect food supply and habitat of native wildlife and migratory waterfowl, and changes to the drainage patterns of the wetlands could affect the wetlands vegetation. However, these impacts are not likely to be significant. Cooling tower operation could produce some deposition of dissolved solids on surrounding vegetation and soil from cooling tower drift, even though the GEIS indicates that the impact of cooling towers on agricultural crops is of small significance and most of the land surrounding the CNS-1 site is farmland.

Any onsite or offsite waste disposal by land filling will also affect terrestrial ecology at least through the period when the disposal area is reclaimed. Deposition of acid rain resulting from NO_x or SO_x emissions, and the deposition of other pollutants, can also affect terrestrial ecology. Given the emission regulations discussed in Section 8.1.1, air deposition impacts may be noticeable but are not likely to be destabilizing. Because of the potential habitat disturbances and potential pollutant deposition, impacts to terrestrial resources from a coal-fired alternative would be designated as MODERATE and would occur mostly during construction.

8.1.5 Human Health

Coal-fired power plants introduce worker risks from coal and limestone mining, from coal and limestone transportation, from plant operations, and from disposal of coal combustion and scrubber wastes. In addition, there are public risks from inhalation of stack emissions (as addressed in Section 8.1.1) and the secondary effects of eating foods grown in areas subject to deposition from plant stacks.

Human health risks of coal-fired power plants are described, in general, in Table 8-2 of the GEIS (NRC, 1996). Cancer and emphysema as a result of the inhalation of toxins and particulates are identified as potential health risks to occupational workers and members of the public (NRC, 1996). The human health risks of coal-fired power plants, both to occupational workers and to members of the public, are greater than those of the current CNS-1 due to exposures to chemicals such as mercury; SO_x; NO_x; radioactive elements such as uranium and thorium contained in coal and coal ash; and polycyclic aromatic hydrocarbon (PAH) compounds, including benzo(a)pyrene.

Regulations restricting emissions—enforced by the EPA or State agencies—have acted to significantly reduce potential health effects but do not entirely eliminate them. These agencies also impose site-specific emission limits as needed to protect human health. Even if the coal-fired alternative were located in a nonattainment area, emission controls and trading or offset mechanisms could prevent further regional degradation; however, local effects could be visible. Many of the byproducts of coal combustion responsible for health effects are largely controlled, captured, or converted in modern power plants (as described in Section 8.1.1), although some level of health effects may remain.

Aside from emission impacts, the coal-fired alternative introduces the risk of coal pile fires and for those plants that use coal combustion liquid and sludge waste impoundments, the release of the waste due to a failure of the impoundment. Although there have been several instances of this occurring in recent years, these types of events are still relatively rare.

Overall, despite the range of potential threats to human health, extensive health-based regulations exist to mitigate the risks to workers and the public. As a result, the NRC staff expects human health impacts to be characterized as SMALL.

8.1.6 Socioeconomics

8.1.6.1 *Land Use*

The GEIS generically evaluates the impacts of nuclear power plant operations on land use both on and off each power plant site. The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a new supercritical coal-fired power plant on the CNS-1 site.

Based on previous experience and operating coal-fired plants of similar size, the NRC staff estimates that an 816-MWe plant would require approximately 170 acres (69 ha) of land. Additional onsite land may be needed to support a rail spur and yard, as well as approximately 140 acres (57 ha) of land area for waste disposal.

Offsite land use impacts would occur from coal mining, in addition to land use impacts from the construction and operation of the new power plant. Scaling from GEIS estimates, approximately 18,260 acres (7,390 ha) of land could be affected by mining coal and waste disposal to support the coal-fired alternative during its operational life (NRC, 1996); however, most of the land in existing coal-mining areas has already experienced some level of disturbance. The elimination of the need for uranium mining to supply fuel for the CNS-1 would partially offset this offsite land use impact. Scaling from GEIS estimates, approximately 816 acres (330 ha) of land used for uranium mining and processing would no longer be needed.

Based on this information, land use impacts could range from MODERATE to LARGE. Some portion of this impact could be mitigated by constructing the rail spur in existing ROWs.

8.1.6.2 *Socioeconomics*

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a new coal-fired power could affect regional employment, income, and expenditures. Job creation is characterized by two types: (1) construction-related jobs, and (2) operation-related jobs in support of power plant operations, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements of power plant construction and operation for the coal-fired alternative were determined in order to measure their possible effects on current socioeconomic conditions.

Based on GEIS estimates, NPPD projected a peak construction workforce of 979 to 2,040 workers would be required to construct the coal-fired alternative at the CNS-1 (NPPD, 2008). During the construction period, the communities surrounding the plant site would experience increased demand for rental housing and public services. The relative economic contributions of these relocating workers to local business and tax revenues would vary over time.

After construction, local communities may be temporarily affected by the loss of construction jobs and associated loss in demand for business services. In addition, the rental housing market could experience increased vacancies and decreased prices. As noted in the GEIS, the socioeconomic impacts at a rural construction site could be larger than at an urban site, because the workforce would need to relocate closer to the construction site. Although the CNS-1 site is a rural site, it is located near the city of Omaha, Nebraska (75 miles), meaning that these effects may be somewhat lessened if workers commute to the site instead of relocating closer. Construction impacts could range from MODERATE to LARGE.

NPPD estimated an operational workforce of 163 to 204 workers for the 816-MWe CNS-1 based on GEIS estimates (NPPD, 2008). The NPPD estimate appears reasonable and is consistent with trends calling for decreased workforces at power facilities. Even at a rural site like CNS-1, impacts are unlikely to be large. Operations impacts would likely be in the range of SMALL to MODERATE.

8.1.6.3 *Transportation*

During construction, approximately 2,000 workers would be commuting to the site. In addition to commuting workers, trucks would transport construction materials and equipment to the worksite increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes resulting in temporary levels of service impacts and delays at intersections. Trains or barges could also be used to deliver large components to the CNS-1 site, which could require the construction of a rail spur or a dock, as well as possible dredging in the Missouri River, if barge delivery is chosen. Transportation impacts are likely to be in the range of MODERATE to LARGE during construction.

Transportation impacts would be greatly reduced after construction, but would not disappear during plant operations. The maximum number of plant operating personnel commuting to the CNS-1 would be approximately 200 workers. Frequent deliveries of coal and limestone by rail (if rail delivery is used) would add to the overall transportation impact. Onsite coal storage would make it possible to receive several trains per day. Limestone delivered by rail could also add additional traffic (though considerably less traffic than that generated by coal deliveries).

The coal-fired alternative would likely create SMALL to MODERATE transportation impacts.

8.1.6.4 *Aesthetics*

The aesthetics impact analysis focuses on the degree of contrast between the coal-fired alternative and the surrounding landscape and the visibility of the coal plant.

The coal-fired alternative would be up to 200 feet (61 m) tall with an exhaust stack up to 500 feet (152 m) and may be visible offsite in daylight hours. The coal-fired plant, however, would be shorter than the current CNS-1 reactor building, which stands at 290 feet (88 m), with a release point at 325 feet (99 m). The assumed mechanical draft towers would generate condensate plumes, but these would be shorter than the plumes from the natural-draft tower alternative. Noise and light from plant operations, as well as lighting on plant structures, may be detectable offsite.

Impacts could be moderated because the higher elevation ridges along the river valley may make it difficult to see or hear the plant outside of the river valley. Overall, aesthetic impacts associated with the coal-fired alternative would likely be designated as SMALL to MODERATE.

8.1.6.5 *Historic and Archaeological Resources*

Cultural resources are the indications of human occupation and use of the landscape as defined and protected by a series of Federal laws, regulations, and guidelines. Prehistoric resources are physical remains of human activities that predate written records; they generally consist of artifacts that may alone or collectively yield information about the past. Historic resources consist of physical remains that postdate the emergence of written records; in the United States, they are architectural structures or districts, archaeological objects, and archaeological features dating from 1492 and later. Ordinarily, sites less than 50 years old are not considered historic, but exceptions can be made for such properties if they are of particular importance, such as structures associated with the development of nuclear power or Cold War themes. American Indian resources are sites, areas, and materials important to American Indians for religious or heritage reasons. Such resources may include geographic features, plants, animals, cemeteries, battlefields, trails, and environmental features. The cultural resource analysis encompassed the power plant site and adjacent areas that could potentially be disturbed by the construction and operation of alternative power plants.

The potential for historic and archaeological resources can vary greatly depending on the location of the proposed site. To consider a project's effects on historic and archaeological resources, any proposed areas will need to be surveyed to identify and record historic and archaeological resources, identify cultural resources (e.g., traditional cultural properties), and develop possible mitigation measures to address any adverse effects from ground disturbing activities. Studies will be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction will occur (e.g., roads, transmission corridors, rail lines, or other ROWs). In most cases, project proponents should avoid areas with the greatest sensitivity.

CNS-1 is situated in an area where historic and archaeological resources could be located several feet beneath the ground surface. As noted in Section 4.9.6, NPPD conducted a Phase 1A survey of the CNS-1 site in 2007 and 2008. NPPD has also developed a Cultural Resources Protection Plan which calls for surveys to be conducted by a qualified archaeologist in areas deemed sensitive prior to work commencing. The plan also includes an inadvertent discovery (stop work) provision to ensure that proper notification is taken to protect these resources should they be discovered. Since NPPD conducted a survey and has established a protection plan, the impact for a coal-fired alternative at the CNS-1 site would be designated as SMALL.

8.1.6.6 *Environmental Justice*

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new coal-fired power plant. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. The minority and low-income populations are subsets of the general public residing around the site, and all are exposed to the same hazards generated from various power plant operations.

Minority and low-income populations could be affected by the construction and operation of a new coal-fired power plant. For example, increased demand for rental housing during construction could disproportionately affect low-income populations. Nevertheless, impacts on minority and low-income populations from the construction and operation of a coal-fired power plant alternative could range from SMALL to MODERATE.

8.1.7 Waste Management

Coal combustion generates several waste streams including ash (a dry solid) and sludge (a semi-solid by-product of emission control system operation). The NRC staff estimates that an 816-MWe power plant would generate annually a total of 326,000 tons (296,000 MT) of dry solid ash and scrubber sludge. Much of this waste would be recycled. Disposal of the remaining waste from the 20-year operation of this alternative would require approximately 141 acres (57 ha). Disposal of the remaining waste could noticeably affect land use and ground water quality, but with a proper siting in accordance with the Title 132, Chapter 4 standards of the Nebraska Administrative Code (NAC), implementation of the monitoring and management practices, it would not destabilize resources. After closure of the waste site and revegetation, the land could be available for other uses.

The impacts from waste generated during operation of this coal-fired alternative would be designated as MODERATE; the impacts would be clearly visible but would not destabilize important resources.

Impacts from waste generated during the construction stage would be short-lived. The amount of the construction waste is small compared to the amount of waste generated during the operational stage, and most could be recycled. Overall, the impacts from waste generated during the construction stage would be designated as SMALL.

The NRC staff, therefore, concludes that waste management impacts from construction and operation of this alternative would be MODERATE.

Table 8-1 provides a summary of the environmental impacts of the supercritical coal-fired alternative compared to continued operation of CNS-1.

Table 8-1. Summary of Environmental Impacts of the Supercritical Coal-Fired Alternative Compared to Continued Operation of CNS-1

	Supercritical Coal-Fired Generation	Continued CNS-1 Operation
Air quality	MODERATE	SMALL
Ground water	SMALL	SMALL
Surface water	SMALL	SMALL
Aquatic and terrestrial resources	SMALL to MODERATE	SMALL
Human health	SMALL	SMALL
Socioeconomics	SMALL to LARGE	SMALL
Waste management	MODERATE	SMALL

8.2 NATURAL GAS-FIRED COMBINED-CYCLE GENERATION

In this section, the environmental impacts of natural gas-fired combined-cycle generation are evaluated at the CNS-1 site.

Natural gas fueled 22 percent of electric generation in the United States in 2007 (the most recent year for which data are available), accounting for the second greatest share of electrical power after coal (EIA, 2009a). Like coal-fired power plants, natural gas-fired plants may be affected by perceived or actual action to limit GHG emissions, although they produce markedly fewer GHGs per unit of electrical output than coal-fired plants. Natural gas-fired power plants are feasible, commercially available options for providing electrical generating capacity beyond CNS-1's current license expiration.

Combined-cycle power plants differ significantly from coal-fired and existing nuclear power plants. Combined-cycle power plants derive the majority of their electrical output from a gas-turbine cycle, and then generate additional power—without burning any additional fuel—through a second, steam-turbine cycle. The first, gas turbine stage (similar to a large jet engine) burns natural gas which turns a driveshaft that powers an electric generator. The exhaust gas from the gas turbine is still hot enough, however, to boil water to steam. Ducts carry the hot exhaust to a heat recovery steam generator, which produces steam to drive a steam turbine and produce additional electrical power. The combined-cycle approach is significantly more efficient than any one cycle on its own; thermal efficiency can exceed 60 percent. Since the natural gas-fired alternative derives much of its power from a gas turbine cycle, and because it wastes less heat than either the coal-fired alternative or the existing CNS-1, it requires significantly less cooling water and smaller cooling towers than the coal-fired alternative discussed in Section 8.1.

In order to replace the 816-MWe that CNS-1 currently supplies, the NRC staff selected a gas-fired alternative that uses two General Electric S107H combined-cycle generating units. While any number of commercially available combined-cycle units could be installed in a variety of combinations to replace the power currently produced by CNS-1, the S107H is a highly efficient model that will help to minimize environmental impacts. Other manufacturers, like Siemens, offer similarly high efficiency models. This gas-fired alternative produces a net 400 MWe per unit. Two units produce a total of 800 MWe, or nearly the same net output as the existing CNS-1.

The combined-cycle alternative operates at a heat rate of 5,690 British thermal units per kilowatt hours (BTU/kWh), or nearly 60 percent thermal efficiency (GE, 2007). As noted above, this gas-fired alternative would require much less cooling water than CNS-1, because it operates at a higher thermal efficiency and because it requires much less water for steam cycle condenser cooling. Cooling towers for this alternative would likely be mechanical draft-type towers approximately 65 feet (20 m) high.

In addition to cooling towers, other visible structures onsite include the turbine buildings and heat recovery steam generators (HRSGs) (which may be enclosed in a single building), two exhaust stacks, an electrical switchyard, and, possibly, equipment associated with a natural gas pipeline, like a compressor station. Based on GEIS estimates, NPPD indicated that this 800-MWe plant would require approximately 90 acres (36 ha).

This 800-MWe power plant would consume 34 billion ft^3 (964 million m^3) of natural gas annually assuming an average heat content of 1,029 BTU/ft^3 (EIA, 2009b). Natural gas would be extracted from the ground through wells, then treated to remove impurities (like hydrogen sulfide), and blended to meet pipeline gas standards, before being piped through the interstate pipeline system to the power plant site. This gas-fired alternative would produce relatively little waste, primarily in the form of spent catalysts used for emissions controls.

Environmental impacts from the gas-fired alternative will be greatest during construction. Site crews will clear vegetation from the site, prepare the site surface, and begin excavation before other crews begin actual construction on the plant and any associated infrastructure, including a pipeline spur to serve the plant and electricity transmission infrastructure connecting the plant to existing transmission lines. Constructing the gas-fired alternative on NPPD property would allow the gas-fired alternative to make use of CNS-1's existing transmission system.

8.2.1.1 *Air Quality*

Nemaha County, Nebraska is in EPA Region 7. All counties in the State of Nebraska are in attainment for all criteria pollutants, except Douglas County, which is a maintenance county for lead. A new gas-fired generating plant developed at the CNS-1 site would qualify as a new major-emitting industrial facility and require a New Source Review (NSR)/Prevention of Significant Deterioration of Air Quality review under CAA, adopted by Nebraska Department of Environmental Quality (NDEQ) in Title 129 of NAC (EPA, 2008). The natural gas-fired plant would need to comply with the standards of performance for electric utility steam generating units set forth in 40 CFR Part 60 Subpart Da.

Subpart P of 40 CFR Part 51 contains the visibility protection regulatory requirements, including the review of the new sources that would be constructed in the attainment or unclassified areas and may affect visibility in any Federal Class I area. If a gas-fired alternative was located close to a mandatory Class I area, additional air pollution control requirements would imply. There are no mandatory Class I Federal areas in the State of Nebraska and the closest mandatory Class I Federal area is Hercules-Glades Wilderness Area, which is located 295 miles southeast from the CNS-1 in the State of Missouri.

The staff projects the following emissions for a gas-fired alternative based on data published by the EIA, EPA, and on performance characteristics for this alternative and its emissions controls:

- Sulfur oxides (SO_x) – 60 tons (54 MT) per year
- Nitrogen oxides (NO_x) – 192 tons (177 MT) per year

- Carbon monoxide (CO) – 40 tons (36 MT) per year
- Total suspended particles (TSP) – 34 tons (30 MT) per year
- Particulate matter (PM) PM10 – 34 tons (30 MT) per year
- Carbon dioxide (CO_2) – 2,050,000 tons (1,860,000 MT) per year

A new natural gas-fired plant would have to comply with Title IV of the CAA (42 U.S.C. §7651) reduction requirements for SO_2 and NO_x, which are main precursors of acid rain and the major cause of reduced visibility. Title IV establishes maximum SO_2 and NO_x emission rates from the existing plants and a system of the SO_2 emission allowances that can be used, sold, or saved for future use by the new plants.

8.2.1.2 *Sulfur and Nitrogen Oxides*

As stated above, the new natural gas-fired alternative would produce 60.02 tons (54.45 MT) per year of SO_x and 192.42 tons (176.56 MT) per year of NO_x based on the use of the dry low NO_x combustion technology and use of the selective catalytic reduction (SCR) in order to significantly reduce NO_x emissions.

The new plant would be subjected to the continuous monitoring requirements of SO_x, NO_x, and CO_2 specified in 40 CFR Part 75. The natural gas-fired plant would emit approximately 2.1 million tons (approximately 1.9 million MT) per year of unregulated CO_2 emissions. Currently, there is no required reporting of GHG emissions in Nebraska.

8.2.1.3 *Particulates*

The new natural gas-fired alternative would produce 33.54 tons (30.43 MT) per year of TSP, all of which would be emitted as PM_{10}.

8.2.1.4 *Hazardous Air Pollutants*

The EPA issued in December 2000 regulatory findings (EPA, 2000a) on emissions of HAPs from electric utility steam-generating units, which identified that natural gas-fired plants emit HAPs such as arsenic, formaldehyde, and nickel, and stated that:

> Also in the utility RTC (Report to Congress), the EPA indicated that the impacts due to HAP emissions from natural gas-fired electric utility steam generating units were negligible based on the results of the study. The Administrator finds that regulation of HAP emissions from natural gas-fired electric utility steam generating units is not appropriate or necessary.
>
> The new natural gas-fired alternative would produce 33.25 tons (30.16 MT) per year of the TSP as PM_{10} emissions

8.2.1.5 *Construction Impacts*

Activities associated with the construction of the new natural gas-fired plant onsite or offsite CNS-1 would cause some additional, temporary air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material handling equipment. Emissions from workers' vehicles and motorized construction equipment exhaust would be temporary. The construction crews would employ dust-control practices in order to control and reduce fugitive dust. The NRC staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of the earth-moving and material handling equipment would be SMALL.

The overall air-quality impacts of a new natural gas-fired plant located at the CNS-1 site would be designated as SMALL to MODERATE.

8.2.2 Ground Water Use and Quality

The use of ground water for a natural gas-fired combined-cycle plant would likely be limited to supply wells for drinking water and possibly filtered service water. Total usage would likely be much less than CNS-1 because fewer workers would be onsite and because the gas-fired alternative would have fewer auxiliary systems requiring service water.

No effects on ground water quality would be apparent except during the construction phase due to temporary dewatering and run-off control measures. Because of the temporary nature of construction and the likelihood of reduced ground water usage during operation, the impact of the coal-fired alternative would be designated as SMALL.

8.2.3 Surface Water Use and Quality

Maximum withdrawals of surface water from the Missouri River would be much less for a gas-fired plant than the 668,000 gpm (2 m^3/s)) maximum currently used by CNS-1; however, by switching from the open-cycle cooling system currently used by CNS-1 to a closed-cycle cooling system used by the proposed alternative, consumptive water losses will increase. Since the consumptive loss will remain less than 0.1 percent of the average annual flow of the Missouri River, the NRC staff concludes the impact of surface water use would be designated as SMALL.

A new gas-fired plant would be required to obtain an NPDES permit from the NDEQ for regulation of industrial wastewater, stormwater, and other discharges. Assuming the plant operates within the limits of this permit, the impact from any possible runoff cooling tower blowdown, stormwater discharge, and effluent discharges on surface water quality would be designated as SMALL.

8.2.4 Aquatic and Terrestrial Ecology

8.2.4.1 *Aquatic Ecology*

Compared to the existing CNS-1 plant, aquatic ecology actually benefits from the onsite gas-fired alternative, as the combined-cycle plant with cooling towers rejects significantly less heat to the environment, thus requiring less water. The number of fish and other aquatic organisms affected by impingement, entrainment, and thermal impacts will be less than those associated with license renewal because water consumption and heat rejected to the Missouri River are substantially lower. Some temporary impacts to aquatic organisms might occur due to any construction or effluent discharge to the river, but NRC assumes that the appropriate agencies would be monitoring and regulating such activities. Although the number of affected organisms would be substantially less than for license renewal, the NRC level of impact for license renewal is already small, and so NRC expects that the levels of impact for impingement, entrainment, and thermal effects would also be designated as SMALL.

8.2.4.2 *Terrestrial Ecology*

Constructing the natural gas alternative will require 90 acres (36 ha) of land. These land disturbances form the basis for impacts to terrestrial ecology.

Impacts to terrestrial ecology will be minor because the selected site has been previously disturbed and is mostly used for agricultural activities. (Gas extraction and collection will also affect terrestrial ecology in offsite gas fields, although, much of this land is likely already disturbed by gas extraction, and the incremental effects of this alternative on gas field terrestrial ecology are difficult to gauge.)

Construction of the two natural gas units and mechanical draft cooling towers could result in the loss of farmland and possible changes to drainage patterns of water into and out of the wetlands on the CNS-1 site, which could affect food supply and habitat of native wildlife. Land disturbance could also affect wetland vegetation, but these effects are not expected to be significant. Operation of the cooling towers would produce a visible plume and cause some deposition of dissolved solids on surrounding vegetation (including some wetlands) and soil from cooling tower drift; however, the GEIS indicates that the impact of cooling towers on agricultural crops is of small significance, and most of the land surrounding the cooling towers is farmland.

Construction of the 40-mile gas pipeline could lead to a conversion of forested lands used by terrestrial wildlife to a mowed right-of-way (ROW) as well as the possible loss of cropland from agricultural production, which could impact wildlife that use the croplands as a food source (NPPD, 2008). Siting of the pipeline may occur partially in wetlands, which could impact wildlife that utilize wetlands habitat. Pipeline construction may fragment surrounding habitat and may increase edge habitat, which may have adverse impacts on forest interior dwelling species, including migratory songbirds. Threatened and endangered species may also be affected by construction of the gas pipeline. Impacts from construction of the pipeline are expected to be MODERATE.

Based on this information, impacts to terrestrial resources could range from SMALL to MODERATE.

8.2.5 Human Health

Like the coal-fired alternative discussed above, a gas-fired plant would emit criteria air pollutants, but generally in smaller quantities (except NO_x, which requires additional controls to reduce emissions). Human health effects of gas-fired generation are generally low, although in Table 8-2 of the GEIS (NRC, 1996), the NRC staff identified cancer and emphysema as potential health risks from gas-fired plants. NO_x emissions contribute to ozone formation, which in turn contributes to human health risks. Emission controls on this gas-fired alternative maintain NO_x emissions well below air quality standards established for the purposes of protecting human health, and emissions trading or offset requirements mean that overall NO_x in the region will not increase. Health risks to workers may also result from handling spent catalysts that may contain heavy metals.

Overall, human health risks to occupational workers and to members of the public from gas-fired power plant emissions sited at CNS-1 would be less than the risks described for a coal-fired alternative and therefore, would likely be designated as SMALL.

8.2.6 Socioeconomics

8.2.6.1 *Land Use*

As discussed in Section 8.1.6, the GEIS generically evaluates the impacts of nuclear power plant operations on land use, both on and off each power plant site. The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a two-unit natural gas-fired combined-cycle power plant at the CNS-1 site.

Based on GEIS estimates, NPPD indicated that approximately 90 acres (36 ha) of land would be needed to support a natural gas-fired alternative to replace CNS-1 (NPPD, 2008). This amount of land use would include other plant structures and associated infrastructure, and is unlikely to exceed 90 acres (36 ha), excluding land for natural gas wells and collection stations. Land use impacts from construction would be designated as SMALL.

In addition to onsite land requirements, land would be required offsite for natural gas wells and collection stations. Scaling from GEIS estimates, approximately 2,988 acres (1,209 ha) would be required for wells, collection stations, and pipelines to bring the gas to the plant. Most of this land requirement would occur on land where gas extraction already occurs. In addition, some natural gas could come from outside the United States and be delivered as liquefied gas.

The elimination of uranium fuel for the CNS-1 could partially offset offsite land requirements. Scaling from GEIS estimates, the NRC staff estimated that approximately 816 acres (330 ha) would not be needed for mining and processing uranium during the operating life of the plant. Overall land use impacts from a gas-fired power plant would be in the range of SMALL to MODERATE.

8.2.6.2 *Socioeconomics*

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a new natural gas-fired power plant could affect regional employment, income, and expenditures. Two types of jobs are created by this alternative: (1) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operation-related jobs in support of power plant operations, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements of power plant construction and operations for the natural gas-fired power plant alternative were determined in order to measure their possible effect on current socioeconomic conditions.

The socioeconomic impacts from constructing and operating a gas-fired plant would have little noticeable effect. Compared to the coal-fired alternative, the small size of the construction and operations workforce would have little or no socioeconomic impact. As discussed in Section 8.1.6.2, the socioeconomic impact of operations of the coal-fired alternative would likely be in the range of SMALL to MODERATE.

Based on GEIS estimates, NPPD projected a maximum construction workforce of 979 (NPPD, 2008). During construction of a gas-fired plant, the communities surrounding the power plant site would experience increased demand for rental housing and public services. The relative economic effect of construction workers on local economy and tax base would vary over time.

After construction, local communities may be temporarily affected by the loss of construction jobs and associated loss in demand for business services, and the rental housing market could experience increased vacancies and decreased prices. As noted in the GEIS, the socioeconomic impacts at a rural construction site could be larger than at an urban site, because the workforce may have to move to be closer to the construction site. The impact of construction on socioeconomic conditions could range from SMALL to MODERATE.

Based on GEIS estimates, NPPD estimated a power plant operations workforce of approximately 125 (NPPD, 2008). The NPPD estimate appears reasonable and is consistent with trends toward lowering labor costs by reducing the size of power plant operations workforces. The small number of operations workers could have a noticeable effect on socioeconomic conditions in the region, however, socioeconomic impacts associated with the operation of a gas-fired power plant at the CNS-1 site would be designated as SMALL.

8.2.6.3 *Transportation*

Transportation impacts associated with construction and operation of a two-unit gas-fired power plant would consist of commuting workers and truck deliveries of construction materials to the CNS-1 site. During construction, up to 1,000 workers would be commuting to the site. In addition to commuting workers, trucks would transport construction materials and equipment to the worksite increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes resulting in temporary levels of service impacts and delays at intersections. Pipeline construction and modification to existing natural gas pipeline systems could also have an impact.

During plant operations, transportation impacts would almost disappear. According to NPPD, approximately 125 workers would be needed to operate the gas-fired power plant. Since fuel is transported by pipeline, most transportation infrastructure would experience little increased use from plant operations.

The transportation infrastructure would experience little to no increased use from plant operations. Overall, the gas-fired alternative would have a SMALL impact on transportation conditions in the region around the CNS-1.

8.2.6.4 *Aesthetics*

The aesthetics impact analysis focuses on the degree of contrast between the natural gas-fired alternative and the surrounding landscape and the visibility of the gas-fired plant.

The two gas-fired units could be approximately 100 feet (30 m) tall, with two exhaust stacks up to 175 feet (53 m) tall. Some structures may require aircraft warning lights. Aesthetic impacts may be mitigated as higher elevations and vegetation along the river valley could make it difficult to see or hear the plant outside of the river valley. Power plant infrastructure would generally be smaller and less noticeable than the CNS-1, which has a reactor building height of 290 feet (88 m). Mechanical draft cooling towers would generate condensate plumes and operational noise. Noise during power plant operations would be limited to industrial processes and communications. Pipelines delivering natural gas fuel could be audible offsite near compressors.

In general, aesthetic changes would be limited to the immediate vicinity of the CNS-1. Impacts would likely be designated as SMALL to MODERATE.

8.2.6.5 *Historic and Archaeological Resources*

The same considerations as discussed in Section 8.1.6.4 for impact of the coal-fired alternative on historic and archaeological resources apply to the gas-fired alternative.

The impact for a gas-fired alternative at the CNS-1 site would be SMALL.

8.2.6.6 *Environmental Justice*

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new natural gas-fired power plant. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. The minority and low-income populations are subsets of the general public residing around the site, and all are exposed to the same hazards generated from various power plant operations.

Minority and low-income populations could be affected by the construction and operation of a new natural gas-fired power plant. Some of these effects have been identified in resource areas discussed in this section. For example, increased demand for rental housing during construction could disproportionately affect low-income populations. Nevertheless, impacts on minority and low-income populations from the construction and operation of a natural gas-fired power plant alternative could range from SMALL to MODERATE.

8.2.7 Waste Management

During the construction stage of the natural gas-fired combined-cycle generation alternative, land clearing and other construction activities would generate waste that can be recycled, disposed onsite or shipped to the offsite waste disposal facility. Because the alternative would be constructed on the previously disturbed CNS-1 site, the amounts of wastes produced during land clearing would be reduced.

During operational stage, spent SCR catalysts, which are used to control NO_x emissions from the natural gas-fired plants, would make up the majority of the waste generated by this alternative.

The NRC staff concluded in the GEIS (NRC, 1996), that natural gas-fired plant would generate minimal waste and the waste impacts would be SMALL for a natural gas-fired alternative located at CNS-1 site or offsite.

Table 8-2 provides a summary of the environmental impacts of the natural gas-fired alternative compared to continued operation of CNS-1.

Table 8-2. Summary of Environmental Impacts of the Natural Gas-Fired Combined-Cycle Generation Alternative Compared to Continued Operation of CNS-1

	Natural Gas Combined-Cycle Generation	Continued CNS-1 Operation
Air quality	SMALL to MODERATE	SMALL
Ground water	SMALL	SMALL
Surface water	SMALL	SMALL
Aquatic and terrestrial resources	SMALL to MODERATE	SMALL
Human health	SMALL	SMALL
Socioeconomics	SMALL to MODERATE	SMALL
Waste management	SMALL	SMALL

8.3 COMBINATION ALTERNATIVE

In this section, the environmental impacts of a combination of alternatives are evaluated. This combination will include a portion of the combined-cycle gas-fired capacity identified in Section 8.2, an energy conservation capacity component, and a wind power component. This alternative requires new construction of a single gas-fired unit installed at the CNS-1 site and the construction of roughly 250 wind turbines at an offsite location, or several different offsite locations.

In this alternative, a portion of CNS-1's output—250 MWe—would be replaced by conservation. Inclusion of this conservation component of the alternative is based on Nebraska's energy efficiency goals for the year 2012. Wind turbines constructed offsite will account for roughly 150 MWe of capacity and 400 MWe will come from one GE S107H combined-cycle power plant. The only major construction anticipated is at the current CNS-1 site where the combined-cycle gas-fired power plant would be constructed and the wind turbine construction at an offsite location (including the right of way for new transmission lines). No major construction should be necessary for the conservation portion.

The appearance of the gas-fired facility would be similar to that of the full gas-fired alternative considered in Section 8.2, though only one unit would be constructed. The NRC staff estimates that it would require about 50 percent of the space necessary for the alternative considered in Section 8.2, and that all construction effects—as well as operational aesthetic, fuel-cycle, air quality, socioeconomic, land use, environmental justice, and water consumption effects—will scale accordingly.

8.3.1 Air Quality

Nemaha County, Nebraska, where CNS-1 is located, is in EPA Region 7. All counties in the State of Nebraska are in attainment for all criteria pollutants. Douglas County is a maintenance county for lead. NDEQ is responsible for managing and monitoring air quality in the State of Nebraska.

This alternative is a combination of one 400-MWe natural gas-fired combined-cycle generating unit, constructed onsite, 250 MWe equivalent of conservation and demand-side management, and 500 MWe of wind capacity constructed offsite, possibly at several different locations.

A new gas-fired generating plant on the CNS-1 site would qualify as a new major-emitting industrial facility and require an NSR under CAA. Nebraska air quality regulations require s that a permit must be obtained before construction of the new major-emitting industrial facility which will be issued only if the new plant includes pollution control measures that reflect the best available control technology (BACT). The natural gas-fired plant must comply with the standards of performance for electric utility steam generating units set forth in 40 CFR Part 60 Subpart Da.

Subpart P of 40 CFR Part 51 contains the visibility protection regulatory requirements, including the review of the new sources that would be constructed in the attainment or unclassified areas and may affect visibility in any Federal Class I area (40 CFR §51.307). If a gas-fired unit were located close to a mandatory Class I area, additional air pollution control requirements would imply. There are no mandatory Class I Federal areas in the State of Nebraska. The closest is Hercules-Glades Wilderness Area, which is located 295 miles southeast of CNS-1 in the State of Missouri.

According to published EIA data, the EPA emission factors, performance characteristics for this alternative and implemented emission controls, emissions from the one natural gas-fired unit with a capacity of 400 MWe built at CNS-1 site would be:

- Sulfur oxides (SO_x) – 30 tons (27 MT) per year
- Nitrogen oxides (NO_x) (with SCR) – 96 tons (87 MT) per year
- Carbon monoxide (CO) – 20 tons (18 MT) per year
- Total suspended particles (TSP) – 17 tons (15 MT) per year
- Particulate matter (PM) PM_{10} – 17 tons (15 MT) per year
- Carbon dioxide (CO_2) – 1,030,000 tons (964,000 MT) per year

The natural gas-fired component of this alternative would emit 17 tons (15. MT) per year of particulate matter having an aerodynamic diameter less than, or equal to, 10 μm (PM_{10}).

In December 2000, the EPA issued regulatory findings (EPA, 2000) on emissions of hazardous air pollutants from electric utility steam-generating units. The findings show that natural gas-fired plants emit HAPs such as arsenic, formaldehyde, and nickel, and state that:

> Also in the utility RTC (Report to Congress, the impacts due to HAP emissions from natural gas-fired electric utility steam generating units were negligible based on the results of the study. The Administrator finds that regulation of HAP emissions from natural gas-fired electric utility steam generating units is not appropriate or necessary.

The new natural gas-fired alternative would produce 16.77 tons (15.21 MT) per year of TSP, all of which would be emitted as PM_{10} emissions.

The natural gas-fired plant would have to comply with CAA reduction requirements for SO_2 and NO_x (42 U.S.C. §7401 et seq.), which are the main precursors of acid rain and major causes of reduced visibility. Title IV establishes maximum SO_2 and NO_x emission rates from the existing plants and a system of the SO_2 emission allowances that can be used, sold, or saved for future use by the new plants.

As stated above, the new natural gas-fired unit would produce 30.01 tons (27.23 MT) per year of SO_x and 96.21 tons (87.28 MT) per year of NO_x based on the use of the dry low NO_x combustion technology and use of the SCR in order to significantly reduce NO_x emissions.

The natural gas-fired component of this alternative would be subjected to the continuous monitoring requirements of SO_2, NO_x, and CO_2 specified in 40 CFR Part 75. The natural gas-fired plant would emit approximately 1.0 million tons (approximately 0.9 million MT) per year of unregulated CO_2 emissions. In response to the Consolidated Appropriations Act of 2008, the EPA has proposed a rule that requires mandatory reporting of GHG emissions from large sources (applicable to the presented alternative) in the United States that would allow collection of accurate and comprehensive emissions data to inform future policy decisions. EPA proposes that suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 MT or more per year of GHG emissions submit annual reports to the EPA. The gases covered by the proposed rule are CO_2, CH_4, N_2O, HFC, PFC, SF_6 and other fluorinated gases including NF_3 and HFE. NPPD states in the “Statement on Addressing the Challenge of Global Climate Change” that it is voluntarily engaged in lowering the GHG emissions (NPPD, 2008). In the “2008 Integrated Resource Plan,” NPPD outlines the environmental goals of the company with emphasis on lowering GHG emissions and obtaining 10 percent of the energy supply from renewable resources by 2020, wind being primarily the source of power (NPPD, 2008).

There would be no operating emissions from the wind or conservation components of the combination alternative.

Activities associated with the construction of the new natural gas-fired plant onsite at CNS-1 and wind turbines offsite would cause some additional air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material handling equipment. Vehicles of workers and construction motorized equipment exhaust emissions would be temporary. The construction crews would employ dust-control practices in order to control and reduce fugitive dust, which would be temporary in nature. The NRC staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of earth-moving and material handling equipment would be designated as SMALL. Implementation of the conservation portion of this alternative would have no noticeable effects on air quality, though some weatherization programs may cause existing indoor air quality problems to become worse.

The overall air-quality impacts of the combination alternative consisting of a natural gas-fired plant located at CNS-1 site, energy conservation, and an offsite wind component would be in the range of SMALL to MODERATE.

8.3.2 Ground Water Use and Quality

If the onsite gas-fired plant continued to use ground water for drinking water and service water, the total usage would likely be much less than CNS-1 uses, because fewer workers are onsite and because the gas-fired unit would have fewer auxiliary systems requiring service water. The current average withdrawal rate is 250 gpm, and pumping tests indicate this rate would not cause an effect on nearby supply wells. A reduction in this withdrawal rate means that impacts of the combination alternative would remain SMALL.

8.3.3 Surface Water Use and Quality

Using a combined alternative with conservation as a major component will reduce the amount of surface water consumed for cooling purposes from the already low consumption of the wholly gas-fired alternative considered in Section 8.2. The maximum consumptive use would be reduced to a fraction of the surface water withdrawn by the open-cycle cooling system currently in use by CNS-1. This represents less than 0.001 percent of the average annual flow rate in the Missouri River. The impact of this withdrawal would be SMALL.

8.3.4 Aquatic and Terrestrial Ecology

8.3.4.1 *Aquatic Ecology*

In order to minimize impacts, NRC assumes that the cooling system for this gas-fired plant would involve closed-cycle cooling. The wind and conservation components would have no associated impingement, entrainment, and thermal impacts. The number of fish and other aquatic resource organisms affected by impingement, entrainment, and other impacts will be less than those associated with license renewal because water consumption and heat injected to the Missouri River would be substantially lower. Some temporary impacts to aquatic organisms might occur due to any construction that might occur or due to any effluent discharges to the river, but these activities would be monitored by the NDEQ under the project's NPDES permit. Although the number of affected organisms would be substantially less than for license renewal, the NRC level of impact for license renewal is already designated as SMALL, and so NRC expects that the impact for impingement, entrainment, and thermal effects would also be SMALL.

8.3.4.2 *Terrestrial Ecology*

A combination alternative of a single natural gas-fired unit, a system using wind energy, and energy conservation would make use of existing disturbed land and possibly some farmland at the CNS-1 site for the natural gas unit and the mechanical draft cooling tower. This alternative would also require land offsite for the gas pipeline and would require additional land offsite to accommodate the number of turbines necessary in a wind farm to offset the power generated by CNS-1.

This alternative would use a portion of the existing plant site land, switchyard, and transmission line system for construction of the gas-fired unit. Approximately 45 ac (18 ha) of land would be required on the CNS-1 site to support a 400 MWe natural gas plant.

Impacts to terrestrial ecology from onsite construction of a single gas-fired unit with one mechanical draft cooling tower would be less than the impacts described for the two-unit gas-fired alternative. The impacts to farmland onsite would be approximately one-half of the impacts of the two-unit natural gas plant alternative. The drainage patterns of the wetland areas onsite may also be impacted, though again to a lesser degree than the two-unit gas alternative. These onsite impacts are expected to be minor. Impacts to terrestrial ecology from offsite construction of the 40-mile (64-km) long gas pipeline for a single gas-fired unit would be the same as for the two gas-fired unit alternative previously discussed (NPPD, 2008).

Based upon data in the GEIS, the wind farm component of the combination alternative producing 500 MWe of electricity would require approximately 32,000 acres (12,950 ha) spread over several offsite locations, with approximately 125 acres (51 ha) in actual use. The remainder of the land would remain in agriculture. Additional land may be needed for construction of transmission line corridors to connect to existing transmission line corridors.

Impacts to terrestrial ecology from construction of the wind farm portion of the combination alternative and any needed transmission lines could include loss of terrestrial habitat, an increase in habitat fragmentation and a corresponding increase in edge habitat, and may impact threatened and endangered species. The GEIS notes that habitat fragmentation may lead to a decline in migrant bird populations. Bird mortality would increase from construction of the wind farm, although proper site selection for the wind farm could help to reduce bird strikes. The GEIS noted that wind farms typically do not cause significant adverse impacts to bird populations, although thousands of acres of wildlife habitat or agricultural land could be impacted, and disruptions could occur to wildlife migratory routes (NRC, 1996).

Based on this information, impacts to terrestrial resources could range from MODERATE to LARGE.

8.3.5 Human Health

The human health risks from a combination of alternatives include the effects already discussed in Section 8.2.5 for the combined cycle gas-fired plant. The GEIS (NRC, 1996) notes that the environmental impacts of conservation and a demand-side management alternative are likely to be centered on indoor air quality. This is due to increased weatherization of the home in the form of extra insulation and reduced air turnover rates from the reduction in air leaks; however, the actual impact from the conservation alternative is highly site specific and not yet well-established. For wind capacity, the GEIS notes that, except for a potential small number of occupational injuries, human health would not be affected by routine operations.

The human health risks from the combination of alternatives, although uncertain, are considered to be SMALL to MODERATE given that the construction and operation of the facilities are expected to comply with health-based Federal and State safety and emission standards.

8.3.6 Socioeconomics

8.3.6.1 *Land Use*

The GEIS generically evaluates the impacts of nuclear power plant operations on land use both on and off each power plant site. The analysis of land use impacts for combination alternative focuses on the amount of land area that would be affected by the construction and operation of a single natural gas-fired unit power plant at the CNS-1 site and at an offsite wind energy generating facility, and demand-side energy conservation.

Based on GEIS estimates, approximately 45 acres (18 ha) would be needed to support the single natural gas-fired unit portion of the combination alternative. Land use impacts from construction of the natural gas-fired power plant at CNS-1 would be designated as SMALL.

In addition to onsite land requirements, land would be required offsite for natural gas wells and collection stations. Scaling from GEIS estimates, the natural gas-fired power plant at the CNS-1 could require 1,469 acres (594 ha) for wells, collection stations, and pipelines to bring the gas to the facility. Most of this land requirement would occur on land where gas extraction already occurs. In addition, some natural gas could come from outside of the United States and be delivered as liquefied gas.

The wind farm component of the combination alternative producing 500 MWe of electricity would require approximately a 32,000-acre (12,950-ha) spread over several locations with approximately 125 acres (51 ha) in actual use.

Land use impacts of an energy efficiency alternative would be designated as SMALL. Quickly replacing and disposing old inefficient equipment could generate waste material and increase the size of landfills; however, given the time for program development and implementation, the cost of replacements, and the average life of equipment, the replacement process would probably be gradual. Older equipment would simply be replaced by more efficient equipment (especially in the case of frequently replaced items, such as light bulbs). In addition, many items (such as home appliances and industrial equipment) have recycling value and would probably not be disposed of in landfills.

The elimination of uranium fuel for CNS-1 could partially offset offsite land requirements. Scaling from GEIS estimates, approximately 816 acres (330 ha) would not be needed for mining and processing uranium during the operating life of the plant. Overall land use impacts from the combination alternative would range from SMALL to MODERATE.

8.3.6.2 *Socioeconomics*

As previously discussed, socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a new single natural gas-fired power plant at CNS-1 and the wind farm could affect regional employment, income, and expenditures. Job creation is characterized by two types: (1) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operation-related jobs in support of power generating operations, which have a greater potential for permanent, long-term socioeconomic impacts. The NRC staff conducted evaluations of construction and operations workforce requirements in order to measure their effect on current socioeconomic conditions.

Based on GEIS projections and a workforce of 1,200 for a 1,000-MWe plant, a single 400 MWe unit at CNS-1 requires a peak estimated construction workforce of 490. Additional estimated construction workforce requirements for this combination alternative include 300 construction workers for the wind farm. The number of additional workers would cause a short-term increase in the demand for services and temporary (rental) housing in the region around the construction site.

After construction and depending on the size of the community, some local communities may be temporarily affected by the loss of the construction jobs and associated loss in demand for business services. The rental housing market could also experience increased vacancies and decreased prices. The impact of construction on socioeconomic conditions would be designated as SMALL.

Following construction, a single-unit gas-fired power plant at CNS-1 could provide up to 63 jobs, based on NPPD estimates, or up to 64 jobs, based on GEIS estimates. Additional estimated operations workforce requirements for this combination alternative include 50 operations workers for the wind farm. Given the small numbers of operations workers at these facilities, socioeconomic impacts associated with the operation of the natural gas-fired power plant at CNS-1 and the wind farm would be designated as SMALL.

Socioeconomic effects of an energy efficiency program would be SMALL. As noted in the GEIS, the program would require additional workers. Lower-income families could benefit from weatherization and insulation programs. This effect would be greater than the effect for the general population because low-income households experience home energy burdens more than four times larger than the average household (OMB, 2007).

8.3.6.3 *Transportation*

Transportation impacts would be SMALL because the number of employees commuting to the CNS-1 site, where the gas-fired portion is located, would be small. Any transportation effects from the energy efficiency alternative would be widely distributed across the state, and would not be noticeable.

Construction and operation of a natural gas-fired power plant and wind farm would increase the number of vehicles on the roads in the vicinity of these facilities. During construction, cars and trucks would deliver workers, materials, and equipment to the worksites. The increase in vehicular traffic would peak during shift changes resulting in temporary levels of service impacts and delays at intersections. Pipeline construction and modification to existing natural gas pipeline systems could also have an impact. Highway delivery of large wind farm components may also cause impacts to traffic.

During plant operations, transportation impacts would almost disappear. Given the small numbers of operations workers at these facilities, levels of service impacts on local roads from the operation of the natural gas-fired power plant at CNS-1 and at the wind farm, would be SMALL. Transportation impacts at the wind farm site would also depend on current road capacities and average daily traffic volumes.

8.3.6.4 *Aesthetics*

The aesthetics impact analysis focuses on the degree of contrast between the surrounding landscape and the visibility of the power plant.

A single natural gas-fired unit located at CNS-1 would be approximately 100 feet (30 m) tall with an exhaust stack of at least 175 feet (53 m) tall, which is less noticeable than the current CNS-1 reactor building at 290 feet (88 m). The impact would be moderated as higher elevations and vegetation along the river valley could make it difficult to see or hear the power plant outside of the river valley. Power plant infrastructure would generally be smaller and less noticeable than the CNS-1 containment and turbine buildings. Mechanical draft cooling towers (if used) would generate condensate plumes and operational noise, which during power plant operations would be limited to noise from industrial processes and communications. In addition to power plant structures, construction of natural gas pipelines would have a short-term impact. Noise from the pipelines could be audible offsite near compressors.

Impacts from energy efficiency programs would be SMALL. Some noise impacts could occur in instances of energy efficiency upgrades to major building systems, although this impact would be intermittent and short-lived.

In general, aesthetic changes would be limited to the immediate vicinity of the CNS-1 site and the wind farm facilities. The wind farm would have the greatest aesthetic effect. Compared to a fossil-fueled power plant unit on 46 to 1,400 acres, the 250 wind turbines at over 300 feet (100 m) tall and spread across multiple sites covering 32,000 acres (13,000 ha) may, in some locations, dominate the view and be a major focus of viewer attention. The overall impact, however, would depend on the sensitivity of the people living around the area of the site; therefore, overall aesthetic impacts from the construction and operation of this combination alternative would be SMALL to MODERATE.

8.3.6.5 *Historic and Archaeological Resources*

Cultural resources are the indications of human occupation and use of the landscape as defined and protected by a series of Federal laws, regulations, and guidelines. Prehistoric resources are physical remains of human activities that predate written records; they generally consist of artifacts that may alone or collectively yield information about the past. Historic resources consist of physical remains that postdate the emergence of written records; in the United States, they are architectural structures or districts, archaeological objects, and archaeological features dating from 1492 and later. Ordinarily, sites less than 50 years old are not considered historic, but exceptions can be made for such properties if they are of particular importance, such as structures associated with the development of nuclear power or Cold War themes. American Indian resources are sites, areas, and materials important to American Indians for religious or heritage reasons. Such resources may include geographic features, plants, animals, burial grounds, battlefields, trails, and environmental features. The cultural resource analysis encompassed the power plant site and adjacent areas that could potentially be disturbed by the construction and operation of alternative power plants.

The potential for historic and archaeological resources can vary greatly depending on the location of the proposed site. To consider a project's effects on historic and archaeological resources, any proposed areas will need to be surveyed to identify and record historic and archaeological resources, identify cultural resources (e.g., traditional cultural properties), and develop possible mitigation measures to address any adverse effects from ground disturbing activities. Studies will be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction will occur (e.g., roads, transmission corridors, rail lines, or other ROWs). In most cases, project proponents should avoid areas with the greatest sensitivity.

The impact for a single-unit natural gas-fired alternative at the CNS-1 site would be SMALL. As noted in Section 4.9.6, NPPD conducted a Phase 1A survey of the CNS-1 site in 2007 and 2008. NPPD has also developed a Cultural Resources Protection Plan which calls for surveys to be conducted by a qualified archaeologist in areas deemed sensitive prior to work commencing. The plan also includes an inadvertent discovery (stop work) provision to ensure that proper notification is taken to protect these resources should they be discovered. Depending on the resource richness of an alternative site or sites ultimately chosen for the wind farm alternative, impacts could range from SMALL to MODERATE.

Impacts to historic and archaeological resources from implementing the energy efficiency programs would be SMALL. A conservation alternative would not affect land use or historical or cultural resources onsite or elsewhere in the state.

8.3.6.6 *Environmental Justice*

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new natural gas-fired power plant and wind farm. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. The minority and low-income populations are subsets of the general public residing around the site, and all are exposed to the same hazards generated from various power plant operations.

Minority and low-income populations could be affected by the construction and operation of a new natural gas-fired power plant and wind farm. Some of these effects have been identified in resource areas discussed in this section. For example, increased demand for rental housing during construction could disproportionately affect low-income populations.

Weatherization programs could target low-income residents as a cost-effective energy efficiency option since low-income populations tend to spend a larger proportion of their incomes paying utility bills (according to the Office of Management and Budget (OMB), low income populations experience energy burdens more than four times as large as those of average households (OMB, 2007)). Impacts to minority and low-income populations from energy efficiency programs would be SMALL, depending on program design and enrollment.

Impacts on minority and low-income populations under the combination alternative could range from SMALL to MODERATE, due to the small number of workers needed to construct and operate the natural gas-fired power plant and wind farm.

8.3.7 Waste Management

During the construction stage of this combination of alternative, land clearing and other construction activities would generate wastes that can be recycled, disposed onsite or shipped to the offsite waste disposal facility. During the operational stage, spent SCR catalysts, which are used to control NO_x emissions from the natural gas-fired plants, would make up the majority of the waste generated by this alternative.

There will be an increase in wastes generated during installation or implementation of conservation measures, such as appropriate disposal of old appliances, installation of control devices and building modifications. New and existing recycling programs would help to minimize the amount of generated waste.

The NRC staff concludes that overall waste impacts from the combination of the natural gas-fired unit constructed onsite, wind capacity, and conservation are SMALL.

Table 8-3 provides a summary of the environmental impacts of the combined alternative compared to continued operation of CNS-1.

Table 8-3. Summary of Environmental Impacts of the Combination Alternative Compared to Continued Operation of CNS 1

	Combination Alternative	Continued CNS-1 Operation
Air quality	SMALL to MODERATE	SMALL
Ground water	SMALL	SMALL
Surface water	SMALL	SMALL
Aquatic and terrestrial resources	SMALL to LARGE	SMALL
Human health	SMALL to MODERATE	SMALL
Socioeconomics	SMALL to MODERATE	SMALL
Waste management	SMALL	SMALL

8.4 ALTERNATIVES CONSIDERED BUT DISMISSED

In this section, the NRC staff presents the alternatives it initially considered for analysis as alternatives to license renewal of CNS-1, but later dismissed due to technical, resource availability, or commercial limitations that currently exist and that the NRC staff believes are likely to continue to exist when the existing CNS-1 license expires. Under each of the following technology headings, the NRC staff indicates why it dismissed each alternative from further consideration. Offsite coal and gas-fired alternatives were not considered because the NRC staff determined that a possibly undisturbed offsite location would generally generate larger impacts than either alternative constructed at the previously disturbed CNS-1 site.

8.4.1 Offsite Coal- and Gas-Fired Capacity

While it is possible that coal- and gas-fired alternatives like those considered in Sections 8.1 and 8.2, respectively, could be constructed at sites other than CNS-1, the NRC staff determined that they would result in greater impacts than alternatives constructed at the CNS-1 site. Greater impacts would occur from construction of support infrastructure, like transmission lines, roads, and railway spurs that are already present on the CNS-1 site. Further, the community around CNS-1 is already familiar with the appearance of a power facility and it is an established part of the region's aesthetic character. Workers skilled in power plant operations would also be available in this area. The availability of these factors is only likely to be available on other recently-industrial sites. In cases where recently-industrial sites exist, other remediation may also be necessary in order to make the site ready for redevelopment. In short, an existing power plant site would present the best location for a new power facility.

8.4.2 Coal-Fired Integrated Gasification Combined-Cycle

While utilities across the United States have considered or are considering plans for integrated gasification combined-cycle (IGCC) coal-fired power plants, few IGCC facilities have yet been constructed. All facilities constructed in the United States to date have been smaller than CNS-1. The technology, however, is commercially available and relies on a gasifier stage and a combined-cycle stage. Existing combined-cycle facilities (like the ones considered in Section 8.2) could be used as a part of an IGCC alternative.

EIA indicates that IGCC and other advanced coal plants may become increasingly common in coming years, though uncertainties about construction time periods and commercial viability in the near future lead NRC staff to believe that IGCC is an unlikely alternative to CNS-1 license renewal (EIA, 2009). For plants whose licenses expire at later dates, IGCC (with or without carbon capture and storage) may prove to be a viable alternative.

8.4.3 New Nuclear

In its ER, NPPD indicated that it is unlikely that a nuclear alternative could be sited, constructed, and operational by the time CNS-1's operating license expires in 2014 (NPPD, 2008). Sources in the nuclear industry have recently indicated that reactor projects currently under development are probably eight or nine years from completion (Nucleonics Week, 2008), or possibly online in the 2016–2017 timeframe. A plant currently under development would also require additional time to develop an application. Given the relatively short time remaining on the current CNS-1 operating license, NRC staff has not evaluated new nuclear generation as an alternative to license renewal.

8.4.4 Energy Conservation and Energy Efficiency

Though often used interchangeably, energy conservation and energy efficiency are different concepts. Energy efficiency means deriving a similar level of services by using less energy, while energy conservation indicates a reduction in energy consumption. Both fall into a larger category known as demand-side management. Demand-side management measures address energy end uses —unlike energy supply alternatives discussed in previous sections. Demand-side management can include measures that (1) shift energy consumption to different times of the day to reduce peak loads, (2) interrupt certain large customers during periods of high demand, (3) interrupt certain appliances during high demand periods (4) replace older, less efficient appliances, lighting, or control systems (5) encourage customers to switch from gas to electricity for water heating and other similar measures that utilities use to boost sales.

Unlike other alternatives to license renewal, the GEIS notes that conservation is not a discrete power generating source; it represents an option that States and utilities may use to reduce their need for power generation capability (NRC, 1996).

While NPPD does state that demand-side management is encouraged by the utility, and that in 2007 there was over 500 MWe demand reduction (NPPD, 2008), it is unlikely that increased energy efficiency in the State of Nebraska will have grown enough to offset the loss of CNS-1 by the license expiration in 2014. Because of this, the NRC staff has not evaluated energy conservation and efficiency as a discrete alternative to license renewal. It has, however, been considered as a component of the combination alternative.

8.4.5 Purchased Power

In its ER, NPPD indicated that purchased electrical power is, in theory, a potential alternative to CNS-1 license renewal; however, for the 2014 to 2034 time frame of CNS-1's renewal, there are no guaranteed available power sources to replace the 816 MWe that CNS-1 provides. NPPD indicates that most of its purchased power supply is imported from Canada, which is expected to decrease over the next two decades. Within the State of Nebraska, two newly licensed coal-fired plants starting production in 2009 and 2012 combined will barely meet the amount of electricity currently provided by CNS-1. Because of the lack of assured availability of purchased electrical power, the NRC staff has not evaluated purchased power as an alternative to license renewal.

8.4.6 Solar Power

Solar technologies use the sun's energy to produce electricity. Currently, the CNS-1 site receives approximately 3.8 to 4.2 kilowatt hours (kWh) per square meter per day, as does most of the eastern portion of Nebraska (NREL, 2008), for solar collectors oriented at an angle equal to the installation's latitude. Since flat-plate photovoltaics tend to be roughly 25 percent efficient, a solar-powered alternative will require at least 11,620 acres (4,700 ha) of collectors to provide an amount of electricity equivalent to that generated by CNS-1. Space between parcels and associated infrastructure increase this land requirement. This amount of land, while large, is consistent with the land required for coal and natural gas fuel cycles. In the GEIS, the NRC staff noted that, by its nature, solar power is intermittent (i.e., it does not work at night and cannot serve baseload when the sun is not shining), and the efficiency of collectors varies greatly with weather conditions. A solar-powered alternative will require energy storage or backup power supply to provide electric power at night. Given the challenges in meeting baseload requirements, the NRC staff did not evaluate solar power as an alternative to license renewal of CNS-1.

8.4.7 Biomass Waste

In 1999, DOE researchers estimated that Nebraska has biomass fuel resources consisting of forest, mill, agricultural, and urban residues, as well as energy crop potential. Excluding potential energy crops, DOE researchers projected that Nebraska had 16,634,800 tons (15,091,000 MT) of plant-based biomass available at 50 dollars per ton delivered (Walsh, et al., 2000; costs are in 1995 dollars). The Bioenergy Feedstock Development Program at Oak Ridge National Laboratory estimates that each air-dry pound of wood residue produces approximately 6,400 BTU of heat (ORNL, 2007). Assuming a 33 percent conversion efficiency, using all biomass available in Nebraska at 50 dollars per ton—the maximum price the researchers considered—would generate roughly 20.6 terawatt hours of electricity.

Walsh, et al. (2000), note that these estimates of biomass capacity contain substantial uncertainty, and that potential availability does not mean biomass will actually be available at the prices indicated or that resources will be usably free of contamination. Some of these plant wastes already have reuse value, and would likely be more costly to deliver because of competition. Others, such as forest residues, may prove unsafe and unsustainable to harvest on a regular basis (the vast majority of biomass capacity in Nebraska, however, comes from agricultural residues, with very little potential from forest residues). It is likely that the available resource potential is much less than the estimate totals in Walsh, et al., and the total resource is not likely to be sufficient to substitute for the capacity provided by CNS-1. As a result, the NRC staff has not considered a biomass-fired alternative to CNS-1 license renewal.

8.4.8 Hydroelectric Power

According to researchers at Idaho National Energy and Environmental Laboratory (INEEL), Nebraska has an estimated 345 MWe of technically available, undeveloped hydroelectric resources at 45 sites throughout the State (INEEL, 1997). Most of these sites have a potential capacity of less than 1 MWe, although the largest site in Nebraska is capable of providing 22 MWe. Given that the available hydroelectric potential in the State of Nebraska constitutes less than one-half of the generating capacity of CNS-1, the NRC staff did not evaluate hydropower as an alternative to license renewal.

8.4.9 Wave and Ocean Energy

Wave and ocean energy has generated considerable interest in recent years. Ocean waves, currents, and tides are often predictable and reliable. Ocean currents flow consistently, while tides can be predicted months and years in advance with well-known behavior in most coastal areas. Most of these technologies are in relatively early stages of development, and while some results have been promising, they are not likely to be able to replace the capacity of CNS-1 by the time its license expires. While testing of new technologies to produce electricity from the ocean continues, and because the CNS-1 site is located far from any ocean, the NRC did not consider wave and ocean energy as an alternative to CNS-1 license renewal.

8.4.10 Geothermal Power

Although geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available, geothermal electric generation is limited by the geographical availability of geothermal resources (NRC, 1996). Nebraska has some geothermal potential in a heating and thermal capacity, but it does not have geothermal electricity potential for development (DOE, 2007). The NRC staff concluded that geothermal energy is not a reasonable alternative to license renewal at CNS-1.

8.4.11 Municipal Solid-Waste

Municipal solid-waste combustors use three types of technologies—mass burn, modular, and refuse-derived fuel. Mass burning is used most frequently in the United States and involves little sorting, shredding, or separation. Consequently, toxic or hazardous components present in the waste stream are combusted, and toxic constituents are exhausted to the air or become part of the resulting solid wastes. Currently, approximately 89 waste-to-energy plants operate in the United States. These plants generate approximately 2,700 MWe, or an average of 30 MWe per plant (Integrated Waste Services Association, 2007). More than 27 average-sized plants will be necessary to provide the same level of output as the other alternatives to CNS-1 license renewal.

Estimates in the GEIS suggest that the overall level of construction impact from a waste-fired plant will be approximately the same as that for a coal-fired power plant. Additionally, waste-fired plants have the same or greater operational impacts than coal-fired technologies (including impacts on the aquatic environment, air, and waste disposal). The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at coal-fired facilities or at wood-waste facilities because of the need for specialized waste separation and handling equipment (NRC, 1996).

The decision to burn municipal waste to generate energy is driven by the need for an alternative to landfills rather than energy considerations. The use of landfills as a waste disposal option is likely to increase as energy prices increase; however, it is possible that municipal waste combustion facilities may become attractive again.

Regulatory structures that once supported municipal solid-waste incineration no longer exist. The Tax Reform Act of 1986 made capital-intensive projects such as municipal-waste combustion facilities more expensive relative to less expensive waste disposal alternatives such as landfills. Also, the 1994 Supreme Court decision C&A Carbone, Inc. v. Town of Clarkstown, New York, struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees.

In addition, environmental regulations have increased the cost to construct and maintain municipal waste combustion facilities.

Given the small average installed size of municipal solid-waste plants and the unfavorable regulatory environment, the NRC staff does not consider municipal solid-waste combustion to be a feasible alternative to CNS-1 license renewal.

8.4.12 Biofuels

In addition to wood and municipal solid-waste fuels, there are other concepts for biomass-fired electric generators, including conversion to liquid biofuels and biomass gasification. In the GEIS, the NRC staff indicates that none of these technologies progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as CNS-1. After reevaluating current technologies, the NRC staff finds other biomass-fired alternatives as still unable to reliably replace the CNS-1 capacity. For this reason, the NRC staff does not consider other biomass-derived fuels to be feasible alternatives to CNS-1 license renewal.

8.4.13 Oil-Fired Power

EIA projects that oil-fired plants will account for very few of new generation capacity constructed in the United States during the 2008 to 2030 time period. Further, EIA does not project that oil-fired power will account for any significant additions to capacity (EIA, 2009a).

The variable costs of oil-fired generation are found to be greater than those of nuclear or coal-fired operations, and oil-fired generation has greater environmental impacts than natural gas-fired generation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive (EIA, 2009a). The high cost of oil has prompted a steady decline in its use for electricity generation. Thus, the NRC staff does not consider oil-fired generation as an alternative to CNS-1 license renewal.

8.4.14 Fuel Cells

Fuel cells oxidize fuels without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and passing air (or oxygen) over a cathode and then separating the two by an electrolyte. The only byproducts (depending on fuel characteristics) are heat, water, and CO_2. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

At the present time, fuel cells are not economically or technologically competitive with other alternatives for large-scale electricity generation. EIA projects that fuel cells may cost $5,374 per installed kW (total overnight costs[4]) (EIA, 2009a), or 3.5 times the construction cost of new coal-fired capacity, and 7.5 times the cost of new, advanced gas-fired, combined-cycle capacity. In addition, fuel cell units are likely to be small (the EIA reference plant is 10 MWe). While it may be possible to use a distributed array of fuel cells to provide an alternative to CNS-1, it would be

[4] Overnight cost is the cost of a construction project if no interest was incurred during construction.

extremely costly to do so. Accordingly, the NRC staff does not consider fuel cells to be an alternative to CNS-1 license renewal.

8.4.15 Delayed Retirement

NPPD has no plans to retire generating capacity in Nebraska prior to 2014 (NPPD, 2008). As a result, delayed retirement is not a feasible alternative to license renewal. Other generation capacity may be retired prior to the expiration of the CNS-1 license, but this capacity is likely to be older, less efficient, and without modern emissions controls.

8.5 NO-ACTION ALTERNATIVE

This section examines environmental effects that occur if NRC takes no action. No action in this case means that NRC does not issue a renewed operating license for CNS-1 and the license expires at the end of the current license term, in 2014. If NRC takes no action, the plant will shutdown at or before the end of the current license. After shutdown, plant operators will initiate decommissioning according to 10 CFR 50.82.

The NRC staff notes that no action is the only alternative that is considered in-depth that does not satisfy the purpose and need for this SEIS, because it does not provide power generation capacity nor would it meet the needs currently met by CNS-1 or the alternatives evaluated in Sections 8.1 through 8.3. Assuming that a need currently exists for the power generated by CNS-1, the no-action alternative would require the appropriate energy planning decision makers to rely on an alternative to replace the capacity of CNS-1 or reduce the need for power.

This section addresses only those impacts that arise directly as a result of plant shutdown. The environmental impacts from decommissioning and related activities have already been addressed in several other documents, including the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC, 2002); the license renewal GEIS (Chapter 7, NRC, 1996); and Chapter 7 of this SEIS. These analyses either directly address or bound the environmental impacts of decommissioning whenever NPPD ceases operating CNS-1.

The NRC staff notes that, even with a renewed operating license, CNS-1 will eventually shut down, and the environmental effects addressed in this section will occur at that time. Since these effects have not otherwise been addressed in this SEIS, the impacts will be addressed in this section. As with decommissioning effects, shutdown effects are expected to be similar whether or not they occur at the end of the current license or at the end of a renewed license.

8.5.1 Air Quality

When the plant stops operating, there will be a reduction in emissions from activities related to plant operation, such as use of diesel generators and employee vehicles. In Chapter 4, the NRC staff determined that these emissions would have a SMALL impact on air quality during the renewal term; therefore, if emissions decrease, the impact to air quality would also decrease and would be a SMALL impact.

8.5.2 Ground Water Use and Quality

The use of ground water would diminish as plant personnel are removed from the site and operations cease. Some consumption of ground water may continue as a small staff remains onsite to maintain facilities prior to decommissioning. Overall impacts would be smaller than during operations, but would remain SMALL.

8.5.3 Surface Water Use and Quality

The rate of consumptive use of surface water would decrease as the plant is shut down and the reactor cooling system continues to remove the heat of decay. Wastewater discharges would also be reduced considerably. Shutdown would reduce the already SMALL impact on surface water resources and quality.

8.5.4 Aquatic and Terrestrial Resources

8.5.4.1 *Aquatic Ecology*

If the plant were to cease operating, impacts to aquatic ecology would decrease, as the plant would withdraw and discharge less water than it does during operations. Shutdown would reduce the already SMALL impacts to aquatic ecology.

8.5.4.2 *Terrestrial Ecology*

Terrestrial ecology impacts would be SMALL. No additional land disturbances on or offsite would occur.

8.5.5 Human Health

Human health risks would be smaller following plant shutdown. The plant, which is currently operating within regulatory limits, would emit less gaseous and liquid radioactive material to the environment. In addition, following shutdown, the variety of potential accidents at the plant (radiological or industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. In Chapter 4 of this draft supplemental EIS, the NRC staff concluded that the impacts of continued plant operation on human health would be SMALL. In Chapter 5, the NRC staff concluded that the impacts of accidents during operation were SMALL. Therefore, as radioactive emissions to the environment decrease, and as likelihood and variety of accidents decrease following shutdown, the NRC staff concludes that the risk to human health following plant shutdown would be SMALL.

8.5.6 Socioeconomics

8.5.6.1 *Land Use*

Plant shutdown would not affect onsite land use. Plant structures and other facilities would remain in place until decommissioning. Most transmission lines connected to CNS-1 would remain in service after the plant stops operating. Maintenance of most existing transmission lines would continue as before. Impacts on land use from plant shutdown would be SMALL.

8.5.6.2 *Socioeconomics*

Plant shutdown would have an impact on socioeconomic conditions in the region around CNS-1. Plant shutdown would eliminate approximately 750 jobs and would reduce tax revenue in the region. The loss of these contributions, which may not entirely cease until after decommissioning, would have a SMALL to MODERATE impact. See Appendix J to NUREG-0586, Supplement 1 (NRC, 2002), for an additional discussion of the potential socioeconomic impacts of plant decommissioning.

8.5.6.3 *Transportation*

Traffic volumes on the roads in the vicinity of CNS-1 would be reduced after plant shutdown. Most of the reduction in traffic volume would be associated with the loss of jobs at the plant. Deliveries to the plant would be reduced until decommissioning. Transportation impacts would be SMALL as a result of plant shutdown. Transportation impacts would increase if a new energy facility were constructed at the CNS-1 site or in the immediate vicinity. These impacts are addressed in Sections 8.1 to 8.3. Such impacts may be SMALL to MODERATE, but of short duration.

8.5.6.4 *Aesthetics*

Plant structures and other facilities would remain in place until decommissioning. Noise caused by plant operation would cease. Aesthetic impacts of plant closure would be SMALL.

8.5.6.5 *Historic and Archaeological Resources*

Impacts from the no-action alternative on historic and archaeological resources would be SMALL, since CNS-1 would be decommissioned. A separate environmental review would be conducted for decommissioning. That assessment would address the protection of historic and archaeological resources.

8.5.6.6 *Environmental Justice*

Termination of power plant operations would not disproportionately affect minority and low-income populations outside the immediate vicinity of CNS-1. Minority and low-income populations are generally concentrated in urban areas. Thus, impacts from plant shutdown would be SMALL. See Appendix J of NUREG-0586, Supplement 1 (NRC, 2002), for additional discussion of these impacts.

8.5.7 Waste Management

If the no-action alternative were implemented, the generation of high-level waste would stop and generation of low-level and mixed waste would decrease. Impacts from implementation of no-action alternative are expected to be SMALL.

Table 8-4 provides a summary of the environmental impacts of the no action alternative compared to continued operation of CNS-1.

Table 8-4. Summary of Environmental Impacts of No Action Compared to Continued Operation of CNS 1

	No Action	Continued CNS-1 Operation
Air Quality	SMALL	SMALL
Ground water	SMALL	SMALL
Surface water	SMALL	SMALL
Aquatic and terrestrial resources	SMALL	SMALL
Human health	SMALL	SMALL
Socioeconomics	SMALL to MODERATE	SMALL
Waste management	SMALL	SMALL

8.6 ALTERNATIVES SUMMARY

In this chapter, the NRC staff considers the following alternatives to CNS-1 license renewal: supercritical coal-fired generation, natural gas combined-cycle generation, and a combination alternative. No action by NRC and its effects were also considered. The impacts for all alternatives to CNS-1 license renewal are summarized in Table 8-6 on the following page.

The environmental impacts of the proposed action (issuing a renewed CNS-1 operating license) would be SMALL for all impact categories, except for the Category 1 issue of collective offsite radiological impacts from the fuel cycle, high level waste (HLW) and from spent fuel disposal. The NRC staff did not add a single significant level to these impacts, but the Commission determined them to be Category 1 issues nonetheless.

The coal-fired alternative is not an environmentally favorable alternative due to impacts on air quality from NO_x, SO_x, PM, PAHs, CO, CO_2, and mercury (and their corresponding human health impacts); and due to construction impacts to aquatic, terrestrial, and potential historic and archaeological resources.

The gas-fired alternative would have slightly lower air emissions, lower waste management, and lower socioeconomic impacts than the coal-fired alternative. The combination alternative would have lower air emissions and waste management impacts than both the gas-fired and coal-fired alternatives; however, the combination alternative would have relatively high construction impacts to aquatic, terrestrial, and potential historic and archaeological resources due mainly to the wind turbine component.

In conclusion, the environmentally preferred alternative in this case is the license renewal of CNS-1. All other alternatives capable of meeting the needs currently served by CNS-1 entail potentially greater impacts than the proposed action of license renewal of CNS-1. The no-action alternative necessitates the implementation of one or a combination of alternatives, all of which have greater impacts than the proposed action, the NRC staff concludes that the no-action alternative will have environmental impacts greater than or equal to the proposed license renewal action.

Table 8-5. Summary of Environmental Impacts of Proposed Action and Alternatives

	Impact Area						
Alternative	**Air Quality**	**Ground water**	**Surface Water**	**Aquatic and Terrestrial Resources**	**Human Health**	**Socioeconomics**	**Waste Management**
License renewal	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	Small
Supercritical coal-fired alternative at CNS-1 site	MODERATE	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to LARGE	MODERATE
Gas-fired alternative at the CNS-1 site	SMALL to MODERATE	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Combination of alternatives	SMALL to MODERATE	SMALL	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL
No action alternative	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL

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9.0 CONCLUSION

This draft supplemental environmental impact statement (SEIS) contains the preliminary environmental review of the Nebraska Public Power District (NPPD) Energy Company, LLC's application for a renewed operating license for Cooper Nuclear Station, Unit 1, (CNS-1) as required by the *Code of Federal Regulations* (CFR), Part 51 of Title 10 (10 CFR Part 51) and the U.S. Nuclear Regulatory Commission's (NRC) regulations that implement the National Environmental Policy Act (NEPA). This chapter presents conclusions and recommendations from the site-specific environmental review of CNS-1 and summarizes site-specific environmental issues of license renewal that were identified during the review. The environmental impacts of license renewal are summarized in Section 9.1; a comparison of the environmental impacts of license renewal and energy alternatives is presented in Section 9.2; unavoidable impacts of license renewal, energy alternatives, and resource commitments are discussed in Section 9.3; and conclusions and NRC staff recommendations are presented in Section 9.4.

9.1 ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL

The staff's review of site-specific environmental issues in this draft SEIS leads to the conclusion that issuing a renewed license would have SMALL impacts for the eight Category 2 issues applicable to license renewal at CNS-1, as well as environmental justice and chronic effects of electromagnetic fields (EMF).

Mitigation measures were considered for each Category 2 issue, as applicable. For ground water, no measures to mitigate the environmental impacts of plant operation were found to be warranted because of the limited radius of influence of CNS-1 wells. NPPD has implemented some impingement and entrainment mitigation measures, such as dual flow screens with modified Ristroph fish buckets and plans to install a fish handling system, which the staff concludes will minimize impacts on aquatic resources. The NRC staff identified a variety of measures that could mitigate potential acute EMF impacts resulting from continued operation of the CNS-1 transmission lines, including erecting barriers along the length of the transmission line to prevent unauthorized access to the ground beneath the conductors and installing road signs at road crossings. These mitigation measures could reduce human health impacts by minimizing public exposures to electric shock hazard.

The staff identified a variety of measures that could mitigate the potential impacts of thermophilic microbiological organisms resulting from continued operation of CNS-1. These mitigation measures include periodically monitoring for thermophilic microbiological organisms in the water and sediments near the discharge, as well as prohibiting recreational use near the discharge plume. These mitigation measures could reduce human health impacts by minimizing public exposures to thermophilic microbiological organisms. NRC staff did not identify any cost-benefit studies applicable to the mitigation measures mentioned above.

The NRC staff also considered cumulative impacts of past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes them. The staff concluded that cumulative impacts of CNS-1's license renewal would be SMALL for potentially affected resources.

9.2 COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL AND ALTERNATIVES

In the conclusion to Chapter 8, we determined that impacts from license renewal are generally less than the impacts of alternatives to license renewal, with the exception of energy conservation and energy efficiency. In comparing possible environmental impacts from supercritical coal-fired generation, natural gas combined-cycle generation, energy conservation and energy efficiency, and a combination alternative that includes natural gas, conservation and efficiency, upgrades to existing hydroelectric dams, and environmental impacts from license renewal, it was found that the energy conservation and energy efficiency alternative would result in the lowest environmental impact. Based on the NRC staff's analysis, it was found that the impacts of license renewal are reasonable in light of the impacts from alternatives to the license renewal of CNS-1.

9.3 RESOURCE COMMITMENTS

9.3.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures. Implementing any of the energy alternatives considered in this SEIS, including the proposed action, would result in some unavoidable adverse environmental impacts.

Minor unavoidable adverse impacts on air quality would occur due to emission and release of various chemical and radiological constituents from power plant operations. Nonradiological emissions resulting from power plant operations are expected to comply with U.S. Environmental Protection Agency (EPA) emissions standards, though the alternative of operating a fossil-fueled power plant in some areas may worsen existing attainment issues. Chemical and radiological emissions would not exceed the National Emission Standards for Hazardous Air Pollutants.

During nuclear power plant operations, workers and members of the public would face unavoidable exposure to radiation and hazardous and toxic chemicals. Workers would be exposed to radiation and chemicals associated with routine plant operations and the handling of nuclear fuel and waste material. Workers would have higher levels of exposure than members of the public, but doses would be administratively controlled and would not exceed standards or administrative control limits. In comparison, the alternatives involving the construction and operation of a non-nuclear power generating facility would also result in unavoidable exposure to hazardous and toxic chemicals to workers and the general public.

The generation of spent nuclear fuel and waste material, including low-level radioactive waste, hazardous waste, and nonhazardous waste would also be unavoidable. In comparison, hazardous and nonhazardous wastes would also be generated at non-nuclear power generating facilities. Wastes generated during plant operations would be collected, stored, and shipped for suitable treatment, recycling, or disposal in accordance with applicable Federal and State regulations. Due to the costs of handling these materials, power plant operators would be expected to conduct all activities and optimize all operations in a way that generates the smallest amount of waste possible.

9.3.2 The Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The operation of power generating facilities would result in short-term uses of the environment as described in Chapters 4, 5, 6, 7, and 8. "Short-term" is the period of time that continued power generating activities take place.

Power plant operations require short-term use of the environment and commitment of resources, and also commit certain resources (e.g., land and energy) indefinitely or permanently. Certain short-term resource commitments are substantially greater under most energy alternatives, including license renewal, than under the No-Action Alternative because of the continued generation of electrical power and the continued use of generating sites and associated infrastructure. During operations, all energy alternatives require similar relationships between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

Air emissions from power plant operations introduce small amounts of radiological and nonradiological constituents to the region around the plant site. Over time, these emissions would result in increased concentrations and exposure, but are not expected to impact air quality or radiation exposure to the extent that public health and long-term productivity of the environment would be impaired.

Continued employment, expenditures, and tax revenues generated during power plant operations directly benefit local, regional, and State economies over the short term. Local governments investing project-generated tax revenues into infrastructure and other required services could enhance economic productivity over the long term.

The management and disposal of spent nuclear fuel, low-level radioactive waste, hazardous waste, and nonhazardous waste requires an increase in energy and consumes space at treatment, storage, or disposal facilities. Regardless of the location, the use of land to meet waste disposal needs would reduce the long-term productivity of the land.

Power plant facilities are committed to electricity production over the short term. After decommissioning these facilities and restoring the area, the land could be available for other future productive uses.

9.3.3 Irreversible and Irretrievable Commitments of Resources

This section describes the irreversible and irretrievable commitment of resources that have been identified in this SEIS. Resources are irreversible when primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for future use. Irreversible and irretrievable commitment of resources for electrical power generation include the commitment of land, water, energy, raw materials, and other natural and man-made resources required for power plant operations. In general, the commitment of capital, energy, labor, and material resources are also irreversible.

The implementation of any of the energy alternatives considered in this SEIS would entail the irreversible and irretrievable commitment of energy, water, chemicals, and, in some cases, fossil fuels. These resources would be committed during the license renewal term and over the entire life cycle of the power plant and would be unrecoverable.

Energy expended would be in the form of fuel for equipment, vehicles, and power plant operations and electricity for equipment and facility operations. Electricity and fuel would be purchased from offsite commercial sources. Water would be obtained from existing water supply systems. These resources are readily available, and the amounts required are not expected to deplete available supplies or exceed available system capacities.

The irreversible and irretrievable commitment of material resources includes materials that cannot be recovered or recycled, materials that are rendered radioactive and cannot be decontaminated, and materials consumed or reduced to unrecoverable forms of waste. None of the resources used by these power generating facilities, however, are in short supply, and for the most part are readily available.

Various materials and chemicals derived from chemical vendors, including acids and caustics, are required to support the operation's activities. Their consumption is not expected to affect local, regional, or national supplies.

The treatment, storage, and disposal of spent nuclear fuel, low-level radioactive waste, hazardous waste, and nonhazardous waste require the irretrievable commitment of energy and fuel and will result in the irreversible commitment of space in disposal facilities.

9.4 RECOMMENDATIONS

Based on (1) the analysis and findings in the GEIS, (2) information provided in the Environmental Report submitted by NPPD, (3) consultation with Federal, State, and local agencies, (4) a review of pertinent documents and reports, and (5) consideration of public comments received during scoping, the preliminary recommendation of the NRC staff is for the Commission to determine that the above considered adverse environmental impacts of license renewal are not so great that preserving the option of license renewal for energy planning decision makers (i.e., State regulatory agencies and NPPD) would be unreasonable.

10.0 LIST OF PREPARERS

This supplemental environmental impact statement (SEIS) was prepared by members of the Office of Nuclear Reactor Regulation, with assistance from other U. S. Nuclear Regulatory Commission (NRC) organizations and with contract support from Pacific Northwest National Laboratory.

Table 10-1 provides a list of NRC staff that participated in the development of the SEIS. Pacific Northwest National Laboratory provided contract support for the severe accident mitigation alternatives (SAMA) analysis, presented in Chapter 5 and Appendix F.

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Joann Scheafer, Director	U.S. Environmental Protection Agency Region 7 901 N. 5th Street Kansas City, KS 66101
Doyle Childers, Director	Nebraska Department of Health & Human Services 301 Centennial Mall South Lincoln, NE 68509
Mark Miles State Historic Preservation Officer	Missouri Department of Natural Resources P.O. Box 176 Jefferson City, MO 65102
Michael J. Smith State Historic Preservation Officer	Department of Natural Resources P.O. Box 176 Jefferson City, MO 65102
Robert Puschendorf	Nebraska State Historical Society P.O. Box 82554 Lincoln, NE 68501
Carla Mason	ADC Digital Communications 820 Central Ave Auburn, NE 68305
Matthew Leaf	KTNC/KLZA Radio 1602 Stone St. Falls City, NE 68355
Daryl J. Oberneyer	ADC Digital Communications 64381 727A Road Brownsville, ME 68321

APPENDIX A.
COMMENTS RECEIVED ON THE COOPER NUCLEAR STATION, UNIT 1, ENVIRONMENTAL REVIEW

A. COMMENTS RECEIVED ON THE COOPER NUCLEAR STATION, UNIT 1, ENVIRONMENTAL REVIEW

A.1. Comments Received During Scoping

The scoping process began on January 26, 2009 with the publication of the U.S. Nuclear Regulatory Commission's (NRC's) Notice of Intent to conduct scoping in the *Federal Register* (74 FR 4476). The scoping process included two public meetings held in Brownville and Auburn, Nebraska on February 25, 2009. Approximately 120 people attended the meetings. After the NRC's prepared statements pertaining to the license renewal process, the meetings were open for public comments. Attendees provided oral statements that were recorded and transcribed by a certified court reporter. Transcripts of the entire meeting, as well as written statements submitted at the public meetings, were issued as an attachment to the Cooper Public Meeting Summary Report dated April 14, 2009 (NRC, 2009). In addition to the comments received during the public meetings, comments were received through the mail and e-mail.

Each commenter was given a unique identifier so every comment could be traced back to its author. Table A-1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's set of comments. The individuals are listed in the order in which they spoke at the public meeting, and in alphabetical order for the comments received by letter or e-mail. To maintain consistency with the Public Meeting Summary Report, the unique identifier used in that report for each set of comments is retained in this appendix.

Specific comments were categorized and consolidated by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by participants. Comments fall into one of the following general groups:

(1) Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address Category 1 (generic) or Category 2 (site-specific) issues or issues not addressed in the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants*. They also address alternatives to license renewal and related Federal actions.

(2) General comments (1) in support of, or opposed to, nuclear power or license renewal or (2) on the renewal process, the NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the Cooper Nuclear Station, Unit 1, (CNS-1) license renewal application.

(3) Comments that do not identify new information for the NRC to analyze as part of its environmental review.

(4) Comments that address issues that do not fall within, or are specifically excluded from, the purview of NRC environmental regulations related to license renewal. These comments typically address issues such as emergency response and preparedness, security and terrorism, energy costs, energy needs, current operational safety issues, and safety issues related to operation during the renewal period.

Table A-1. Commenters on the Scope of the Environmental Review. *Each comment is identified along with their affiliation and how their comment was submitted.*

Commenter ID	Commenter	Affiliation	Comment Source	ADAMS Accession Number[a]
CNS-1-A	Martin Hansen	Village Board of Brownville	Afternoon Scoping Meeting	ML090840062
CNS-1-B	Glen Krueger	Member of the Public	Afternoon Scoping Meeting	ML090840062
CNS-1-C	Becky Cromer	Falls City Economic Development and Growth Enterprise	Afternoon Scoping Meeting	ML090840062
CNS-1-D	Arnold Ehlers	City Clerk/Treasurer for the City of Nebraska City, Nebraska	Afternoon Scoping Meeting	ML090840062
CNS-1-E	James Gerwick	Emergency Management Director for Richardson County, Nebraska	Afternoon Scoping Meeting	ML090840062
CNS-1-F	Robert Cole	Nemaha County Emergency Management Director	Evening Scoping Meeting	ML090840063
CNS-1-G	Rod Vandeberg	Mayor of Falls City, Nebraska	Evening Scoping Meeting	ML090840063
CNS-1-H	Larry Shepard	U.S. Environmental Protection Agency	Evening Scoping Meeting	ML090840063
CNS-1-I	Bob Engles	Mayor of Auburn, Nebraska	Evening Scoping Meeting	ML090840063
CNS-1-J	Kendall Neiman	Auburn Chamber of Commerce	Evening Scoping Meeting	ML090840063
CNS-1-K	David Sickel	County Commissioner Richardson County	Evening Scoping Meeting	ML090840063
CNS-1-L	Ron Asche,	Nebraska Public Power District	Evening Scoping Meeting	ML090840063
CNS-1-M	Alan Richard	Pawnee City Development Corporation	Letter	ML090720067
CNS-1-N	Ashtin Paris	Deputy Clerk City of Rock Port	Letter	ML090720068
CNS-1-O	James Gerwick	Emergency Management Director for Richardson County, Nebraska	Letter	ML090720066
CNS-1-P	Larry Spepard	U.S. Environmental Protection Agency	Email	ML091070269
CNS-1-Q	Jill Dolberg	Nebraska State Historic Preservation Office	Letter	ML090650061
CNS-1-R	Jean Angell	Nebraska Department of Natural Resources	Letter	ML090860762

[a] The accession number for the afternoon transcript is ML090840062
The accession number for the evening transcript is ML090840063

Comments received during scoping applicable to this environmental review are presented in this section along with the NRC response. Comments received during the public meeting have been transcribed; comments received by letter or e-mail have been copied in this document to maintain authenticity. Comments are grouped by category. There were two categories as follows:

(1) Comments in support of license renewal at CNS-1, discussed in Section A.2

(2) General comments regarding the license renewal review of CNS-1, discussed in A.3

A.2. Comments in Support of License Renewal at Cooper Nuclear Station, Unit, 1

Comment CNS-1- A: My name is Martin Hansen, a member of the Village Board of Brownville. I'm filling in for our chairman, Marty Hayes, today. I would like to welcome the members of the Nuclear Regulatory System [sic] to our community for this meeting. Brownville, while being a small community, we see the importance of Cooper Nuclear Station. It is, of course, the largest employer in our community and throughout southeastern Nebraska. But for our community, it is a little more than that. This community was here when the construction on Cooper started nearly 40 years ago. We are here on each day of operation which is around the clock. Cooper continues to operate safely and our community of Brownville appreciates that very much.

Cooper is a partner with the community. It has lent us support. One of the examples is the Village of Brownville Volunteer Fire Department. The management of Cooper has allowed our group of dedicated fire fighters to utilize their training facilities that has enhanced its firefighting capabilities and has cooperated in an effort and has enabled our department to upgrade its equipment and training capabilities over a number of years. I'm sure that you will hear a lot more from other communities about the economic impact of Cooper on the community and the importance it has on the economy. A 2002 economic study found that there would be detrimental impact to not only Brownville, but to other communities in this area, so Cooper is important to continue operation through the license extension of 20 years.

Emergency response is an important part of Cooper operation, and any need for that action to take place would be handled in a manner that is both professional and done for the protection of the public. Cooper Emergency Response organization takes it very seriously and each resident in a 10-mile zone around Cooper always receives the appropriate information about any possible emergency response activity on the site and would have comfort of knowledge that these plans are in place and tested annually.

Earlier this month, the Village Board of Brownville unanimously approved a resolution in support of Nebraska Public Power District at Cooper Nuclear Station license renewal for an additional 20 years. I would like to read that resolution into the official record at this time.

<u>Resolution No. 2-2-09-1</u>

WHEREAS, the Nebraska Public Power District Cooper Nuclear Station in Brownville became operational with startup in 1974 and has operated safely and efficiently for more than 30 years and its 828 megawatts of electricity generated; and

WHEREAS, the Village of Brownville has had a longstanding history with Cooper Nuclear Station since the plant's construction, through refueling outages, and day-to-day operations; and

WHEREAS, the Village of Brownville Volunteer Fire Department has been able to utilize training facilities to enhance the firefighting capabilities and this cooperative effort has allowed the department to upgrade equipment in training firefighters over the years;

WHEREAS, Nebraska Public Power District has continually reinvested in the Cooper Nuclear Station facility to access continued safety, clean, reasonable, and affordable production of electricity for Nebraskans across the State; and

WHEREAS, the Cooper Nuclear Station is a critical asset as part of Nebraska Public Power District generation resources and the state's unique public power system, continues to assist in keeping state electricity rates among the lowest in the country;

WHEREAS, more than 700 permanent jobs at Cooper Nuclear Station and extensive use of contractors in ongoing maintenance and refueling outages are organized and important to the economy of the Village of Brownville, Nemaha County, and surrounding communities in southeastern Nebraska; and

WHEREAS, a 2002 economic study of the impact of the loss of Cooper Nuclear Station would be detrimental to the Village of Brownville and other communities in southeast Nebraska; and

WHEREAS, the United States Nuclear Regulatory Commission is the federal agency charged with oversight of our nation's vital nuclear facilities and encouraged public input and comment on license renewal and process from the neighborhood and communities; and

WHEREAS, the Cooper Nuclear Station has continued to be a good neighbor to Brownville for more than three decades;

NOW, THEREFORE, BE IT RESOLVED that the Village of Brownville Council supports the renewal of the license for the nuclear generation facility at Cooper Nuclear Station, and to assure their continued operations of safe, affordable, and important component of Nebraska's public power supply system for another 20 years; but

BE IT FURTHER RESOLVED that the Village of Brownville clerk is directed to make available copies of this resolution to the Nuclear Regulatory Commission at its upcoming Environment Scope Public Meeting.

Again, I wish to thank the Nuclear Regulatory Commission for hosting this important public meeting, and we'll make ourselves available to you if you have any questions of us, thank you. (End of Comment CNS-1-A)

Comment CNS-1-B: My name is Glen Krueger and I was the hospital administrator, and I don't think the present one is here at this time. I was the hospital administrator. I came in 1971, so was there when it was started and I retired in 2002. And I would like to say that we have had a full and wonderful cooperation with the Nebraska Public Power District for emergency services. We were able to send an employee down to Tennessee to learn more about radiation. Yes, we were learning more when it first started up, but we finally came that we were very comfortable, that we knew how to take care of if an accident did happen over here. We had full cooperation from them and I would totally support this new license.

But, also, as a citizen of Auburn, I would like to restate and I would like to have this new permit be renewed, because of the need that we have in the City of Auburn, if the need -- the people that work there. We have a lot of those employees who work in our church and a lot of those employees, in fact, I have three of those employees in my block where I live. Very appreciative of them. (End of Comment CNS-1 -B)

Comment CNS-1-C: I also would like to thank you for the opportunity to speak here this afternoon. My name is Beckie Cromer. I'm Executive Director of our Falls City Economic Development and Growth Enterprise. And I'm here this afternoon on behalf of the economic development team from Falls City. We would like to confirm our unwavering support for the 20-year license extension of Cooper Nuclear Station. Falls City EDGE did pass a resolution of support for the 20-year license extension, and we have forwarded that resolution to NPPD officials, although, after reading the materials here today, I think we'll also forward that NRC with the information provided within the packets today. And in addition to that, our mayor will be speaking in support of Nebraska Public Power District this evening, as well.

Cooper Nuclear Station is an economic development gem that injects millions into our local economy by providing almost 800 jobs that pay more than double the Nebraska state average. The decommissioning of Cooper Nuclear Station would result in monumental loss of revenue and jobs for our southeast Nebraska area. Additionally, Cooper Nuclear Station runs a very safe operation. It allows Nebraska to offer a diverse portfolio of power to our citizens.

I had the opportunity to tour Cooper Nuclear Station this week with many Falls City community leaders. The facility was top notch. The staff was professional and knowledgeable, and the safety measures in place for workers and the surrounding public exceeds benchmarks set by government agencies.

Southeast Nebraska is proud to have Cooper Nuclear Station as a partner in economic development and we ask that you grant the licensing request being made by Cooper Nuclear Station. Thank you. (End of Comment CNS-1 -C)

Comment CNS-1-D: Good afternoon. My name is Arnold Ehlers, City Clerk/Treasurer for the City of Nebraska City, Nebraska. I am here to present a resolution passed unanimously by the City Council and Mayor of Nebraska City, supporting the license renewal of Cooper Nuclear Station. I would also like to make you aware of the economic impact Cooper Nuclear Station has on southeast Nebraska, as well as southwestern Iowa and northwest Missouri, an economic impact that is over $500 million a year. But the economic impact is just one part of the contribution made by Nebraska Public Power District and its employees. NPPD employees belong to volunteer fire departments, serve on library boards, school boards, and many other boards and committees too numerous to mention. Their spouses and families are also very important contributors to the communities in which they live.

Over the years, Cooper has been a good safe partner and good neighbor to all of us. They have attracted employees from around the world, enhancing the multicultural experiences of the area. We've actually become a global community due to this. It is a privilege to live in a public power state and in a city that owns its own utilities. Nebraska City, in fact all of Nebraska, benefits from the low-cost electricity that Cooper Nuclear plays a significant role in providing.

I have a resolution that I would like to have entered into the record. I won't bore you with the reading of it, unless it needs to be read. I thank you for this opportunity. (End of Comment CNS-1-D)

Comment CNS-1-E: Good afternoon. Many thanks to the Nuclear Regulatory Commission for hosting this public forum. My name is Jim Gerwick, and I'm the Emergency Management Director for Richardson County, Nebraska, the county just south of here.

In my position, hardly a month has gone by where some form of interchange has not transpired between Cooper Nuclear Station's Emergency Management Department and other nuclear operations staff and my office in Richardson County. The referenced activities include quarterly emergency communication drills, unannounced communications checks, written correspondence involving improvements in emergency plans and training in many forms, to include FEMA, Federal Emergency Management Agency, evaluated radiological emergency preparedness exercises.

Other joint training activities include NPPD staff involvement in annual training of our local radiological emergency response organization, and our joint quarterly off-site training meetings.

Cooper Nuclear Station has fully demonstrated its ability to provide safe, reliable electricity for the citizens of the state of Nebraska. Richardson County has supported Cooper Nuclear Station in its off-site responsibilities to protect the public and property for many years, since the plant started, actually, and is glad to be part of the team that supports nuclear power. The bottom line in our realm of experience, the staff at NPPD and Cooper Nuclear Station is thoroughly professional and meticulous in attention to detail concerning their approach to public safety. In short, they are fully integrated and a key member of our public safety team.

And in view of their professional performance and contributions to our community, we support NPPD's application to continue to operate Cooper Nuclear Station for another 20 years.

In closing, Richardson County is proud to have Cooper Nuclear Station in the Richardson County area. (End of Comment CNS-1-E)

Comment CNS-1-F: Thank you for the opportunity to speak tonight. I'm Robert Cole. I'm the Nemaha County Emergency Management Director. I wanted to make a few short statements. I've already submitted a letter of support on the relicensing application; however, I wanted to touch on a few of the highlights that I mentioned in the letter.

One of the great things about our relationship with Cooper Nuclear Plant is that they have been good partners for the communities that they are neighbors to. One example of that would be the fact that most of my day today was spent taking delivery on sirens that Cooper Nuclear has donated for several local communities in the area, both in Nebraska and Missouri, that lacked operational or modern sirens. These retired sirens from Cooper, although they are dating back to the 1970s, are well maintained and very functional and will certainly be a vital asset to communities that could not otherwise afford replacement of their siren equipment. That's a real benefit to everybody.

Also, my relationship with Cooper has been excellent. I correspond or talk to Cooper representatives at least monthly, generally more often, in regard to emergency planning exercises and just day-to-day communications checks. Every time I have talked to somebody from the station, they have always been very professional and very competent, and I have very great confidence in the plant and their operations. It's a joy to be here in Nemaha County, and one of that joys is serving the County in this relationship to Cooper Nuclear. Thanks very much for the opportunity to be here. (End of Comment CNS-1-F)

Comment CNS-1-G: Good evening. I have prepared comments which I'd be happy to give to you if you would like them at the end of the meeting. I apologize. I maybe have gotten a little bit too lengthy, but I'll try to talk fast.

My name is Rod Vandeberg, and I am the mayor of Falls City, Nebraska. Falls City is a community of 4,200, and is located about 20 miles south of Cooper Nuclear Station as you head toward the Nebraska/Kansas border.

Interestingly, I personally had the opportunity, along with 18 community members from Falls City, to tour Cooper Nuclear Station last Monday. I can speak for myself and the others who took the tour that we were very impressed by the serious and cordial manner in which NPPD employees were watching out for our personal safety while we were on tour, and also by the extent of the security presence at the site. This opportunity gave us all a little better first-hand look at Cooper Nuclear Station, which many of us had not seen, but have heard so much about over the years. Perhaps properly so, Cooper is a well kept secret. And I would like to take this opportunity to thank everyone who participated with us in that tour. We had the opportunity to hear from the gentleman who heads the management company. And then we had the opportunity to be with several NPPD employees. And it was really an outstanding experience.

The impact of going inside such a facility and seeing how well the facility is maintained and how expansive the facility is, how it serves to protect employees, public, and the environment was time well spent. I want to thank NPPD for this opportunity.

Several months ago, I sat in a breakfast meeting right here in this building in Auburn and heard from your CEO, Ron Asche, and other NPPD employees about the license renewal process, what the needs for extending of licensing of Cooper for an additional 20 years means, and what does that mean not only for my community, but all of Nebraska. What I learned is that NPPD has put an extensive amount of money into facility improvements for safety and operations of the facility so that it can be an operation that will be able to operate safely and efficiently for an additional 20 years. What I also heard at that time was that replacing Cooper would take several billion dollars to construct another generating facility, probably using coal as fuel to replace the electric generation of Cooper. Just getting a facility sited may be a significant task, and replacing Cooper with that kind of facility may not be the most environmentally friendly one, as Cooper does not generate any greenhouse gases from its nuclear operations.

I realize that there are numerous areas that are required to be reviewed by the U.S. Nuclear Regulatory Commission related to the license renewal application, many dealing with the environment, another part on how equipment is expected to last if Cooper Nuclear Station were to operate another 20 years. As I heard at our meeting in the fall, Nebraska Public Power District's Board of Directors has had the foresight to invest millions of dollars into the operation in order to continue that operation in a safe manner, and that is what we expect for the residents of Falls City, Richardson County, and southeast Nebraska.

Our community leaders in Falls City also heard from NPPD, at my request, to tell us more about the license renewal in a luncheon session in Falls City two or three months ago. Many in the room that day have had contact with Cooper employees, both personal or for business reasons, for we have a contingent of employees that reside in Falls City and Richardson County, 101 employees to be exact.

From a socio-economic aspect, that number is important in small communities such as Falls City. Cooper employees do business in our community. They are part of community activities, and they support our schools and services. These individuals operate an important electric generation for Nebraska, and they do it safely in a nuclear operation. On our tour, we were able to get a peek at a control room simulator and what these highly trained employees must train to do. The requirements are rigorous to meet the requirements to become a licensed operator.

A loss of Cooper would cause a severe negative impact on Falls City as would it be for all of southeastern Nebraska.

NPPD's CEO, Ron Asche, spoke to us last year about several maintenance issues at the plant. He could have easily passed over telling us that information, but he chose to do so, and he expressed confidence to us that NPPD would resolve these issues to the satisfaction of the NRC and return Cooper to the top level of operations for nuclear power plants in the country. And as I have learned, those words have been put into action and those findings have been resolved. Frankly, I believe Cooper is one of the safest nuclear plants in the United States.

I, and the members of the City Council of Falls City, recently passed a unanimous resolution of support for Cooper Nuclear Station's license extension for an additional 20 years. We feel that it is an important asset for southeast Nebraska and Nebraska in general, and I would like for this resolution to be included in the official meeting transcript tonight.

I want to thank the Nuclear Regulatory Commission for taking the time to hear from communities such as ours on this very important issue, not only locally, but nationally, as we work towards future energy independence. Thank you very much. (End of Comment CNS-1-G)

Comment CNS-1-H: Good evening. Thank you, Dave. And I'd like to thank the NRC. I'd also like to thank the cities and counties of southeastern Nebraska for the opportunity to attend this scoping meeting. My name is Larry Shepard. I'm an environmental scientist with the U.S. Environmental Protection Agency, in our Kansas City Regional Office. EPA has 10 regional offices around the country. Our regional office is responsible for EPA program activities in Kansas, Iowa, Missouri, and Nebraska.

My point in speaking tonight was just to help everyone tonight to understand what EPA's role is in this process, this relicensing process. EPA will be reviewing the Draft Supplemental Environmental Impact Statement and providing comment, but also in actually scoring both the document and the project itself. And we will also, in addition to that, be providing comment -- scoping comment to NRC by the March 27th deadline. And that was really my whole purpose. If anyone has any questions after the meeting, I'll be hanging around also. Thank you very much. (End of Comment CNS-1-H)

Comment CNS-1-I: Good evening. My name is Bob Engles, and I'm the mayor of Auburn, Nebraska. I'd like to thank the NRC for this opportunity and specifically for holding this public forum.

As I was watching the NRC presentation, safety review and environmental impact studies were mentioned as key parts of the process. I trust that both NPPD and the NRC will conduct a thorough process to identify issues that must be addressed in these areas so that Cooper Nuclear Station can continue operating for an additional 20 years.

That's exactly why I'm here. I'm here in support of extending the license for Nebraska Public Power District's Cooper Nuclear Station. I'll speak just a little bit about the socio-economic impact on my city in particular. From a practical standpoint, I'm not sure it makes sense to discard a proven and effective method of power generation, especially when it has served Auburn, Nemaha County, and the state of Nebraska for so many years as a safe and reliable source of electrical generation for the last 35 years in a manner that has protected the public and the environment.

Cooper Nuclear Station is an economic stimulus to Auburn and southeast Nebraska. Their footprint is a stabilizing factor in our community's economy. For example, they employ approximately 720 people, and half of those people live in Nemaha County; 234 of those people live in Auburn.

The plant's annual payroll is approximately $55 million. Over $17 million of that payroll goes to people that live in Auburn, and with just a little bit of math, that shows that the average income per employee living in Auburn is about $75,000. These employees are highly educated, highly trained and skilled, and they do a quality job day in and day out with safety as their prime responsibility.

Cooper employees have become a part of the fabric of this community over the years. They live here. They're involved in community activities. They're involved in our churches; they frequent the business community; they are involved in youth activities and social events within our community.

These people are our friends. They're our neighbors. Their kids attend our schools. They volunteer their time to make Auburn and southeast Nebraska a better place in which to live.

Late last year, following NPPD's submittal of a license renewal application, Ron Asche, CEO and President of NPPD, which owns Cooper, held a series of meetings within the community with myself and other elected officials from other communities and the business community. Mr. Asche pointed out that NPPD's Board of Directors has invested over $300 million in improvements to Cooper in preparation for the license extension. NPPD is serious about making these improvements that will enhance the safety of the operations, as well as continuing to generate low-cost electricity, something that Nebraskans expect and which NPPD is mandated under state law to do.

Several years ago, NPPD discussed the possibility of closing Cooper. This community was concerned about that, primarily because of the impact on the economy of Auburn and southeast Nebraska. Closing Cooper would have been unfortunate. But NPPD's Board of Directors saw the value in keeping the facility operating and have done a great job in moving forward with the safe operations of the facility, something that was expected to continue for another 20 years.

Indeed, all Nebraskans benefit from the operation of Cooper Nuclear Station. Auburn has benefited from Cooper's operations directly, even though the plant is 10 miles away. Nebraska Public Power District has two facilities in our community that we believe are important for the operations of the site. The former Sheridan Elementary School has been transformed into a training center for Cooper employees and the many contractors who come into the community every 18 months for refueling outages. We believe that the training facility plays a great part of the strong environmental responsibility and safe operations of the facility each day.

A second facility was remodeled in our downtown area and houses a state-of-the-art Emergency Operations Center which would operate as needed. Exercises are held on a regular basis from that facility, including ones with local emergency management personnel from southeast Nebraska.

As mayor, I'm confident in the ability of NPPD to operate and manage in a safe manner. What we may hear from people that are concerned about safety issues, we can all be concerned about safety issues. But throughout the years, I've come to know that the people at Cooper and NPPD have confidence and that they understand the risks associated with nuclear power generation and that they have been and continue to do everything in their power to ensure my safety and our community's safety, because the same people that are working at NPPD Cooper Nuclear Station live in Auburn. They live in Brownville, Nemaha County, Falls City, and Nebraska City.

And at this time, I'd like to introduce into the formal record a resolution that our City Council passed a while back unanimously approving support for the extension of the Cooper Nuclear Station license.

And once again, I'd like to thank the NRC for hosting these meetings in our community, and if there's anything our town can do to help you further this process, please do not hesitate to contact us. Thank you. (End of Comment CNS-1-I)

Comment CNS-1-J: Good evening. My name is Kendall Neiman and I'm President of Auburn Chamber of Commerce, and also the publisher of the Nemaha County Herald, the local weekly newspaper here. On behalf of the Auburn Chamber of Commerce, I'm expressing full support for the Nebraska Public Power District's application to extend the Cooper Nuclear Station for an additional 20 years.

We believe that Cooper's safety and performance speaks for NPPD's expertise in nuclear plant operations. Several years ago, it appeared that NPPD might close down the Cooper Nuclear Station. This was something that southeastern Nebraska could not afford to have happen. A community group had an economic study done that gave us a look at what we could see locally if the facility was closed. That was about six years ago, and that picture was not very pretty. Devastating might be a better word. If Cooper Nuclear were not to continue operating after its current license expires, we could see those impacts all over southeastern Nebraska.

Over 700 employees live, work, shop, and are involved in the communities in southeastern Nebraska. A majority of these employees live right here in Auburn and Nemaha County. They are contributors to the community, but they are also workers at the nuclear power plant that emphasizes nuclear safety of all as a top priority.

I recently attended an open house held by NPPD in the Cooper Nuclear facility and was able to learn more about the license extension, safety, emergency response, and other operations of the facility. It's very complex, but I found that the people that I talked to be very knowledgeable and they were concerned with safety of the operations, but they were very proud of what they do on a daily basis. It is our hope that the Nuclear Regulatory Commission's review of the license application will be thorough in both the environmental review as well as the safety review of the Cooper Nuclear Station as required for license renewal. We believe that NPPD has done an excellent job in the operation of the facility as they have turned out a record generation year in 2007, have maintained a strong safety culture for the safety of the employees and the public, and maintained a high visible emergency response operation with local governments and continue to watch over a reliable generating source of electricity for Nebraskans with a watchful eye.

The Auburn Chamber of Commerce supports this license renewal extension and look forward to the Nuclear Regulatory Commission's review of the facility and seeing a 20-year extension added to the existing license of the facility. Again, thank you for coming to Auburn and giving the community an opportunity to be heard. (End of Comment CNS-1-J)

Comment CNS-1-K: My name is David Sickel. I'm one of the three County Commissioners from Richardson County. I'm pleased to have the opportunity to speak to the Nuclear Regulatory Commission concerning the extension of the Cooper Nuclear Station's license for an additional 20 years.

While Richardson County may be somewhat outside the influence of Cooper Nuclear Station's operations, it is important to acknowledge that over the years this facility has been able to operate in a safe and effective manner for the residents of Nebraska. It is important that a complete review of the environmental impacts for 20 more years of operation be studied thoroughly by both the Nebraska Public Power District and the Nuclear Regulatory Commission.

As I understand another critical phase is a safety review. Again, this is important this type of review be conducted to ensure that equipment at the facility can operate an additional 20 years without having the impact on employee and public safety. The fact that much of this information is available to the public and can have public involvement is an important aspect of the entire process.

Cooper Nuclear Station is an important part of our community. It operates safely. The employees at Cooper are highly trained. Cooper generates a reliable source of electricity for the people of the state of Nebraska. Employees reside in communities such as Richardson County. Over the years, the presence of Cooper employees in southeast Nebraska has been an important part of our economy, our schools, or business community, and the community in which these folks live. The impact on this area from the loss of Cooper operations would create an economic hardship when you consider those losses. That loss would impact Richardson County, southeast Nebraska, and the complete state of Nebraska.

On behalf of the citizens of Richardson County, we are in support of the extension of the Cooper Nuclear Station's license renewal for an additional 20 years.

In a letter that I wrote to NPPD's CEO and President, Ron Asche, I explained that Richardson County was proud to have Cooper Nuclear Station in the Richardson County area. Cooper Nuclear Station clearly demonstrated its ability to provide safe and reliable electricity for citizens of Nebraska. I would like to mention that as the only public power state in the country, we enjoy having the fifth lowest cost electricity rates in the United States. Richardson County, through its Emergency Management has supported the facility in its off-site responsibilities to protect the public for many years, and we are glad to be part of that team that supports Cooper and nuclear power.

Thank you for this opportunity to speak to you this evening. (End of Comment CNS-1-K)

Comment CNS-1-L: I'm Ron Asche, the President and CEO of Nebraska Public Power District, the owner and operator of Cooper Nuclear Station. We began our process of compiling our license renewal application several years ago, and submitted that to the NRC in September of this past year. These public meetings tonight conducted by the NRC are a very important process in that relicensing process. They provide an opportunity for members of the local communities that surround Cooper Station and for other interested stakeholders to provide input directly to the NRC regarding our license application and any issues that they may have regarding the environmental impacts of extending Cooper's license for another 20 years, as well as any public safety issues that they may have. And I'd like to thank all of those that came this evening to express their comments to the Nuclear Regulatory Commission, both in these meetings today and for comments that you might submit via letter or e-mail, et cetera. These are a very important part of that process.

I want to close just by saying that NPPD is committed to operating Cooper Station, both now and in the future, in a manner that protects the health and safety of the public and all of our employees and workers at the plant, as well as protecting the environment. We look forward to working together with the NRC over the course of the next several years in addressing issues that may arise, which we hope will ultimately result in an extension of our license for another 20 years to operate Cooper Station and continue to provide low cost, reliable, and safe energy to the members of our communities and the state of Nebraska as a whole. Thank you. (End of Comment CNS-1-L)

Comment CNS-1-M

PAWNEE CITY DEVELOPMENT CORPORATION
P.O. Box 85
Pawnee City, NE 68420

Pawnee City - "Pleasant Past, Progressive Future"

12/30/08
73 FR 79921
(2)

Chief, Rulemaking
Directives and Editing Branch
Division of Administrative Services, Office of Administration
Mailstop T-6D59
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

To Whom It May Concern:

The Pawnee City Economic Development Corporation is submitting this letter to support the renewal of the license for Cooper Nuclear Station operated by Nebraska Public Power in southeast Nebraska. Our group recognizes the importance of the Station in providing low cost and safe energy to our region. We can assure any potential business, that the Station is committed to safety by their safe operations for the past 40 years and their investment of $300 million to upgrade the facility. Their trained workforce has a strong economic impact on our area. We do not see any negative environmental impact with this facility but if it were to be replaced by a coal-powered plant, we do not think that would be the case. We urge you to approve the license renewal so we have good, clean, green energy for years to come. CNS-1-M

Sincerely,

Alan Richard
President, Pawnee City Development Corporation

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SUNSI Review Complete
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E-RIDS = ADM-03
Add = E. Sayoc (ecs3)

:

(CNS-1-M)

Comment CNS 1-N

City of Rock Port

500 South Main
Rock Port, MO 64482

Phone 660-744-2636 • FAX 660-744-5553
rpcityhall@rpt.coop

February 27, 2009

12/30/08
73FR 79921
(3)

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Chief, Rules and Directives Branch
Division of Administrative Services
Office of Administration
U.S. Nuclear Regulatory Commission
Mailstop T-6D 59
Washington, D.C. 20555-0001

To whom it may concern:

Please find enclosed a copy of Resolution #2009-1 supporting Nebraska Public Power District's Cooper Nuclear Station License Renewal passed by the City of Rock Port on February 18, 2009. CNS-1-N

Sincerely,

Ashtin Paris
Deputy Clerk
City of Rock Port

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Call = E. Sayoc (ECS3)

(CNS-1-N)

RESOLUTION # 2009-1

**A RESOLUTION OF THE BOARD OF ALDERMEN
OF THE CITY OF ROCK PORT, MISSOURI
Supporting Nebraska Public Power District's
Cooper Nuclear Station License Renewal**

WHEREAS, Nebraska Public Power District's Cooper Nuclear Station in Brownville became operational with startup in 1974; and

WHEREAS, Cooper Nuclear Station has operated safely and efficiently for more than 30 years, generated a record 6.6 million megawatt hours of electricity in 2007, and its 828 megawatts of electrical generating capacity remains vital to Nebraska's economy; and

WHEREAS, Nebraska Public Power District has continually reinvested in the Cooper Nuclear Station facility to assure continued safe, clean, reliable and affordable production of electricity for Nebraskans across the state; and

WHEREAS, Cooper Nuclear Station is a critical asset as part of Nebraska Public Power District's generation resources and the state's unique public power system, continues to assist in keeping state electric rates among the lowest in the country; and

CNS-1-N

WHEREAS, more than 700 permanent jobs at Cooper Nuclear Station and the extensive use of contractors for ongoing maintenance and refueling outages are recognized as vitally important to the economies of the City of Rock Port, Atchison County, and surrounding communities of southeastern Nebraska and northwest Missouri; and

WHEREAS, Nebraska Public Power District submitted an application to renew Cooper Nuclear Station's operating license to the United States Nuclear Regulatory Commission on September 29, 2008; and

WHEREAS, the United States Nuclear Regulatory Commission is the federal agency charged with oversight of our nation's vital nuclear facilities and encourages public input and comment on license renewal proceedings from its neighboring communities; and

WHEREAS, Cooper Nuclear Station has been a good neighbor to its communities for more than three decades and its employees are interwoven into the fabric of the community, local schools churches, and community activities;

NOW, THEREFORE, BE IT RESOLVED that the City of Rock Port City Council supports the renewal of the license for the nuclear generating facilities at Cooper Nuclear Station, to assure their continued operation of safe, affordable and integrally important component of Nebraska's public power electric power supply system for another 20 years; and

BE IT FURTHER RESOLVED that the City of Rock Port City Clerk is directed to make available a copy of this resolution to the Nuclear Regulatory Commission at its upcoming Environmental Scoping Public meeting.

Passed and approved this 18th day of February 2009

Helen Jo Stevens, Mayor

ATTEST:

Maureen K. Moore, City Clerk/Admin.

Comment CNS-1-0:

Emergency response- James Gerweck, Richardson County

Good afternoon, many thanks to the NRC for hosting this public forum. I'm James Gerweck. I am the Director of the Richardson County, Nebraska, Emergency Management Agency. In my position, hardly a month has gone by where some form of interchange has not transpired between the Cooper Nuclear Station's Emergency Management Department and other nuclear operations staff and my office in Richardson County.

The referenced activities included quarterly emergency communications drills, unannounced communications checks, written correspondence involving improvements in emergency plans and training in many forms to include FEMA evaluated radiological emergency preparedness exercises. Other joint training activities include NPPD staff involvement and annual training of our radiological emergency response organization and our joint quarterly off-site training meetings. CNS-1-O

Cooper Nuclear Station has fully demonstrated its ability to provide safe and reliable electricity for the citizens of the State of Nebraska. Richardson County has supported CNS in its offsite responsibilities to protect the public and property for many years and is glad to be a part of the team that supports nuclear power.

The bottom line in our realm of experience, the staff at the NPPD and Cooper Nuclear Station is thoroughly professional and meticulous in attention to detail concerning their approach to public safety. In short, they are fully integrated and a key member of our

1 of 2

public safety team and in view of their professional performance and contributions to our community, and we support the NPPD's application to continue operating at Cooper Nuclear Station for another 20 years.

In closing, Richardson County is proud to have CNS in the Richardson County area. CNS-1-O

Thank you.

James A. Gerweck, director
PO Box 609
Falls City, Nebraska 68355
402-245-2446 office
402-245-5578 Fax
rcema@sentco.net Email

(CNS-1-O)

NRC Response to Comments CNS-1-A through CNS-1-O: The comments are supportive of license renewal. The comments are general in nature, provide no new information and, therefore, will not be evaluated further. No change to the scope of the Cooper Nuclear Station Environmental Impact Statement (EIS) will be made as a result of these comments.

A.3. Comments Regarding the license renewal review of Cooper Nuclear Station, Unit, 1

Emmanuel Sayoc

From: CooperEIS Resource
Sent: Thursday, April 16, 2009 1:39 PM
To: Emmanuel Sayoc
Subject: FW: Scoping Comments for Relicensing of Cooper Nuclear Station, Brownvi

-----Original Message-----
From: Shepard.Larry@epamail.epa.gov [mailto:Shepard.Larry@epamail.epa.gov]
Sent: Friday, March 27, 2009 4:59 PM
To: CooperEIS Resource
Cc: Cothern.Joe@epamail.epa.gov; Hooper.CharlesA@epamail.epa.gov; Dunn.John@epamai
Lancaster.Kris@epamail.epa.gov
Subject: Scoping Comments for Relicensing of Cooper Nuclear Station, Brownville, NE

RE: Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Cooper Nuclear Station; Federal Register Volume 74, No. 15, January 26,2009, page 4476.

Thank you for the opportunity to provide scoping comments on the proposed relicensing of Cooper Nuclear Station (CNS), in support of the U.S. Nuclear Regulatory Commission's (NRC) preparation of an Environmental Impact Statement (EIS). EPA reviewed this project in accordance with the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. We request that, in the future, the NRC provide an adequate period of time after conducting site audits for the submission of scoping comments by state or federal agencies. In this instance, scoping comments are to be submitted prior to the NRC site audit for this project.

Pleased consider the following comments during the EIS development process. CNS-1-P

Radiation - Given the uncertainty involved with licensing the Yucca Mountain Nevada facility and the extremely long time-frames needed to secure Congressional approval and complete site preparation for any possible alternative permanent site for the disposal of spent nuclear fuel, all utilities planning on extending operation of existing nuclear units should consider contingencies for long-term storage of waste on-site.

Water Quality - The current CNS site has an existing infrastructure, which includes intake and discharge structures. The source of water for the plant is the Missouri River. Potential impacts to plant operation associated with available river flow, particularly during periods of sustained low flow, should be thoroughly described in the draft EIS. The draft EIS should articulate the assurance of a long-term water supply (i.e., greater than 20 years) for the operation of the reactor. This analysis should address contingencies created by changing regional climate and potential future changes in the operation of the river by the Army Corps of Engineers (i.e., flow releases). The current facility is covered by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Nebraska Department of Environmental Quality (NDEQ). New studies and analyses performed in support of the most recent permit application (e.g., thermal and chemical discharges) should be included in the draft EIS. The draft EIS should also completely discuss issues associated with entrainment and impingement of aquatic organisms (i.e., Section 316b of the Clean Water Act) and include alternatives to the present intake design. From a review of the Environmental Report, it is apparent that there is a great deal of information available regarding the impact of plant operation on the river ecosystem. However, we generally caution that these studies are 30 years old and the draft EIS should clearly articulate whether these data are representative of current river condition and ecological impact. We would expect the NRC to provide both its reasoning and data supporting that additional and more recent research is not required to adequately document current impacts.

The draft EIS should thoroughly characterize past contamination associated with the operation of CNS, particularly source and fate of tritium in the system, and document current condition of surface water and groundwater upstream and downstream from the site.

Environmental Management System - The Council on Environmental Quality (CEQ) published "Aligning NEPA processes with Environmental management Systems-A Guide for NEPA and EMS Practitioners" to improve NEPA implementation and environmental sustainability goals in NEPA and Executive Order 13423. The NEPA document should discuss EMS as appropriate.

CNS-1-P continued

Larry Shepard
NEPA Team/Interstate Waters
US EPA Region 7
913-551-7441

1 (CNS-1-P)

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
Michael J. Smith, Director/CEO

February 2, 2009

Mr. David L. Pelton, Chief
Division of License Renewal
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: Cooper Nuclear Station license renewal HP# 0801-050-001

Dear Mr. Pelton:

Thank you for submitting the referenced project for our review and comment. Our comment on this project and its potential to affect historic properties is required by Section 106 of the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR Part 800. Before we are able to adequately review the proposed Area of Potential Effect (APE) for this project for its potential to affect historic properties, we require the following information:

- A map clearly defining the boundaries of the APE

Please submit this information to: Bob Puschendorf, Nebraska State Historic Preservation Office, P.O. Box 82554, 1420 P Street, Lincoln, NE 68501-2554.

CNS-1-Q

Sincerely,

Jill E. Dolberg
Review and Compliance Coordinator
Nebraska State Historic Preservation Office

Cc: Tam Tran, NRC
Emmanuel Sayoc, NRC
Steward B. Minahan, Chief Nuclear Officer, Cooper Nuclear Station

(CNS-1-Q)

STATE OF NEBRASKA

Dave Heineman
Governor

DEPARTMENT OF NATURAL RESOURCES
Brian P. Dunnigan, P.E.
[redacted] *Director*

March 9, 2009

IN REPLY TO:

David L. Pelton, Branch Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation
United State Regulatory Commission
Washington, DC 20555

Dear Mr. Pelton:

A letter sent by you February 4, 2009, to the Nebraska Department of Natural Resources is being returned. The letter requests a list of protected species. The appropriate Nebraska agency for such request is the Nebraska Game and Parks Commission at the following address: CNS-1-R

Kristal Stoner
Nebraska Game and Parks Commission
P.O. Box 30370
Lincoln, NE 68503-0370

If we can be of assistance to you in other matters, please feel free to contact us.

Sincerely,

Jean E. Angell

Enclosure
cc: Kristal Stoner, NGPC

legal/angell/2009
301 Centennial Mall South, 4th Floor • P.O. Box 94676 • Lincoln, Nebraska 68509-4676 • Phone (402) 471-2363 • Telefax (402) 471-2900
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(CNS-1-R) The NRC subsequently sent correspondence to the Nebraska Game and Parks Commission and received the requested list of protected species by email as shown in Appendix D1. The NPPD also received a letter the U.S. Fish and Wildlife Service that it "concurs with the NPPD and NRC determination that the proposed relicensing action is not likely to adversely affect federally listed species or result in the destruction or adverse modification of federally designated critical habitat." This letter is also included in Appendix D.

NRC Response to Comments CNS-1-Q through CNS-R-: With respect to the comments from the Nebraska State Historical Society (CNS-1-Q), and the Nebraska Department of Natural Resources (CNS-1-R), these comments contain matter from consultations with other government agencies, which support the license renewal review process. No change to the scope of the Cooper Nuclear Station Environmental Impact Statement (EIS) will be made as a result of these comments.

With respect to the EPA scoping comments (CNS-1-P) regarding the disposal of spent nuclear fuel, all utilities planning on extending operation of existing nuclear units should consider contingencies for long-term storage of waste on-site.

The NRC fully evaluated and addressed this issue in our Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437) and in its regulations. The current and potential environmental impacts from spent fuel storage onsite at the current reactor sites have been studied extensively and are well understood. The storage of spent fuel in spent fuel pools was considered for each plant in the safety and environmental reviews at the construction permit and operating license stage. The NRC has studied the safety and environmental effects from the temporary storage of spent fuel after the cessation of reactor operations (which may include the term of a revised or renewed license), and it published a generic determination of no significant environmental impact (the Waste Confidence Rule) in its regulations at 10 CFR 51.23. 10 CFR 51.23 (a) states

> The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impact for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent-fuel storage basin or at either on-site or off-site independent fuel storage installations.

In September 2009, the Commission reviewed this rule and declined to approve an update of the rule. In accordance with this determination, the rule also provides that no discussion is required concerning the environmental impacts of spent fuel storage for the period following the term of the reactor operating license, including a renewed license. Therefore, the SEIS will not include a discussion on the storage of spent nuclear fuel.

With respect to the EPA scoping comments (CNS-1-P), regarding past contamination associated with the operation of CNS-1, particularly source and fate of tritium in the system, the draft SEIS will have a discussion on the impacts of radioactive liquid effluents discharged into the Missouri River. The discussion will evaluate the radiological dose impact to members of the public as well the impact to the environment. The SEIS will also discuss the results of Cooper's radiological environmental monitoring program in which environmental sample media are collected and analyzed in order to evaluate the radiological impacts, if any, of plant operation on the environment.

With respect to the EPA scoping comments (CNS-1-P), regarding water quality, the SEIS will discuss NPDES permits and related activities including any updated information, available river flow including low flows, USACE river flow control operations, as well as aquatic and terrestrial ecosystem issues. The NRC staff does recognize that the river ecological studies are generally dated, and will address this issue in the EIS. The NRC staff is doing a search for more recent data. The staffs analysis, findings, as well as references and data used will be outlined in the EIS and referenced for publicly availability. .

A.4. References

74 FR 4476. U.S. Nuclear Regulatory Commission, Washington, D.C, “United States Nuclear Regulatory Commission, Nebraska Public Power District, Cooper Nuclear Station, Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process, *Federal Register:* Vol. 74, No. 15, pp. 4476–4477 January 26, 2009.

NRC (U.S. Nuclear Regulatory Commission). “Summary of Public Environmental Scoping Meeting Related to the Review of the Cooper Nuclear Station Unit 1 License Renewal Application,” 2009. ADAMS Accession No. ML000910308.

APPENDIX B.
NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

B. NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

Table B-1. Summary of Issues and Findings. *This table is taken from Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51. Data supporting this table are contained in NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Throughout this report, "Generic" issues are also referred to as Category 1 issues, and "Site-specific" issues are also referred to as Category 2 issues.*

Issue	Type of Issue	Finding
Surface Water Quality, Hydrology, and Use		
Impacts of refurbishment on surface water quality	Generic	SMALL. Impacts are expected to be negligible during refurbishment because best management practices are expected to be employed to control soil erosion and spills.
Impacts of refurbishment on surface water use	Generic	SMALL. Water use during refurbishment will not increase appreciably or will be reduced during plant outage.
Altered current patterns at intake and discharge structures	Generic	SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered salinity gradients	Generic	SMALL. Salinity gradients have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered thermal stratification of lakes	Generic	SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Temperature effects on sediment transport capacity	Generic	SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Scouring caused by discharged cooling water	Generic	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.
Eutrophication	Generic	SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Discharge of chlorine or other biocides	Generic	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.
Discharge of sanitary wastes and minor chemical spills	Generic	SMALL. Effects are readily controlled through National Pollutant Discharge Elimination System (NPDES) permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

Issue	Type of Issue	Finding
Discharge of other metals in wastewater	Generic	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.
Water use conflicts (plants with once-through cooling systems)	Generic	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.
Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	Site-specific	SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations. See § 51.53(c)(3)(ii)(A).
		Aquatic Ecology
Refurbishment	Generic	SMALL. During plant shutdown and refurbishment, there will be negligible effects on aquatic biota because of a reduction of entrainment and impingement of organisms or a reduced release of chemicals.
Accumulation of contaminants in sediments or biota	Generic	SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.
Entrainment of phytoplankton and zooplankton	Generic	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Cold shock	Generic	SMALL. Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations, or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.
Thermal plume barrier to migrating fish	Generic	SMALL. Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Distribution of aquatic organisms	Generic	SMALL. Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.
Premature emergence of aquatic insects	Generic	SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.

Issue	Type of Issue	Finding
Gas supersaturation (gas bubble disease)	Generic	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Low dissolved oxygen in the discharge	Generic	SMALL. Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	Generic	SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Stimulation of nuisance organisms (e.g., shipworms)	Generic	SMALL. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Aquatic Ecology (for plants with once-through and cooling-pond heat dissipation systems)		
Entrainment of fish and shellfish in early life stages	Site-specific	SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See § 51.53(c)(3)(ii)(B).
Impingement of fish and shellfish	Site-specific	SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See § 51.53(c)(3)(ii)(B).
Heat shock	Site-specific	SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See § 51.53(c)(3)(ii)(B).
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)		
Entrainment of fish and shellfish in early life stages	Generic	SMALL. Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Impingement of fish and shellfish	Generic	SMALL. The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

Issue	Type of Issue	Finding
Heat shock	Generic	SMALL. Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Ground Water Use and Quality		
Impacts of refurbishment on ground water use and quality	Generic	SMALL. Extensive dewatering during the original construction on some sites will not be repeated during refurbishment on any sites. Any plant wastes produced during refurbishment will be handled in the same manner as in current operating practices and are not expected to be a problem during the license renewal term.
Ground water use conflicts (potable and service water; plants that use <100 gallons per minute (gpm)	Generic	SMALL. Plants using less than 100 gpm are not expected to cause any ground water use conflicts.
Ground water use conflicts (potable and service water, and dewatering plants that use >100 gpm	Site-specific	SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause ground water use conflicts with nearby ground water users. See § 51.53(c)(3)(ii)(C).
Ground water use conflicts (plants using cooling towers withdrawing makeup water from a small river)	Site-specific	SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other ground water or upstream surface water users come online before the time of license renewal. See § 51.53(c)(3)(ii)(A).
Ground water use conflicts (Ranney wells)	Site-specific	SMALL, MODERATE, OR LARGE. Ranney wells can result in potential ground water depression beyond the site boundary. Impacts of large ground water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See § 51.53(c)(3)(ii)(C).
Ground water quality degradation (Ranney wells)	Generic	SMALL. Ground water quality at river sites may be degraded by induced infiltration of poor-quality river water into an aquifer that supplies large quantities of reactor cooling water. However, the lower quality infiltrating water would not preclude the current uses of ground water and is not expected to be a problem during the license renewal term.
Ground water quality degradation (saltwater intrusion)	Generic	SMALL. Nuclear power plants do not contribute significantly to saltwater intrusion.
Ground water quality degradation (cooling ponds in salt marshes)	Generic	SMALL. Sites with closed-cycle cooling ponds may degrade ground water quality. Because water in salt marshes is brackish, this is not a concern for plants located in salt marshes.
Ground water quality degradation (cooling ponds at inland sites)	Site-specific	SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade ground water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See § 51.53(c)(3)(ii)(D).

Issue	Type of Issue	Finding
Terrestrial Ecology		
Refurbishment impacts	Site-specific	SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See § 51.53(c)(3)(ii)(E).
Cooling tower impacts on crops and ornamental vegetation	Generic	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling tower impacts on native plants	Generic	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Bird collisions with cooling towers	Generic	SMALL. These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling pond impacts on terrestrial resources	Generic	SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.
Power line right of way (ROW) management (cutting and herbicide application)	Generic	SMALL. The impacts of ROW maintenance on wildlife are expected to be of small significance at all sites.
Bird collisions with power lines	Generic	SMALL. Impacts are expected to be of small significance at all sites.
Impacts of electromagnetic fields on flora and fauna	Generic	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.
Floodplains and wetland on power line ROW	Generic	SMALL. Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.
Threatened and Endangered Species		
Threatened or endangered species	Site-specific	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether or not threatened or endangered species are present and whether or not they would be adversely affected. See § 51.53(c)(3)(ii)(E).

Issue	Type of Issue	Finding
		Air Quality
Air quality during refurbishment (non-attainment and maintenance areas)	Site-specific	SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the number of workers expected to be employed during the outage. See § 51.53(c)(3)(ii)(F).
Air quality effects of transmission lines	Generic	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.
		Land Use
Onsite land use	Generic	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.
Power line ROW	Generic	SMALL. Ongoing use of power line ROWs would continue with no change in restrictions. The effects of these restrictions are of small significance.
		Human Health
Radiation exposures to the public during refurbishment	Generic	SMALL. During refurbishment, the gaseous effluents would result in doses that are similar to those from current operation. Applicable regulatory dose limits to the public are not expected to be exceeded.
Occupational radiation exposures during refurbishment	Generic	SMALL. Occupational doses from refurbishment are expected to be within the range of annual average collective doses experienced for pressurized-water reactors and boiling-water reactors. Occupational mortality risk from all causes including radiation is in the mid-range for industrial settings.
Microbiological organisms (occupational health)	Generic	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize exposure to workers.
Microbiological organisms (public health)(plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	Site-specific	SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See § 51.53(c)(3)(ii)(G).
Noise	Generic	SMALL. Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.

Issue	Type of Issue	Finding
Electromagnetic fields – acute effects (electric shock)	Site-specific	SMALL, MODERATE, OR LARGE. Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site. See § 51.53(c)(3)(ii)(H).
Electromagnetic fields – chronic effects	Uncategorized	UNCERTAIN. Biological and physical studies of 60-hertz (Hz) electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached.
Radiation exposures to public (license renewal term)	Generic	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.
Occupational radiation exposures (license renewal term)	Generic	SMALL. Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.
Socioeconomic Impacts		
Housing impacts	Site-specific	SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See § 51.53(c)(3)(ii)(I).
Public services: public safety, social services, and tourism and recreation	Generic	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.
Public services: public utilities	Site-specific	SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See § 51.53(c)(3)(ii)(I).
Public services: education (refurbishment)	Site-specific	SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See § 51.53(c)(3)(ii)(I).
Public services: education (license renewal term)	Generic	SMALL. Only impacts of small significance are expected.
Offsite land use (refurbishment)	Site-specific	SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas. See § 51.53(c)(3)(ii)(I).
Offsite land use (license renewal term)	Site-specific	SMALL, MODERATE, OR LARGE. Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal. See § 51.53(c)(3)(ii)(I).

Issue	Type of Issue	Finding
Public services: transportation	Site-specific	SMALL, MODERATE, OR LARGE. Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See § 51.53(c)(3)(ii)(J).
Historic and archaeological resources	Site-specific	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether or not there are properties present that require protection. See § 51.53(c)(3)(ii)(K).
Aesthetic impacts (refurbishment)	Generic	SMALL. No significant impacts are expected during refurbishment.
Aesthetic impacts (license renewal term)	Generic	SMALL. No significant impacts are expected during the license renewal term.
Aesthetic impacts of transmission lines (license renewal term)	Generic	SMALL. No significant impacts are expected during the license renewal term.
Postulated Accidents		
Design basis accidents	Generic	SMALL. The NRC staff has concluded that the environmental impacts of design-basis accidents are of small significance for all plants.
Severe accidents	Site-specific	SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See § 51.53(c)(3)(ii)(L).
Uranium Fuel Cycle and Waste Management		
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	Generic	SMALL. Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

Issue	Type of Issue	Finding
Offsite radiological impacts (collective effects)	Generic	The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high level waste, and spent fuel disposal excepted, is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the United States. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful; however, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations. Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1 (Generic).
Offsite radiological impacts (spent fuel and high level waste disposal)	Generic	For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if it is assumed that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 3 x 10-3. Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of

Issue	Type of Issue	Finding
		events that could seriously compromise the integrity of a deep geologic repository were evaluated by the Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, the EPA's generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing the amount of radioactive material released over 10,000 years. The cumulative release limits are based on the EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric ton (MT) repository. Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered in Category 1 (Generic).
Nonradiological impacts of the uranium fuel cycle	Generic	SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

Issue	Type of Issue	Finding
Low-level waste storage and disposal	Generic	SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.
Mixed waste storage and disposal	Generic	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.
Onsite spent fuel	Generic	SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.
Nonradiological waste	Generic	SMALL. No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.
Transportation	Generic	SMALL. The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 megawatt days per metric-ton uranium Wd/MTU)and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S–4 – Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.
	Decommissioning	
Radiation doses	Generic	SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.

Issue	Type of Issue	Finding
Waste management	Generic	SMALL. Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.
Air quality	Generic	SMALL. Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.
Water quality	Generic	SMALL. The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.
Ecological resources	Generic	SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.
Socioeconomic impacts	Generic	SMALL. Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.
Environmental Justice		
Environmental justice	Uncategorized	NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.

APPENDIX C.
APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

C. APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

The Atomic Energy Act (42 USC § 2021) authorizes U.S. Nuclear Regulatory Commission (NRC) to enter into agreement with any State to assume to assume regulatory authority for certain activities. For example, through the Agreement State Program, Nebraska assumed regulatory responsibility over certain byproduct, source, and small quantities of special nuclear material. The Nebraska Agreement State Program is administered by the Radiation Control Program (the program) in the Department of Health. The Program Manager reports to the Section Administrator for Consumer Health Services, who reports to the Division Director for Public Health Assurance, who in turn reports to the Director of Regulation and Licensure.

In addition to implementing some Federal programs, State legislatures develop their own laws. State statutes supplement as well as implement Federal laws for protection of air, water quality, and ground water. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The Clean Water Act (CWA) allows for primary enforcement and administration through State agencies, provided the State program is at least as stringent as the Federal program. The State program must conform to the CWA and to the delegation of authority for the Federal National Pollutant Discharge Elimination System (NPDES) program from the EPA to the State. The primary mechanism to control water pollution is the requirement for direct dischargers to obtain an NPDES permit, or in the case of States where the authority has been delegated from the EPA, a State Pollutant Discharge Elimination System (SPDES) permit, pursuant to the CWA. In Nebraska, the Nebraska Department of Environmental Quality (NDEQ) issues and enforces NPDES permits.

C.1. Federal Environmental Requirements

Cooper Nuclear Station, Unit 1, (CNS-1) is subject to Federal requirements regarding their environmental program. Those requirements are briefly described below. See Section 1.9 for CNS-1's compliance status with these requirements.

Table C-1 provides a list of the principal Federal environmental regulations and laws that are applicable to the review of the environmental resources that could be affected by this project that may affect license renewal applications for nuclear power plants.

Table C-1. Federal Environmental Requirements.

Law/Regulation	Requirements
	Current Operating License and License Renewal
10 CFR Part 51. *Code of Federal Regulations* (CFR), Title 10, Energy, Part 51	"Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." This part contains environmental protection regulations applicable to NRC's domestic licensing and related regulatory functions.
10 CFR Part 54.	10 CFR Part 54. "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." Part 54 of 10 CFR focuses on managing adverse effects of aging; rather than identification of all aging mechanisms. The rule is intended to ensure that important systems, structures, and components will continue to perform their intended function in the period of extended operation.
10 CFR Part 50	Regulations promulgated by the NRC pursuant to the Atomic Energy Act of 1954, as amended (68 Stat. 919), and Title II of the Energy Reorganization Act of 1974 (88

Law/Regulation	Requirements
	Stat. 1242), to provide for the licensing of production and utilization facilities. This part also gives notice to all persons who knowingly provide to any licensee, applicant, contractor, or subcontractor, components, equipment, materials, or other goods or services, that relate to a licensee's or applicant's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of § 50.5.
Air Quality Protection	
Clean Air Act (CAA) (42 U.S.C. §7401 et seq.)	The Clean Air Act (CAA) is a comprehensive Federal law that regulates air emissions. Under CAA, Federal actions cannot thwart State and local efforts to remedy long-standing air quality problems that threaten public health issues associated with the six criteria air pollutants (i.e., ozone, nitrogen dioxide, sulfur dioxide, particulate matter, carbon monoxide, and lead).
Water Resources Protection	
Section 404 of the Clean Water Act (CWA) (33 U.S.C. § 1344)	Section 404 of the CWA established a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. The Army Corps of Engineers (USACE) and the EPA jointly administer this program. Under the 404 program, no discharge of dredged or fill material is allowed if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. A Federal permit is required to discharge dredged or fill material into wetlands and waters of the United States.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)(42 U.S.C. §. 9601 et seq)	Section 101 of CERCLA requires a permit to cover consumptive water use over 20,000 gallons per day (over a 30-day average) of surface and ground water.
Wild and Scenic River Act (16 U.S.C. §1271 et seq.)	Created the National Wild and Scenic Rivers System, established to protect the environmental values of free flowing streams from degradation by impacting activities including water resources projects.
Floodplain Executive Order (No. 11988. May 24, 1977, 42 F.R. 26951) and Wetlands Executive Order (No. 11990. May 24, l977, 42 F.R. 26961)	Both executive orders require Federal agencies to consider the impacts of their actions on floodplains and wetlands through existing review procedures such as National Environmental Policy Act of 1969.

Law/Regulation	Requirements
Waste Management and Pollution Prevention	
Resource Conservation and Recovery Act (RCRA) (42 USC § 6901et seq.)	Before a material can be classified as a hazardous waste, it must first be a solid waste as defined under the RCRA. Hazardous waste is classified under Subtitle C of the RCRA. Parts 261 and 262 of Title 40 CFR contain all applicable generators of hazardous waste regulations. Part 261.5 (a) and (e) contains requirements for Conditionally Exempt Small Quantity Generators (CESQGs). Part 262.34(d) contains requirements for Small Quantity Generators (SQGs). Parts 262 and 261.5(e) contain requirements for Large Quantity Generators (LQGs)
Pollution Prevention Act (42 U.S.C. § 13101 et seq)	Formally established a national policy to prevent or reduce pollution at its source whenever feasible. The Act provides funds for State and local pollution prevention programs through a grant program to promote the use of pollution prevention techniques by business.

Law/Regulation	Requirements
Endangered Species	
Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.)	Forbids any government agency, corporation, or citizen from taking (harming or killing) endangered animals without an Endangered Species Permit.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	To minimize adverse impacts of proposed actions on fish and wildlife resources and habitat, requires that Federal agencies consult government agencies regarding activities that affect, control, or modify waters of any stream or bodies of water. It also requires that justifiable means and measures be used in modifying plans to protect fish and wildlife in these waters.
Historic Preservation	
National Historic Preservation Act (NHPA) (16 U.S.C. § 470 et seq.)	Directs Federal agencies to consider the impact of their actions on historic properties. NHPA also encourages state and local preservation societies.
Farmland	
Farmland and Protection Policy Act (7 U.S.C. § 4201 et seq.)	Requires that Federal programs, as practicable, shall be administered in a manner compatible with State and local government and private programs and policies to protect farmland.

APPENDIX D.
CONSULTATION CORRESPONDENCE

D. CONSULTATION CORRESPONDENCES

The Endangered Species Act of 1973, as amended, the Magnuson-Stevens Fisheries Management Act of 1996, as amended; and the National Historic Preservation Act of 1966 require that Federal agencies consult with applicable State and Federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historic and archaeological resources, respectively. This appendix contains consultation documentation.

Table D-1 provides a list of the consultation documents sent between the U.S. Nuclear Regulatory Commission (NRC) and other agencies. The NRC staff is required to consult with these agencies based on the National Environmental Policy Act of 1969 (NEPA) requirements.

Table D-1. Consultation Correspondences.

Author	Recipient	Date of Letter/Email
U.S. Nuclear Regulatory Commission (D. Pelton)	Nebraska State Historic Society (M. Smith)	January 16, 2009 (ML090080197)
U.S. Nuclear Regulatory Commission (D. Pelton)	Advisory Council on Historic Preservation (D. Klima)	January 26, 2009 (ML090080683)
U.S. Nuclear Regulatory Commission (D. Pelton)	Environmental Services Division, Environmental Protection Agency Region 7 (J. Cothern)	January 27, 2009 (ML090230446)
U.S. Nuclear Regulatory Commission (D. Pelton)	Department of Health and Human Services, Regulation and Licensure, Public Health Assurance (J. Schmitt)	January 28, 2009 (ML090210249)
U.S Nuclear Regulatory Commission (D. Pelton)	U. S. Fish and Wildlife Service, Ecological Services – Nebraska Field Office (J. Cochnar)	January 29, 2009 (ML090070507)
U.S Nuclear Regulatory Commission (D. Pelton)	Missouri State Historic Society (M. Miles)	January 29, 2009 (ML090210750)
Nebraska State Historical Society (J. Dolberg)	U.S. Nuclear Regulatory Commission (D. Pelton)	February 02, 2009 (ML090650061)
U.S Nuclear Regulatory Commission (D. Pelton)	Nebraska Department of Natural Resources (A. Bleed)	February 04, 2009 (ML090260380)
U.S. Nuclear Regulatory Commission (D. Pelton)	U.S. Army Corps of Engineers, Omaha District (D. Press)	February 04, 2009 (ML090160476)
U.S. Nuclear Regulatory Commission (D. Pelton)	Sac and Fox Tribe of the Mississippi in Iowa (A. Pushetonequa)[a]	February 04, 2009 (ML090080045)
Nebraska Department of Natural Resources (J.Angell)	U.S. Nuclear Regulatory Commission (D. Pelton)	March 09, 2009

Author	Recipient	Date of Letter/Email
Environmental Protection Agency Region 7 (L. Shepard)	U.S. Nuclear Regulatory Commission (E. Sayoc)	April 16, 2009 (ML091070269)
Nebraska Games and Parks Commission (R. Simpson)	U.S. Nuclear Regulatory Commission (R. Bulavinetz)	May 08, 2009 (ML091400110)
Fish and Wildlife Service (J. DeWeese)	Nebraska Public Power District (J. Citta)	June 8, 2009 (ML091830055)

[a] Similar letters went to 14 other Native American Tribes listed in Section 1.8.

D.1. Consultation Correspondence

The following pages contain copies of the letters listed in Table D-1.

January 16, 2009

Mr. Michael J. Smith
State Historic Preservation Officer
Nebraska State Historical Society
P.O. Box 82554
Lincoln, NE 68501

SUBJECT: COOPER NUCLEAR STATION LICENSE RENEWAL APPLICATION REVIEW (HP NO. 0801-050-01, DESCRIPTION, NPPD, COOPER NUCLEAR STATION)

Dear Mr. Smith:

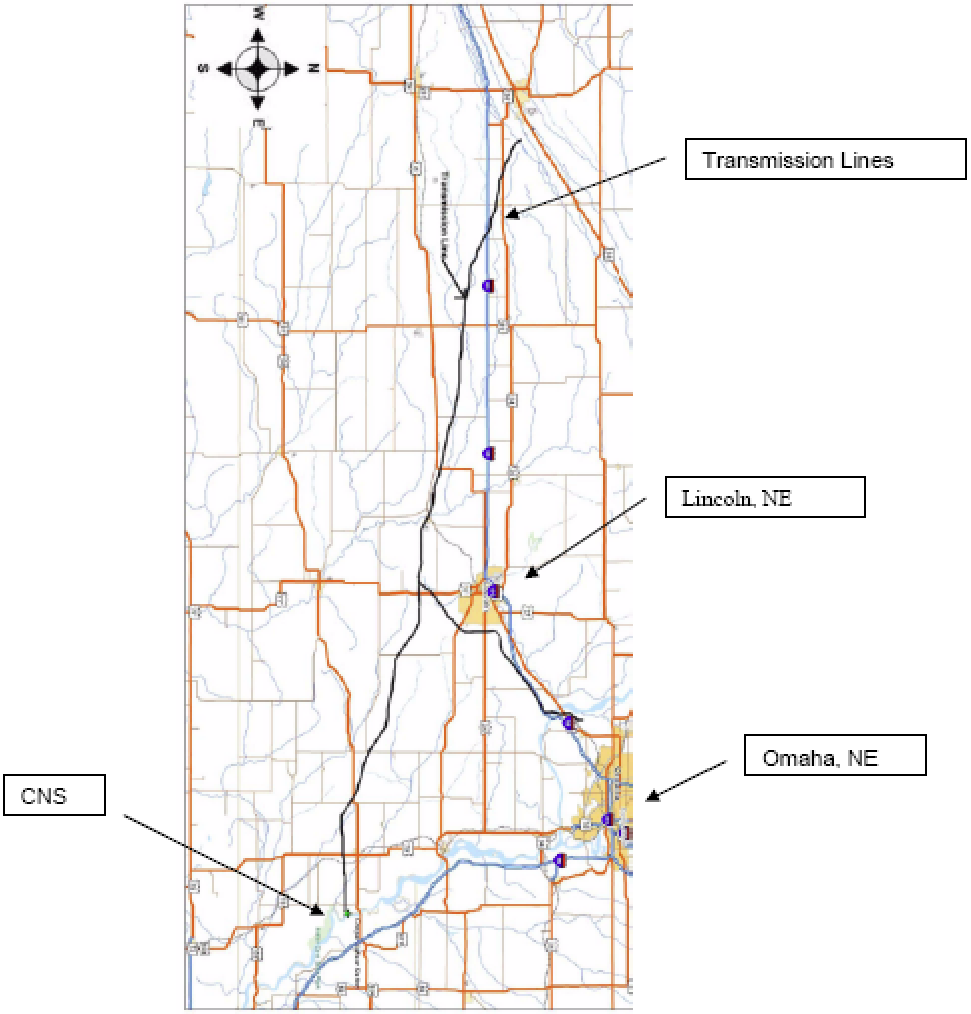
The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application to renew the operating license for Cooper Nuclear Station (CNS), which is located in Nemaha County, Nebraska, on the west bank of the Missouri River at river mile (RM) 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site. CNS is operated by the Nebraska Public Power District (NPPD). The application for renewal was submitted by NPPD by letter dated September 24, 2008, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants", NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or possible refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post- license renewal land-disturbing operations or projected refurbishment activities specifically related to license renewal may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On February 25, 2009, the NRC will conduct two public license renewal and environmental scoping meetings. The first session will be held at the Brownville Concert Hall at 126 Atlantic St., Brownville, NE 68321, telephone (402) 825-3331, and will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will be held at the Auburn Senior Center at 1101 J St., Auburn, NE 68305, telephone (402) 274-3420, and will convene at 7:00 p.m., with a repeat of the overview portions of the meeting and will continue until 10:00 p.m., as necessary. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The staff expects to publish the draft SEIS in December 2009.

1 Cooper Nuclear Station Site Map – 6 Mile Radius



Cooper Nuclear Station Transmission Lines

January 26, 2009

Mr. Don L. Klima, Director
Advisory Council on Historic Preservation
Office of Federal Agency Programs
1100 Pennsylvania Ave., NW, Suite 803
Washington, DC 20004

SUBJECT: COOPER NUCLEAR STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application to renew the operating license for Cooper Nuclear Station (CNS) which is located near Brownville, Nebraska. It is operated by the Nebraska Public Power District (NPPD). The application for renewal was submitted by NPPD by letter dated September 24, 2008, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants", NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

On February 25, 2009, the NRC will conduct two public license renewal and environmental scoping meetings. The first session will be held at the Brownville Concert Hall at 126 Atlantic St., Brownville, NE 68321, telephone (402) 825-3331, and will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will be held at the Auburn Senior Center at 1101 J St., Auburn, NE 68305, telephone (402) 274-3420, and will convene at 7:00 p.m., with a repeat of the overview portions of the meeting and will continue until 10:00 p.m., as necessary. You and your staff are invited to attend. In addition, during the week of March 30, 2009, the NRC staff plans to conduct a site audit at CNS. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2009.

D. Klima - 2 -

If you have any questions or require additional information, please contact the License Renewal Project Managers, Tam Tran telephone, (301) 415-3617, email: tam.tran@nrc.gov or Emmanuel Sayoc, telephone (301) 415-1924, email: emmanuel.sayoc@nrc.gov.

Sincerely,

\RA

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-298

cc w/o encl: See next page

January 27, 2009

Mr. Joseph Cothern
Environmental Review Coordinator
Environmental Services Division
USEPA Region 7
901 North 5th Street
Kansas City, KS 66101

SUBJECT: COOPER NUCLEAR STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Cothern:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by Nebraska Public Power District, for the renewal of the operating license for Cooper Nuclear Station (CNS) Unit 1, which is located in Nemaha County, Nebraska, on the west bank of the Missouri River at river mile 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site, and Lincoln, NE, is located approximately 60 miles west northwest of the site. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act of 1969.

CNS is requesting the renewal of its operating license for a period of 20 years beyond the expiration of the current license term, renewing the license until January 18, 2034. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines; CNS does not plan to construct or alter any facilities associated with the plant during the period of extended operation.

The NRC staff plans to hold two identical public meetings covering the license renewal and environmental scoping process on February 25, 2009. The first session will be held at the Brownville Concert Hall at 126 Atlantic Street, Brownville, NE 68321, telephone (402) 825-3331, and will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will be held at the Auburn Senior Center at 1101 J Street, Auburn, NE 68305, telephone (402) 274 3420, and will convene at 7:00 p.m., with a repeat of the overview portions of the meeting and will continue until 10:00 p.m., as necessary. In addition, during the week of March 30, 2009, the NRC plans to conduct a site audit. You and your staff are invited to attend both the site audit and the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2009.

J. Cothern - 2 -

If you have any questions concerning the NRC staff's review of this LRA, please contact NRC's Project Managers, Tam Tran, by telephone, 1-800-368-5642, extension 3617, or by e-mail at tam.tran@nrc.gov, or Emmanuel Sayoc, by telephone, 1-800-368-5642, extension 1924, or by e-mail at emmanuel.sayoc@nrc.gov.

Sincerely,

\RA

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-298

cc w/encls: See next page

January 28, 2009

Ms. Julia Schmitt, Manager
Radiation Control Program
Department of Health and Human Services
Regulation and Licensure
Public Health Assurance
301 Centennial Mall, South
P.O. Box 95007
Lincoln, NE 68509-5007

SUBJECT: COOPER NUCLEAR STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Ms. Schmitt:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by Nebraska Public Power District (NPPD), for the renewal of the operating license for Cooper Nuclear Station (CNS), which is located in Nemaha County, Nebraska (NE), on the west bank of the Missouri River at river mile (RM) 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site, and Lincoln, Nebraska, is located approximately 60 miles west northwest of the site. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the Code of Federal Regulations Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act (NEPA) of 1969.

CNS is requesting the renewal of its operating license for a period of 20 years beyond the expiration of the current license term, renewing the license until January 18, 2034. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines; CNS does not plan to construct or alter any facilities associated with the plant during the period of extended operation.

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J. Schmitt - 2 -

If you have any questions concerning the NRC staff's review of this license renewal application, please contact NRC's Project Managers, Tam Tran, by telephone,1-800-368-5642, extension 3617, or by email to the NRC at tam.tran@nrc.gov, or Emmanuel Sayoc, by telephone, 1-800-368-5642, extension 1924, or by email to the NRC at emmanuel.sayoc@nrc.gov.

Sincerely,

\RA

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-298

cc w/o encl: See next page

January 29, 2009

Mr. John Cochnar
U. S. Fish and Wildlife Service
Ecological Services - Nebraska Field Office
203 West Second Street
Grand Island, NE 68801

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE COOPER NUCLEAR STATION, UNIT 1 LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Cochnar:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by the Nebraska Public Power District (NPPD) for the renewal of the operating license for Cooper Nuclear Station (CNS) Unit 1. CNS is located in Nemaha County, Nebraska (NE), on the west bank of the Missouri River at river mile (RM) 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site and Lincoln, NE, is located approximately 60 miles west northwest of the site. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act (NEPA) of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The site surroundings are predominantly agricultural with zero population within a one-half mile radius of the plant. Brownville, NE, is the nearest developed community, at a distance of approximately 2.25 miles from the site, with a 2005 population of approximately 137. The largest town with industry within 10 miles is Auburn, Nebraska, located to the west, with a 2005 population of approximately 3,076. Maryville, Missouri, located approximately 40 miles east of the plant, is the largest community within 50 miles and had a 2005 population of approximately 10,567.

Over 99 percent of the acreage in Nemaha County is used for agriculture and farming. Farming is also the major activity for the rest of the area within a 50-mile radius as well. The site is located on a constructional plain bordering the west bank of the Missouri River. It is situated on the first bottomland of the broad, nearly level, flood plain, which is approximately six miles wide at the site. The U.S. Army Corp of Engineer (USACE) has stabilized the channel by use of pile dikes and bank protection. Earthen levees run parallel with the Missouri River, on both sides of the river.

The station site grade level of 903 feet above mean sea level (AMSL) has been raised 13 feet above the natural grade level of 890 feet AMSL, in order to bring final grade one foot above the existing 902 feet AMSL levee constructed by the USACE. The site slopes generally east, with surface drainage toward the Missouri River.

The CNS property includes 239 acres on the east side of the Missouri River in Atchison County, Missouri, the most northwestern county in Missouri, bounded on the west by the Missouri River. The eastern bank of the Missouri River is chiefly a densely forested land similar to the un-farmable bluffs that run parallel to the Missouri River. To the west there are bluffs that peak at 1,100 feet, but average 1,000 feet along the stretch of river from Brownville to Nemaha. Beyond the bluffs, the land is a gently rolling flood plain.

There are several Native American lands within a 50-mile radius of CNS. These include the Sac and Fox Reservation, Iowa Reservation, and Kickapoo Reservation. There are also several local and county parks, golf courses, forest lands, wildlife areas, and other public recreation lands within a 50-mile radius of CNS.

Flow of the Missouri River at CNS is largely controlled by the Gavins Point Dam located about 200 miles upstream in Yankton, South Dakota. The flow is highly channelized with swift flows and heavy sediment transport. Wing dams are located on the Missouri side of the river near CNS to force the flow into a central channel.

The USACE constructed and operates six of the seven mainstem dams on the Missouri River; the U.S. Bureau of Reclamation operates the seventh, Canyon Ferry Dam, east of Helena, Montana. When the USACE constructed five of the Missouri River mainstem dams in the 1950s and 1960s after passage of the Pick-Sloan Plan, goals for dam and reservoir operations were to reduce flood damages, enhance navigation, generate hydroelectric power, and store water for irrigation.

Missouri River reservoirs and river segments presently contain populations of exotic fishes, including cisco, several salmon and trout species, and several Asian carp species. Some of these species have contributed to the development of economically important recreational fisheries.

CNS cooling is classified as a circulating water system that uses water taken from the Missouri River. Water passes through trash racks and then through traveling screens. A major portion of the flow is directed to the circulating water pumps, which deliver water to the main condenser. A smaller portion of the Missouri River water is used by the service water pumps. The discharge from the condenser and from the service water system is returned via the discharge channel to the river. The circulating water intake structure (CWIS) is located on the west shoreline. In front of the CWIS is a guide wall and submerged weir constructed of steel sheet piling that runs parallel to and at distance of 14.25 feet (ft) from the face of the intake. The purpose of the guide wall and weir is to reduce the sediment input to the CWIS. It accomplishes this by forcing bed load and other material contained in the river to flow around and past the CWIS.

Four circulating water pumps provide the circulating water for the facility. Each pump can draw 159,000 gpm. The pump design water level is at El. 875.0 ft, with a minimum submergence level at El. 865.0 ft. There are four service water pumps providing a combined flow of 32,000 gpm. Velocities in the intake structure are 1.1 ft/sec under the curtain wall, 0.7 ft/sec at the trash racks, and approximately 2.0 ft/sec at the traveling water screens. These velocities were calculated at low water levels (El. 874.5 ft) and maximum circulating water pump flow (159,000 gpm per pump). The flow is highly channelized with swift flows and heavy sediment transport. Turning vanes and a low sheetpile wall are located in front of the intake bays. Wing dams are located on the Missouri side of the river to force the flow into a central channel. During the winter, ice is very common on the river. To prevent ice damage, ice deflector barges are installed during the winter months. To prevent the formation of frazzle ice, some of the main condenser discharge water (25–30 percent) is re-circulated through the ice control tunnel and released in front of the trash rack within the CWIS while the remaining water is discharged about 1,300 ft downstream of the intake via a discharge canal.

The chlorination system connection is located on the common inlet to Screen Wash Pump A and B from the service water system. Bacteria that occur naturally in the Missouri River may contribute to the growth of biological film fouling of the main condenser tubes. The station is proceeding with a study to determine if routine chemical injection (chlorine, bromine, etc.) will be effective in eliminating the microbiological film on the interior walls of the condenser tubes.

Water leaves the pump house and circulates through the condenser, where it is collected from the condenser section through a large manifold. It then travels through concrete tunnels to the seal well structure and the discharge canal. At the rated circulating water flow of 631,000 gpm through the condenser and at design power on the turbine generator, the temperature rise through the condenser is approximately 17.8°F. From the seal well and gate control structure, the water is directed into a discharge canal that is approximately 1,000 ft long; it then enters the river at a slight angle. The velocity of discharge is about 1 fps during average water levels of 879.4 ft AMSL and 35,000 cfs flow, and increases to about 2.5 fps as the water surface elevation is reduced to 874.5 ft AMSL and flows near 11,000 cfs.

The transmission lines which were constructed to connect CNS to the grid for purposes of power distribution includes (1) NPPD line TL3501 (345 kV energized in August 1969) 63.6 miles in length from CNS to the Mark T. Moore substation near Hallam, Nebraska, (2) NPPD line TL3502 (345 kV energized in July 1970) 82.6 miles in length from the Mark T. Moore substation to the Grand Island substation, and (3) Omaha Public Power District (OPPD) Line "60," which was already planned when CNS was constructed, (4) NPPD line TL3504 was energized as a 345 kV line in July 1970 and is 0.64 miles in length from CNS to the center of the Missouri River.

The transmission line "K-Towers" are supported by two wooden poles that are 26 feet apart. Therefore, the farming activity adjacent to and under the towers and lines continues essentially unimpeded with the only land removed from service being that upon which transmission poles physically rest. No cultivated land along the transmission route has been removed from service as a result of rights-of-way, and access for repairs and maintenance is requested on an individual basis from each property owner. For the remainder of the transmission line route, which passes over non-cultivated land, the right-of-way (ROW) is cleared only of woody plants that have a growth pattern that would cause them to grow into or fall onto the line conductors. Thereafter, control of these species is maintained; however, all of the natural grasses and low growing bushy, woody plants are allowed to grow.

There are no densely forested areas on the transmission route, and the land beneath the transmission lines is allowed to return to its natural state. Steel towers are used for the lines crossing the Missouri River and in the immediate vicinity of the station. Based on NPPD clearance practices, the required minimum ground clearance is 29.3 feet.

Provided for your information is the CNS Site Layout (Enclosure 1) and Transmission Line Map (Enclosure 2). To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests information on Federally-listed, proposed, and candidate species and critical habitat that may be in the vicinity of CNS and its associated transmission line rights-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

The NRC staff plans to hold two public license renewal and environmental scoping meetings on February 25, 2009. There will be two sessions, an afternoon and evening session, to accommodate interested parties. The first session will be held at the Brownville Concert Hall at 126 Atlantic St., Brownville, NE 68321, telephone (402) 825-3331, and will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will be held at the Auburn Senior Center at 1101 J St., Auburn, NE 68305, telephone (402) 274-3420, and will convene at 7:00 p.m., with a repeat of the overview portions of the meeting and will continue until 10:00 p.m., as necessary. In addition, during the week of March 30, the NRC plans to conduct a site audit. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2009.

January 29, 2009

Mr. Mark Miles
State Historic Preservation Officer
Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

SUBJECT: COOPER NUCLEAR STATION LICENSE RENEWAL APPLICATION REVIEW (NEBRASKA PUBLIC POWER DISTRICT - COOPER NUCLEAR STATION SHPO LOG NUMBER 004-AT-08)

Dear Mr. Miles:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application to renew the operating license for Cooper Nuclear Station (CNS), which is located in Nemaha County, Nebraska (NE), on the west bank of the Missouri River at river mile 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site. CNS is operated by the Nebraska Public Power District (NPPD). The application for renewal was submitted by NPPD by letter dated September 24, 2008, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants", NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities specifically related to license renewal may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On February 25, 2009, the NRC will conduct two public license renewal and environmental scoping meetings. The first session will be held at the Brownville Concert Hall at 126 Atlantic St., Brownville, NE 68321, telephone (402) 825-3331, and will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will be held at the Auburn Senior Center at 1101 J St., Auburn, NE 68305, telephone (402) 274-3420, and will convene at 7:00 p.m., with a repeat of the overview portions of the meeting and will continue until 10:00 p.m., as necessary. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The staff expects to publish the draft SEIS in December 2009.

If you have any questions concerning the NRC staff's review of this license renewal application, please contact NRC's Project Managers, Tam Tran, by telephone, 1-800-368-5642, extension 3617, or by email to the NRC at tam.tran@nrc.gov, or Emmanuel Sayoc, by telephone, 1-800-368-5642, extension 1924, or by email to the NRC at emmanuel.sayoc@nrc.gov.

Sincerely,

/RA/

David Pelton, Branch Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-298

cc: See next page

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
Michael J. Smith, Director/CEO

February 2, 2009

Mr. David L. Pelton, Chief
Division of License Renewal
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: Cooper Nuclear Station license renewal HP# 0801-050-001

Dear Mr. Pelton:

Thank you for submitting the referenced project for our review and comment. Our comment on this project and its potential to affect historic properties is required by Section 106 of the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR Part 800. Before we are able to adequately review the proposed Area of Potential Effect (APE) for this project for its potential to affect historic properties, we require the following information:

- A map clearly defining the boundaries of the APE

Please submit this information to: Bob Puschendorf, Nebraska State Historic Preservation Office, P.O. Box 82554, 1420 P Street, Lincoln, NE 68501-2554.

Sincerely,

Jill E. Dolberg
Review and Compliance Coordinator
Nebraska State Historic Preservation Office

Cc: Tam Tran, NRC
Emmanuel Sayoc, NRC
Steward B. Minahan, Chief Nuclear Officer, Cooper Nuclear Station

February 04, 2009

Ms. Ann Salomon Bleed, Director
Nebraska Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, NE 68509-4676

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE COOPER NUCLEAR STATION, UNIT 1 LICENSE RENEWAL APPLICATION REVIEW

Dear Ms. Bleed:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by the Nebraska Public Power District (NPPD) for the renewal of the operating license for Cooper Nuclear Station (CNS) Unit 1. Cooper Nuclear Station (CNS), located in Nemaha County, Nebraska (NE), on the west bank of the Missouri River at river mile (RM) 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site, and Lincoln, NE, is located approximately 60 miles west northwest of the site. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act (NEPA) of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The site surroundings are predominantly agricultural with zero population within a one-half mile radius of the plant. Brownville, NE, is the nearest developed community, at a distance of approximately 2.25 miles from the site, and a 2005 population of approximately 137. The largest town with industry within 10 miles is Auburn, NE, located to the west, with a 2005 population of approximately 3,076. Maryville, Missouri, located approximately 40 miles east of the plant, is the largest community within 50 miles and had a 2005 population of approximately 10,567.

Over 99 percent of the acreage in Nemaha County is used for agriculture and farming. Farming is the major activity for the rest of the area within a 50-mile radius as well. The site is located on a constructional plain bordering the west bank of the Missouri River. It is situated on the first bottomland of the broad, nearly level, flood plain, which is approximately six miles wide at the site. The U.S. Army Corps of Engineers (USACE) has stabilized the channel by use of pile dikes and bank protection. Earthen levees run parallel with the Missouri River, on both sides of the river.

The station site grade level of 903 feet above mean sea level (AMSL) has been raised 13 feet above the natural grade level of 890 feet AMSL, in order to bring final grade one foot above the existing 902 feet AMSL levee constructed by the USACE. The site slopes generally east, with surface drainage toward the Missouri River.

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The transmission line "K-Towers" are supported by two wooden poles that are 26 feet apart. Therefore, the farming activity adjacent to and under the towers and lines continues essentially unimpeded with the only land removed from service being that upon which transmission poles physically rest. No cultivated land along the transmission route has been removed from service as a result of rights-of-way, and access for repairs and maintenance is requested on an individual basis from each property owner. For the remainder of the transmission line route, which passes over non-cultivated land, the right-of-way (ROW) is cleared only of woody plants that have a growth pattern that would cause them to grow into or fall onto the line conductors. Thereafter, control of these species is maintained; however, all of the natural grasses and low growing bushy, woody plants are allowed to grow.

There are no densely forested areas on the transmission route, and the land beneath the transmission lines is allowed to return to its natural state. Steel towers are used for the lines crossing the Missouri River and in the immediate vicinity of the station. Based on NPPD clearance practices, the required minimum ground clearance is 29.3 feet.

Provided for your information is the CNS Site Layout (Enclosure 1) and Transmission Line Map (Enclosure 2). To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests information on State-listed, proposed, and candidate species and critical habitat that may be in the vicinity of CNS and its associated transmission line rights-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

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February 04, 2009

Colonel David C. Press, Commander
U.S. Army Corps of Engineers
Omaha District
106 South 15th Street
Omaha, NE 68102-1618

SUBJECT: COOPER NUCLEAR STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Colonel Press:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by Nebraska Public Power District (NPPD), for the renewal of the operating license for Cooper Nuclear Station (CNS), which is located in Nemaha County, Nebraska (NE), on the west bank of the Missouri River at river mile 532.5. The Village of Brownville, NE is located approximately 2.25 miles northwest of the site, and Lincoln, NE is located approximately 60 miles west northwest of the site. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act (NEPA) of 1969.

CNS is requesting the renewal of its operating license for a period of 20 years beyond the expiration of the current license term, renewing the license until January 18, 2034. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines; CNS does not plan to construct or alter any facilities associated with the plant during the period of extended operation.

The NRC staff plans to hold two identical public meetings covering the license renewal and environmental scoping process on February 25, 2009. The first session will be to be held at the Brownville Concert Hall at 126 Atlantic St., Brownville, NE 68321 telephone 402-825-3331, and will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will be held at the Auburn Senior Center at 1101 J St., Auburn, NE 68305, telephone 402-274 3420, and will convene at 7:00 p.m., with a repeat of the overview portions of the meeting and will continue until 10:00 p.m., as necessary. In addition, during the week of March 30, 2009 the NRC plans to conduct a site audit. You and your staff are invited to attend both the site audit and the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2009.

D. Press - 2 -

If you have any questions concerning the NRC staff's review of this license renewal application, please contact NRC's Project Managers, Tam Tran, by telephone, 1-800-368-5642, extension 3617, or by email to the NRC at tam.tran@nrc.gov, or Emmanuel Sayoc, by telephone, 1-800-368-5642, extension 1924, or by email to the NRC at emmanuel.sayoc@nrc.gov.

Sincerely,

/RA/

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-298

cc w/o encl.: See next page

February 04, 2009

Adrian Pushetonequa, Chairman
Sac and Fox Tribe of the Mississippi in Iowa
349 Meskwaki Road
Tama, IA 52339-9629

SUBJECT: REQUEST FOR SCOPING COMMENTS CONCERNING THE COOPER NUCLEAR STATION, UNIT 1 LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Pushetonequa:

The U.S. Nuclear Regulatory Commission (NRC or the staff) has recently received an application from Nebraska Public Power District for the renewal of the operating license for the Cooper Nuclear Station (CNS) Unit 1, located in Nemaha County, Nebraska. The NRC is in the initial stages of developing a Supplemental Environmental Impact Statement to the Generic Environmental Impact Statement (GEIS), which will document the impacts associated with the license renewal of the CNS Unit 1. We would like your assistance in our review by providing input to the NRC's environmental review scoping process. The NRC's process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts pursuant to Title 10 of the *Code of Federal Regulations* Part 51, Section 51.28(b). In addition, as outlined in 36 CFR 800.8(c), the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating license for CNS Unit 1 will expire in January 18, 2014. Provided for your information is the CNS Unit 1 Site Layout (Enclosure 1) and Transmission Line Map (Enclosure 2). Additionally, attached you will find a compact disk containing copies of the license renewal application and the GEIS.

The GEIS considered the environmental impacts of renewing nuclear power plant operating licenses for a 20-year period on all currently operating sites. In the GEIS the NRC staff identified 92 environmental issues and developed generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. For the remaining 23 issues, plant-specific analyses will be documented in a supplement to the GEIS.

A Supplemental Environmental Impact Statement will be prepared for CNS Unit 1 to document the staff's review of environmental impacts related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others), and will contain a recommendation regarding the environmental acceptability of the license renewal action.

Please submit any comments that you may have to offer on the scope of the environmental review by March 27, 2009. Written comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington D.C. 20555-0001. Electronic comments may be submitted to the NRC by e-mail at CooperEIS@nrc.gov. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and mail a copy to you.

To accommodate interested members of the public, the NRC will hold two public scoping meetings for the CNS Unit 1 license renewal supplement to the GEIS on February 25, 2008. The first session will be held in the afternoon at the Brownville Concert Hall at 126 Atlantic Street, Brownville, NE 68321, telephone (402) 825-3331. The second session, covering the same subjects will be held in the evening at the Auburn Senior Center at 1101 J Street, Auburn, NE 68305, telephone (402) 274 3420. Additionally, the NRC staff will host informal discussions one hour before the start of each session. You and your staff are invited to attend the public meetings.

The CNS Unit 1 license renewal application and the GEIS are available on the internet at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/cooper.html. In addition, the Auburn Memorial Library, 1810 Courthouse Avenue, Auburn, NE 68305, telephone (402) 274-4023, has agreed to make the license renewal application and the GEIS available for public inspection.

The staff expects to publish the draft Supplemental Environmental Impact Statement in December 2009. A copy of the document will be sent to you for your review and comment. The NRC will hold another set of public meetings in the site vicinity to solicit comments on the draft Supplemental Environmental Impact Statement. After consideration of public comments received, the NRC will prepare a final Supplemental Environmental Impact Statement, which is scheduled to be issued in July 2010.

The NRC is sending this letter to the tribal contacts for the following Federally-recognized tribes: Prairie Band of Potawatomi Indians, Iowa Tribe of Kansas and Nebraska, Iowa Tribe of Oklahoma, Kickapoo Tribe in Kansas, Otoe-Missouria Tribe of Indians, Omaha Tribe of Nebraska, Sac and Fox Nation of Missouri, Sac and Fox Nation of Oklahoma, and the Sac and Fox Tribe of Mississippi in Iowa.

If you need additional information regarding the license renewal review process, please contact Tam Tran, by telephone, 1-800-368-5642, extension 3617, or by e-mail at tam.tran@nrc.gov, or

Emmanuel Sayoc, by telephone, 1-800-368-5642, extension 1924, or by e-mail at emmanuel.sayoc@nrc.gov.

Sincerely,

/RA/

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-298

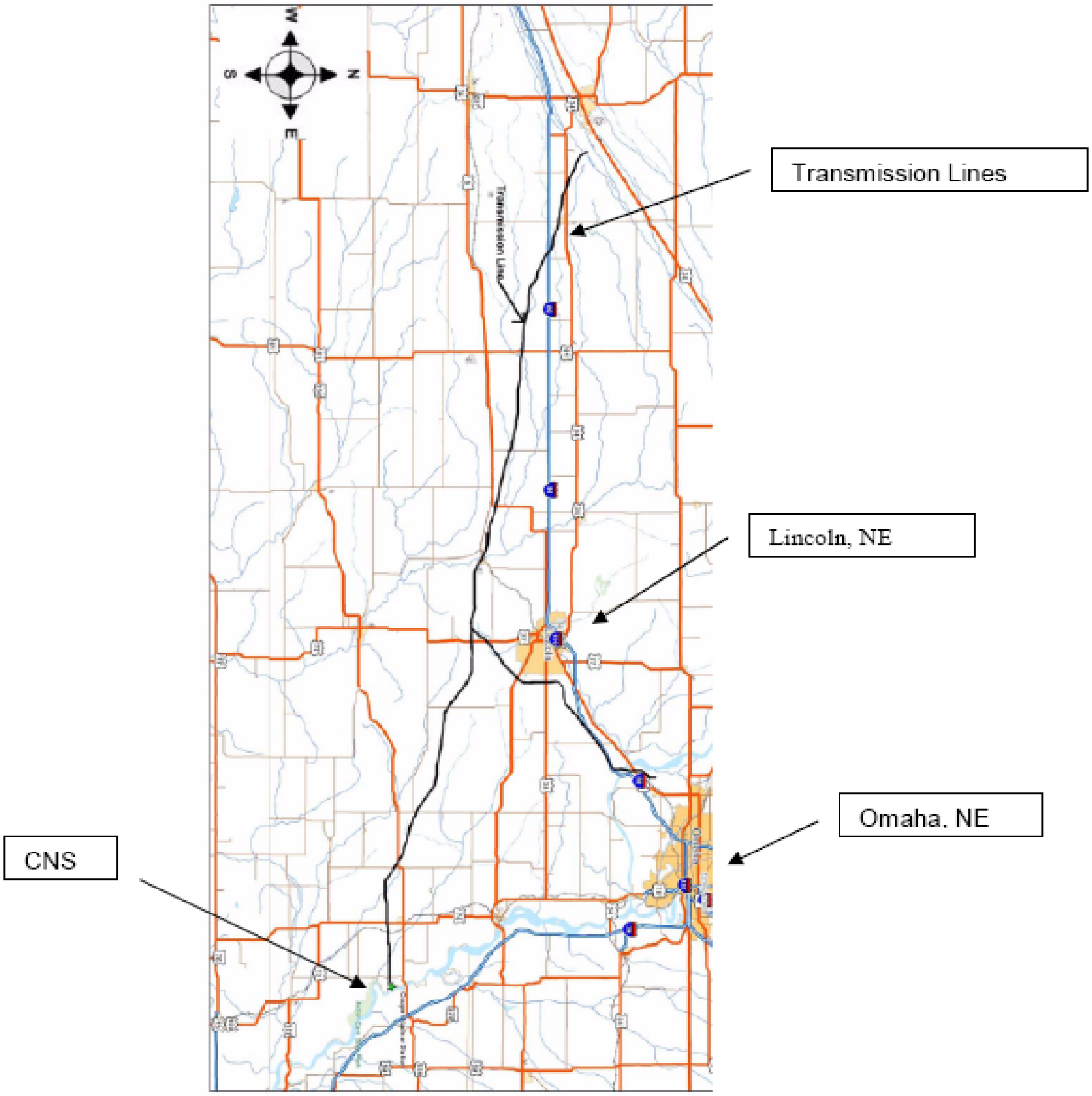
Enclosures:
1. Site Layout
2. Transmission Line Map

cc w/encls: See next page

Cooper Nuclear Station Site Map – 6 Mile Radius

ENCLOSURE 1

1



Cooper Nuclear Station Transmission Lines

ENCLOSURE 2

Emmanuel Sayoc

From: CooperEIS Resource
Sent: Thursday, April 16, 2009 1:39 PM
To: Emmanuel Sayoc
Subject: FW: Scoping Comments for Relicensing of Cooper Nuclear Station, Brownville, NE

-----Original Message-----
From: Shepard.Larry@epamail.epa.gov [mailto:Shepard.Larry@epamail.epa.gov]
Sent: Friday, March 27, 2009 4:59 PM
To: CooperEIS Resource
Cc: Cothern.Joe@epamail.epa.gov; Hooper.CharlesA@epamail.epa.gov; Dunn.John@epamail.epa.gov; Lancaster.Kris@epamail.epa.gov
Subject: Scoping Comments for Relicensing of Cooper Nuclear Station, Brownville, NE

RE: Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Cooper Nuclear Station; Federal Register Volume 74, No. 15, January 26,2009, page 4476.

Thank you for the opportunity to provide scoping comments on the proposed relicensing of Cooper Nuclear Station (CNS), in support of the U.S. Nuclear Regulatory Commission's (NRC) preparation of an Environmental Impact Statement (EIS). EPA reviewed this project in accordance with the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. We request that, in the future, the NRC provide an adequate period of time after conducting site audits for the submission of scoping comments by state or federal agencies. In this instance, scoping comments are to be submitted prior to the NRC site audit for this project.

Pleased consider the following comments during the EIS development process.

Radiation - Given the uncertainty involved with licensing the Yucca Mountain Nevada facility and the extremely long time-frames needed to secure Congressional approval and complete site preparation for any possible alternative permanent site for the disposal of spent nuclear fuel, all utilities planning on extending operation of existing nuclear units should consider contingencies for long-term storage of waste on-site.

Water Quality - The current CNS site has an existing infrastructure, which includes intake and discharge structures. The source of water for the plant is the Missouri River. Potential impacts to plant operation associated with available river flow, particularly during periods of sustained low flow, should be thoroughly described in the draft EIS. The draft EIS should articulate the assurance of a long-term water supply (i.e., greater than 20 years) for the operation of the reactor. This analysis should address contingencies created by changing regional climate and potential future changes in the operation of the river by the Army Corps of Engineers (i.e., flow releases). The current facility is covered by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Nebraska Department of Environmental Quality (NDEQ). New studies and analyses performed in support of the most recent permit application (e.g., thermal and chemical discharges) should be included in the draft EIS. The draft EIS should also completely discuss issues associated with entrainment and impingement of aquatic organisms (i.e., Section 316b of the Clean Water Act) and include alternatives to the present intake design. From a review of the Environmental Report, it is apparent that there is a great deal of information available regarding the impact of plant operation on the river ecosystem. However, we generally caution that these studies are 30 years old and the draft EIS should clearly articulate whether these data are representative of current river condition and ecological impact. We would expect the NRC to provide both its reasoning and data supporting that additional and more recent research is not required to adequately document current impacts.

The draft EIS should thoroughly characterize past contamination associated with the operation of CNS, particularly source and fate of tritium in the system, and document current condition of surface water and groundwater upstream and downstream from the site.

Environmental Management System - The Council on Environmental Quality (CEQ) published "Aligning NEPA processes with Environmental management Systems-A Guide for NEPA and EMS Practitioners" to improve NEPA implementation and environmental sustainability goals in NEPA and Executive Order 13423. The NEPA document should discuss EMS as appropriate.

Larry Shepard
NEPA Team/Interstate Waters
US EPA Region 7
913-551-7441

Richard Bulavinetz

From: Simpson, rachel [rachel.simpson@nebraska.gov]
Sent: Friday, May 08, 2009 4:11 PM
To: Richard Bulavinetz
Subject: RE: Cooper Nuclear Station (CNS) - T & E; & List of Species of Concern
Attachments: NNHP - species by county list for selected Nebraska counties.xls

Dear Mr. Bulavinetz,

Thank you for your inquiry regarding information our program has on species which potentially occur in the following counties: Nemaha County, Johnson County, Gage County, Lancaster County, Saline County, Fillmore County, York County, Hamilton County, and Merrick County.

Attached is the information you requested. Please don't hesitate to contact me if you have any questions about the interpretation of the data or would like additional information.

Sincerely,
Rachel

Rachel Simpson
Data Manager
Nebraska Natural Heritage Program
Nebraska Game and Parks Commission
2200 N. 33rd St.
Lincoln, NE 68503
rachel.simpson@nebraska.gov
402-471-5427

From: Schneider, Rick
Sent: Thursday, April 30, 2009 2:56 PM
To: Simpson, rachel
Cc: Richard.Bulavinetz@nrc.go
Subject: FW: Cooper Nuclear Station (CNS) - T & E; & List of Species of Concern

Rachel,

Could you send Richard a list of species, by county (see list below), for which we have records in the database. For each species, list the federal and state status, Legacy status, and species in need of conservation status. Also, could you include on the list those state or federally listed species which may occur in the county, even though we currently have no records. Richard is with a federal agency so there will be no charge for the data request.
Let me know if you have questions or you could contact Richard.
Thanks.

Rick Schneider
Coordinator/Ecologist
Nebraska Natural Heritage Program
Nebraska Game and Parks Commission
2200 N. 33rd St.
Lincoln, NE 68503

Rick.Schneider@nebraska.gov

402-471-5569 Please note new email address

From: Richard Bulavinetz [Richard.Bulavinetz@nrc.gov]
Sent: Thursday, April 30, 2009 2:40 PM
To: Schneider, Rick
Subject: Cooper Nuclear Station (CNS) - T & E; & List of Species of Concern

Rick:

Per our conversation 2 mins ago - here is my e-mail address.
The counties is question are:

Nemaha County, Johnson County, Gage County, Lancaster County, Saline County, Fillmore County, York County, Hamilton County, and Merrick County

Thanks for your help,

Rich

Richard E. Bulavinetz
Aquatic Ecologist
Nuclear Regulatory Commission
Rockville, MD 20852
301-415-3607
301-415-2002 (fax)
richard.bulavinetz@nrc.gov<mailto:richard.bulavinetz@nrc.gov>

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Species-by-County List for Selected Nebraska Counties
List produced May 8, 2009 by the Nebraska Natural Heritage Program

Source indicates whether the information came from existing records in the Nebraska Natural Heritage Database (source='Heritage DB')
or from the Nebraska Natural Heritage Program's set of range maps for Threatened and Endangered Species (source='Listed Species Range Maps')

Source	COUNTY	SNAME	SCOMNAME	GNAME	GCOMNAME	STATE_STAT	FED_STAT	LGCY_STAT	S_RANK	G_RANK	ELEMENT_TY	CATEGORY
Heritage DB	Fillmore	Botaurus lentiginosus	American Bittern	Botaurus lentiginosus	American Bittern			Tier 2	S4	G4	Vertebrate Animal	A
Heritage DB	Fillmore	Circus cyaneus	Northern Harrier	Circus cyaneus	Northern Harrier			Tier 2	S4	G5	Vertebrate Animal	A
Heritage DB	Fillmore	Cistothorus platensis	Sedge Wren	Cistothorus platensis	Sedge Wren			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Fillmore	Eleocharis wolfii	Wolf Spikerush	Eleocharis wolfii	Wolf's Spikerush			Tier 1	S2	G3G4	Vascular Plant	P
Listed Species Range Maps	Fillmore	Grus americana	Whooping Crane	Grus americana	Whooping Crane	E	E	Tier 1	S1	G1	Vertebrate Animal	A
Heritage DB	Fillmore	Haliaeetus leucocephalus	Bald Eagle	Haliaeetus leucocephalus	Bald Eagle			Tier 1	S3	G5	Vertebrate Animal	A
Heritage DB	Fillmore	Isoetes melanopoda	Quillwort	Isoetes melanopoda	Blackfoot Quillwort			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Fillmore	Ixobrychus exilis	Least Bittern	Ixobrychus exilis	Least Bittern			Tier 2	S4	G5	Vertebrate Animal	A
Heritage DB	Fillmore	Noturus gyrinus	Tadpole Madtom	Noturus gyrinus	Tadpole Madtom			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Fillmore	Nycticorax nycticorax	Black-crowned Night-heron	Nycticorax nycticorax	Black-crowned Night-Heron			Tier 2	S3	G5	Vertebrate Animal	A
Listed Species Range Maps	Fillmore	Platanthera praeclara	Western Prairie Fringed Orchid	Platanthera praeclara	Western Prairie White-fringed C	T	T	Tier 1	S2	G2	Vascular Plant	P
Heritage DB	Fillmore	Rallus elegans	King Rail	Rallus elegans	King Rail			Tier 1	S1	G4	Vertebrate Animal	A
Heritage DB	Fillmore	Scirpus heterochaetus	Slender Bulrush	Schoenoplectus heterochaetus	Slender Bulrush				S4	G5	Vascular Plant	P
Heritage DB	Fillmore	Scirpus saximontanus	Rocky Mountain Bulrush	Schoenoplectus saximontanus	Rocky Mountain Bulrush			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Fillmore	Sistrurus catenatus	Massasauga	Sistrurus catenatus	Massasauga	T		Tier 1	S1	G3G4	Vertebrate Animal	A
Heritage DB	Gage	Agkistrodon contortrix	Copperhead	Agkistrodon contortrix	Copperhead	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Gage	Bidens polylepis	Coreopsis Beggar-tick	Bidens polylepis	Awnless Beggar-ticks			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Gage	Carex bushii	Bush's Sedge	Carex bushii	Bush's Sedge			Tier 2	S1S2	G4	Vascular Plant	P
Heritage DB	Gage	Carex frankii	Frank's Sedge	Carex frankii	Frank's Sedge			Tier 2	S1S2	G5	Vascular Plant	P
Heritage DB	Gage	Carex leavenworthii	Lawn Sedge	Carex leavenworthii	Leavenworth's Sedge				S5	G5	Vascular Plant	P
Heritage DB	Gage	Crotalus horridus	Timber Rattlesnake	Crotalus horridus	Timber Rattlesnake	NC		Tier 1	S1	G4	Vertebrate Animal	A
Heritage DB	Gage	Croton capitatus var. capitatus	Woolly Croton	Croton capitatus var. capitatus	Hogwort				S4?	G5T5?	Vascular Plant	P
Heritage DB	Gage	Etheostoma nigrum	Johnny Darter	Etheostoma nigrum	Johnny Darter			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Gage	Etheostoma spectabile	Orangethroat Darter	Etheostoma spectabile	Orangethroat Darter			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Gage	Eumeces obsoletus	Great Plains Skink	Eumeces obsoletus	Great Plains Skink	NC		Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Gage	Gastrophryne olivacea	Great Plains Narrowmouth Toad	Gastrophryne olivacea	Great Plains Narrowmouth Toa	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Gage	Haliaeetus leucocephalus	Bald Eagle	Haliaeetus leucocephalus	Bald Eagle			Tier 1	S3	G5	Vertebrate Animal	A
Heritage DB	Gage	Hieracium longipilum	Longbeard Hawkweed	Hieracium longipilum	Hairy Hawkweed				S4	G4G5	Vascular Plant	P
Heritage DB	Gage	Lampropeltis calligaster	Prairie Kingsnake	Lampropeltis calligaster	Yellow-bellied Kingsnake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Gage	Ligumia subrostrata	Pondmussel	Ligumia subrostrata	Pondmussel			Tier 1	S1	G5	Invertebrate Animal	A
Heritage DB	Gage	Neotoma floridana	Eastern Woodrat	Neotoma floridana	Eastern Woodrat			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Gage	Noturus gyrinus	Tadpole Madtom	Noturus gyrinus	Tadpole Madtom			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Gage	Pellaea atropurpurea	Purple Cliff Brake	Pellaea atropurpurea	Purple-stem Cliffbrake			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Gage	Penstemon cobaea	Cobaea Penstemon	Penstemon cobaea	Cobaea Beardtongue				S3?	G4	Vascular Plant	P
Listed Species Range Maps	Gage	Platanthera praeclara	Western Prairie Fringed Orchid	Platanthera praeclara	Western Prairie White-fringed C	T	T	Tier 1	S2	G2	Vascular Plant	P
Heritage DB	Gage	Regina grahamii	Graham's Crayfish Snake	Regina grahamii	Graham's Crayfish Snake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Gage	Sistrurus catenatus	Massasauga	Sistrurus catenatus	Massasauga	T		Tier 1	S1	G3G4	Vertebrate Animal	A
Heritage DB	Gage	Sparganium chlorocarpum	Simple-stem Bur-reed	Sparganium chlorocarpum	Greenfruit Bur-reed			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Gage	Spilogale putorius	Eastern Spotted Skunk	Spilogale putorius	Eastern Spotted Skunk			Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Gage	Trifolium reflexum	Buffalo Clover	Trifolium reflexum	Buffalo Clover				S1	G3G4	Vascular Plant	P
Heritage DB	Hamilton	Charadrius melodus	Piping Plover	Charadrius melodus	Piping Plover	T	T	Tier 1	S2	G3	Vertebrate Animal	A
Heritage DB	Hamilton	Cistothorus platensis	Sedge Wren	Cistothorus platensis	Sedge Wren			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Culaea inconstans	Brook Stickleback	Culaea inconstans	Brook Stickleback			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Cypripedium candidum	Small White Lady's-slipper	Cypripedium candidum	Small White Lady's-slipper	T		Tier 1	S1	G4	Vascular Plant	P
Heritage DB	Hamilton	Eleocharis wolfii	Wolf Spikerush	Eleocharis wolfii	Wolf's Spikerush			Tier 1	S2	G3G4	Vascular Plant	P
Heritage DB	Hamilton	Etheostoma nigrum	Johnny Darter	Etheostoma nigrum	Johnny Darter			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Etheostoma spectabile	Orangethroat Darter	Etheostoma spectabile	Orangethroat Darter			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Falco peregrinus	Peregrine Falcon	Falco peregrinus	Peregrine Falcon			Tier 2	S1	G4	Vertebrate Animal	A
Heritage DB	Hamilton	Fundulus sciadicus	Plains Topminnow	Fundulus sciadicus	Plains Topminnow			Tier 1	S2	G4	Vertebrate Animal	A
Heritage DB	Hamilton	Grus americana	Whooping Crane	Grus americana	Whooping Crane	E	E	Tier 1	S1	G1	Vertebrate Animal	A
Heritage DB	Hamilton	Isoetes melanopoda	Quillwort	Isoetes melanopoda	Blackfoot Quillwort			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Hamilton	Lutra canadensis	River Otter	Lontra canadensis	North American River Otter	T		Tier 1	S2	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Macrhybopsis gelida	Sturgeon Chub	Macrhybopsis gelida	Sturgeon Chub	E		Tier 1	S1	G3	Vertebrate Animal	A
Heritage DB	Hamilton	Noturus gyrinus	Tadpole Madtom	Noturus gyrinus	Tadpole Madtom			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Nycticorax nycticorax	Black-crowned Night-heron	Nycticorax nycticorax	Black-crowned Night-Heron			Tier 2	S3	G5	Vertebrate Animal	A
Listed Species Range Maps	Hamilton	Platanthera praeclara	Western Prairie Fringed Orchid	Platanthera praeclara	Western Prairie White-fringed C	T	T	Tier 1	S2	G2	Vascular Plant	P
Heritage DB	Hamilton	Spilogale putorius	Eastern Spotted Skunk	Spilogale putorius	Eastern Spotted Skunk			Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Hamilton	Sterna antillarum athalassos	Interior Least Tern	Sternula antillarum athalassos	Interior Least Tern	E	E	Tier 1	S2	G4T2Q	Vertebrate Animal	A
Heritage DB	Johnson	Aesculus glabra var. arguta	Western Buckeye	Aesculus glabra var. arguta	Ohio Buckeye			Tier 2	S1S2	G5T4?Q	Vascular Plant	P
Heritage DB	Johnson	Ammodramus henslowii	Henslow's Sparrow	Ammodramus henslowii	Henslow's Sparrow			Tier 1	S2	G4	Vertebrate Animal	A
Heritage DB	Johnson	Arnoglossum atriplicifolium	Pale Indian-plantain	Arnoglossum atriplicifolium	Pale Indian-plantain			Tier 2	S2	G4G5	Vascular Plant	P

Heritage DB	Johnson	Asclepias amplexicaulis	Clasping-leaf Milkweed	Asclepias amplexicaulis	Clasping Milkweed			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Johnson	Asclepias viridis	Spider Milkweed	Asclepias viridis	Spider Milkweed				S5	G4G5	Vascular Plant	P
Heritage DB	Johnson	Asimina triloba	Pawpaw	Asimina triloba	Pawpaw				S4?	G5	Vascular Plant	P
Heritage DB	Johnson	Cistothorus platensis	Sedge Wren	Cistothorus platensis	Sedge Wren			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Johnson	Dasistoma macrophylla	Mullein Foxglove	Dasistoma macrophylla	Mullein Foxglove			Tier 2	S1	G4	Vascular Plant	P
Heritage DB	Johnson	Desmodium cuspidatum	Largebract Ticktrefoil	Desmodium cuspidatum	Toothed Tick-trefoil				S2?	G5	Vascular Plant	P
Heritage DB	Johnson	Dracocephalum parviflorum	American Dragonhead	Dracocephalum parviflorum	American Dragonhead				S1	G5	Vascular Plant	P
Heritage DB	Johnson	Etheostoma nigrum	Johnny Darter	Etheostoma nigrum	Johnny Darter			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Johnson	Lampropeltis calligaster	Prairie Kingsnake	Lampropeltis calligaster	Yellow-bellied Kingsnake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Johnson	Lampropeltis getula	Common Kingsnake	Lampropeltis getula	Common Kingsnake	NC		Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Johnson	Liatris squarrosa var. hirsuta	Plains Gayfeather	Liatris squarrosa var. hirsuta	Glades Gayfeather			Tier 2	S1?	G5T4?	Vascular Plant	P
Heritage DB	Johnson	Lilium michiganense	Turk's Cap Lily	Lilium michiganense	Michigan Lily			Tier 2	S3?	G5	Vascular Plant	P
Heritage DB	Johnson	Melica nitens	Tall Melic	Melica nitens	Three-flower Meliograss			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Johnson	Ophisaurus attenuatus	Slender Glass Lizard	Ophisaurus attenuatus	Slender Glass Lizard	NC			S1	G5	Vertebrate Animal	A
Heritage DB	Johnson	Penstemon tubaeflorus	Funnel-form Penstemon	Penstemon tubiflorus	White-wand Beardtongue				S1	G5	Vascular Plant	P
Heritage DB	Johnson	Phenacobius mirabilis	Suckermouth Minnow	Phenacobius mirabilis	Suckermouth Minnow				S4	G5	Vertebrate Animal	A
Listed Species Range Maps	Johnson	Platanthera praeclara	Western Prairie Fringed Orchid	Platanthera praeclara	Western Prairie White-fringed C	T	T	Tier 1	S2	G2	Vascular Plant	P
Heritage DB	Johnson	Senna marilandica	Wild Senna	Senna marilandica	Maryland Senna			Tier 2	S1S2	G5	Vascular Plant	P
Listed Species Range Maps	Johnson	Sistrurus catenatus	Massasauga	Sistrurus catenatus	Massasauga		T	Tier 1	S1	G3G4	Vertebrate Animal	A
Heritage DB	Johnson	Triodanis biflora	Small Venus'-looking-glass	Triodanis perfoliata var. biflora	Claspingleaf Venus'-looking-glass			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Johnson	Veronicastrum virginicum	Culver's-root	Veronicastrum virginicum	Culver's-root			Tier 2	S1	G4	Vascular Plant	P
Heritage DB	Lancaster	Agalinis skinneriana	Pale False Foxglove	Agalinis skinneriana	Pale False Foxglove				SNA	G3G4	Vascular Plant	P
Heritage DB	Lancaster	Ammodramus henslowii	Henslow's Sparrow	Ammodramus henslowii	Henslow's Sparrow			Tier 1	S2	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Arabis shortii	Short's Rockcress	Arabis shortii	Short's Rockcress			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Lancaster	Ardea herodias	Great Blue Heron	Ardea herodias	Great Blue Heron				S4	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Arisaema dracontium	Green Dragon	Arisaema dracontium	Green Dragon			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Lancaster	Asclepias viridis	Spider Milkweed	Asclepias viridis	Spider Milkweed				S5	G4G5	Vascular Plant	P
Heritage DB	Lancaster	Aster subulatus var. ligulatus	Saltmarsh Aster	Symphyotrichum divaricatum	Saltmarsh Aster			Tier 2	S4?	G5T5	Vascular Plant	P
Heritage DB	Lancaster	Atrytone arogos iowa	Iowa Skipper	Atrytone arogos iowa	Iowa Skipper			Tier 1	S1	G3T3	Invertebrate Animal	A
Heritage DB	Lancaster	Blephilia hirsuta	Wood-mint	Blephilia hirsuta	Hairy Woodmint			Tier 2	S1	G5?	Vascular Plant	P
Heritage DB	Lancaster	Botaurus lentiginosus	American Bittern	Botaurus lentiginosus	American Bittern			Tier 2	S4	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Carex crus-corvi	Raven's Foot Sedge	Carex crus-corvi	Ravenfoot Sedge				S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Carex squarrosa	Squarrose Sedge	Carex squarrosa	Squarrose Sedge				SNA	G4G5	Vascular Plant	P
Heritage DB	Lancaster	Cicindela nevadica lincolniana	A Tiger Beetle	Cicindela nevadica lincolniana	Salt Creek Tiger Beetle	E	E	Tier 1	S1	G5T1	Invertebrate Animal	A
Heritage DB	Lancaster	Cicindela togata	A Tiger Beetle	Cicindela togata	White-cloaked Tiger Beetle			Tier 2	S1	G5	Invertebrate Animal	A
Heritage DB	Lancaster	Cistothorus platensis	Sedge Wren	Cistothorus platensis	Sedge Wren			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Colinus virginianus	Northern Bobwhite	Colinus virginianus	Northern Bobwhite			Tier 2	S5	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Corydalis aurea	Golden Corydalis	Corydalis aurea	Golden Corydalis			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Croton capitatus var. capitatus	Woolly Croton	Croton capitatus var. capitatus	Hogwort				S4?	G5T5?	Vascular Plant	P
Heritage DB	Lancaster	Culaea inconstans	Brook Stickleback	Culaea inconstans	Brook Stickleback			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Cygnus buccinator	Trumpeter Swan	Cygnus buccinator	Trumpeter Swan			Tier 1	S3	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Cypripedium candidum	Small White Lady's-slipper	Cypripedium candidum	Small White Lady's-slipper	T		Tier 1	S1	G4	Vascular Plant	P
Heritage DB	Lancaster	Dracocephalum parviflorum	American Dragonhead	Dracocephalum parviflorum	American Dragonhead				S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Eragrostis reptans	Hairy Creeping Lovegrass	Neeragrostis reptans	Hairy Creeping Lovegrass				S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Erysimum inconspicuum	Small Wallflower	Erysimum inconspicuum	Small-flower Prairie Wallflower			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Lancaster	Erythronium mesochoreum	Prairie Dog-tooth-violet	Erythronium mesochoreum	Midland Fawnlily			Tier 2	S2	G4G5	Vascular Plant	P
Heritage DB	Lancaster	Eupatorium serotinum	Late Boneset	Eupatorium serotinum	Late-flowering Throughwort				S5?	G5	Vascular Plant	P
Heritage DB	Lancaster	Falco peregrinus	Peregrine Falcon	Falco peregrinus	Peregrine Falcon			Tier 2	S1	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Gallinago delicata	Wilson's Snipe	Gallinago delicata	Wilson's Snipe			Tier 2	S4	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Haliaeetus leucocephalus	Bald Eagle	Haliaeetus leucocephalus	Bald Eagle			Tier 1	S3	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Heliotropium curassavicum var. c	Seaside Heliotrope	Heliotropium curassavicum var. curassavicum				Tier 2	S1	GNR	Vascular Plant	P
Heritage DB	Lancaster	Hieracium longipilum	Longbeard Hawkweed	Hieracium longipilum	Hairy Hawkweed				S4	G4G5	Vascular Plant	P
Heritage DB	Lancaster	Ixobrychus exilis	Least Bittern	Ixobrychus exilis	Least Bittern			Tier 2	S4	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Lampropeltis calligaster	Prairie Kingsnake	Lampropeltis calligaster	Yellow-bellied Kingsnake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Lampropeltis getula	Common Kingsnake	Lampropeltis getula	Common Kingsnake	NC		Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Lanius ludovicianus	Loggerhead Shrike	Lanius ludovicianus	Loggerhead Shrike				S5	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Laterallus jamaicensis	Black Rail	Laterallus jamaicensis	Black Rail			Tier 2	S1	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Ligumia subrostrata	Pondmussel	Ligumia subrostrata	Pondmussel			Tier 1	S1	G5	Invertebrate Animal	A
Heritage DB	Lancaster	Mustela nivalis	Least Weasel	Mustela nivalis	Least Weasel				S5	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Myriophyllum pinnatum	Cutleaf Water Milfoil	Myriophyllum pinnatum	Cutleaf Water-milfoil				S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Nicrophorus americanus	American Burying Beetle	Nicrophorus americanus	American Burying Beetle	E	E	Tier 1	S1	G2G3	Invertebrate Animal	A
Heritage DB	Lancaster	Notropis heterolepis	Blacknose Shiner	Notropis heterolepis	Blacknose Shiner	E		Tier 1	S1	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Notropis topeka	Topeka Shiner	Notropis topeka	Topeka Shiner	E	E	Tier 1	S1	G3	Vertebrate Animal	A
Heritage DB	Lancaster	Nuphar variegata	Yellow pond-lily	Nuphar variegata				Tier 2	S2	GNR	Vascular Plant	P
Heritage DB	Lancaster	Nymphaea odorata	White Water-lily	Nymphaea odorata	American Water-lily			Tier 2	S2?	G5	Vascular Plant	P
Heritage DB	Lancaster	Orobanche uniflora	One-flower Broomrape	Orobanche uniflora	One-flowered Broomrape			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Penstemon cobaea	Cobaea Penstemon	Penstemon cobaea	Cobaea Beardtongue				S3?	G4	Vascular Plant	P
Heritage DB	Lancaster	Pimephales notatus	Bluntnose Minnow	Pimephales notatus	Bluntnose Minnow			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Plantago elongata	Slender Plantain	Plantago elongata	Slender Plantain				S3	G4	Vascular Plant	P
Heritage DB	Lancaster	Platanthera praeclara	Western Prairie Fringed Orchid	Platanthera praeclara	Western Prairie White-fringed C	T	T	Tier 1	S3	G3	Vascular Plant	P

Heritage DB	Lancaster	Polioptila caerulea	Blue-gray Gnatcatcher	Polioptila caerulea	Blue-gray Gnatcatcher			Tier 2	S4	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Potamogeton diversifolius	Water-thread Pondweed	Potamogeton diversifolius	Water-thread Pondweed			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Lancaster	Rallus elegans	King Rail	Rallus elegans	King Rail			Tier 1	S1	G4	Vertebrate Animal	A
Heritage DB	Lancaster	Regina grahamii	Graham's Crayfish Snake	Regina grahamii	Graham's Crayfish Snake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Sagittaria rigida	Stiff Arrowhead	Sagittaria rigida	Sessile-fruit Arrowhead			Tier 2	S3	G5	Vascular Plant	P
Heritage DB	Lancaster	Salicornia rubra	Saltwort	Salicornia rubra	Western Glasswort	E		Tier 1	S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Senna marilandica	Wild Senna	Senna marilandica	Maryland Senna			Tier 2	S1S2	G5	Vascular Plant	P
Heritage DB	Lancaster	Sistrurus catenatus	Massasauga	Sistrurus catenatus	Massasauga	T		Tier 1	S1	G3G4	Vertebrate Animal	A
Heritage DB	Lancaster	Spilogale putorius	Eastern Spotted Skunk	Spilogale putorius	Eastern Spotted Skunk			Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Spiranthes vernalis	Early Ladies'-tresses	Spiranthes vernalis	Twisted Ladies'-tresses			Tier 2	S2?	G5	Vascular Plant	P
Heritage DB	Lancaster	Sporobolus texanus	Texas Dropseed	Sporobolus texanus	Texas Dropseed			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Strix varia	Barred Owl	Strix varia	Barred Owl			Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Sturnella magna	Eastern Meadowlark	Sturnella magna	Eastern Meadowlark			Tier 2	S5	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Thamnophis proximus	Western Ribbon Snake	Thamnophis proximus	Western Ribbonsnake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Lancaster	Trifolium reflexum	Buffalo Clover	Trifolium reflexum	Buffalo Clover				S1	G3G4	Vascular Plant	P
Heritage DB	Lancaster	Typha domingensis	Southern Cattail	Typha domingensis	Southern Cattail				SNA	G4G5	Vascular Plant	P
Heritage DB	Lancaster	Verbena simplex	Narrowleaf Vervain	Verbena simplex	Narrowleaf Vervain			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Lancaster	Vireo bellii	Bell's Vireo	Vireo bellii	Bell's Vireo			Tier 1	S5	G5	Vertebrate Animal	A
Heritage DB	Merrick	Agalinis purpurea	Purple False Foxglove	Agalinis purpurea	Large-purple False Foxglove			Tier 2	S1?	G5	Vascular Plant	P
Heritage DB	Merrick	Charadrius melodus	Piping Plover	Charadrius melodus	Piping Plover	T	T	Tier 1	S2	G3	Vertebrate Animal	A
Heritage DB	Merrick	Culaea inconstans	Brook Stickleback	Culaea inconstans	Brook Stickleback			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Merrick	Cypripedium candidum	Small White Lady's-slipper	Cypripedium candidum	Small White Lady's-slipper	T		Tier 1	S1	G4	Vascular Plant	P
Heritage DB	Merrick	Eleocharis atropurpurea	Purple Spikerush	Eleocharis atropurpurea	Purple Spikerush			Tier 2	S1	G4G5	Vascular Plant	P
Heritage DB	Merrick	Falco peregrinus	Peregrine Falcon	Falco peregrinus	Peregrine Falcon			Tier 2	S1	G4	Vertebrate Animal	A
Heritage DB	Merrick	Fundulus sciadicus	Plains Topminnow	Fundulus sciadicus	Plains Topminnow			Tier 1	S2	G4	Vertebrate Animal	A
Heritage DB	Merrick	Grus americana	Whooping Crane	Grus americana	Whooping Crane	E	E	Tier 1	S1	G1	Vertebrate Animal	A
Heritage DB	Merrick	Haliaeetus leucocephalus	Bald Eagle	Haliaeetus leucocephalus	Bald Eagle			Tier 1	S3	G5	Vertebrate Animal	A
Heritage DB	Merrick	Helianthemum bicknellii	Frostweed	Helianthemum bicknellii	Plains Frostweed			Tier 2	S1S2	G5	Vascular Plant	P
Heritage DB	Merrick	Ironoquia plattensis	Platte River Caddisfly	Ironoquia plattensis	A Caddisfly			Tier 1	SNR	G1G2	Invertebrate Animal	A
Heritage DB	Merrick	Leucospora multifida	Narrowleaf Paleseed	Leucospora multifida	Narrowleaf Paleseed			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Merrick	Liochlorophis vernalis	Smooth Green Snake	Liochlorophis vernalis	Smooth Green Snake	NC		Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Merrick	Lutra canadensis	River Otter	Lontra canadensis	North American River Otter	T		Tier 1	S2	G5	Vertebrate Animal	A
Heritage DB	Merrick	Macrhybopsis gelida	Sturgeon Chub	Macrhybopsis gelida	Sturgeon Chub	E		Tier 1	S1	G3	Vertebrate Animal	A
Heritage DB	Merrick	Margariscus margarita	Pearl Dace	Margariscus margarita	Pearl Dace			Tier 1	S2	G5	Vertebrate Animal	A
Heritage DB	Merrick	Numenius borealis	Eskimo Curlew	Numenius borealis	Eskimo Curlew	E	E		SX	GH	Vertebrate Animal	A
Heritage DB	Merrick	Phoxinus neogaeus	Finescale Dace	Phoxinus neogaeus	Finescale Dace	T		Tier 1	S2	G5	Vertebrate Animal	A
Heritage DB	Merrick	Pimephales notatus	Bluntnose Minnow	Pimephales notatus	Bluntnose Minnow			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Merrick	Plantago elongata	Slender Plaintain	Plantago elongata	Slender Plantain				S3	G4	Vascular Plant	P
Listed Species Range Maps	Merrick	Platanthera praeclara	Western Prairie Fringed Orchid	Platanthera praeclara	Western Prairie White-fringed C	T	T	Tier 1	S2	G2	Vascular Plant	P
Heritage DB	Merrick	Speyeria idalia	Regal Fritillary	Speyeria idalia	Regal Fritillary			Tier 1	S3	G3	Invertebrate Animal	A
Heritage DB	Merrick	Sterna antillarum athalassos	Interior Least Tern	Sternula antillarum athalassos	Interior Least Tern	E	E	Tier 1	S2	G4T2Q	Vertebrate Animal	A
Heritage DB	Nemaha	Acipenser fulvescens	Lake Sturgeon	Acipenser fulvescens	Lake Sturgeon	T		Tier 1	S1	G3G4	Vertebrate Animal	A
Heritage DB	Nemaha	Ambystoma texanum	Smallmouth Salamander	Ambystoma texanum	Smallmouth Salamander	NC		Tier 2	S1	G5	Vertebrate Animal	A
Heritage DB	Nemaha	Amelanchier arborea	Juneberry	Amelanchier arborea	Downy Serviceberry				S3?	G5	Vascular Plant	P
Heritage DB	Nemaha	Ampelopsis cordata	Raccoon Grape	Ampelopsis cordata	Heartleaf Peppervine				S3?	G5	Vascular Plant	P
Heritage DB	Nemaha	Anagallis minima	Chaffweed	Anagallis minima	Chaffweed			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Arabis canadensis	Sicklepod	Arabis canadensis	Sicklepod				S4?	G5	Vascular Plant	P
Heritage DB	Nemaha	Aralia racemosa	Spikenard	Aralia racemosa	American Spikenard			Tier 2	S1	G4G5	Vascular Plant	P
Heritage DB	Nemaha	Amoglossum atriplicifolium	Pale Indian-plantain	Amoglossum atriplicifolium	Pale Indian-plantain			Tier 2	S2	G4G5	Vascular Plant	P
Heritage DB	Nemaha	Asclepias amplexicaulis	Clasping-leaf Milkweed	Asclepias amplexicaulis	Clasping Milkweed			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Asclepias purpurascens	Purple Milkweed	Asclepias purpurascens	Purple Milkweed			Tier 2	S1	G5?	Vascular Plant	P
Heritage DB	Nemaha	Asimina triloba	Pawpaw	Asimina triloba	Pawpaw				S4?	G5	Vascular Plant	P
Heritage DB	Nemaha	Bidens polylepis	Coreopsis Beggar-tick	Bidens polylepis	Awnless Beggar-ticks			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Nemaha	Bonasa umbellus	Ruffed Grouse	Bonasa umbellus	Ruffed Grouse				SX	G5	Vertebrate Animal	A
Heritage DB	Nemaha	Brachyelytrum erectum	Bearded Wood Grass	Brachyelytrum erectum	Bearded Shorthusk			Tier 2	S2	G5	Vascular Plant	P
Heritage DB	Nemaha	Caprimulgus vociferus	Whip-poor-will	Caprimulgus vociferus	Whip-poor-will			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Nemaha	Cardamine concatenata	Cutleaf Toothwort	Cardamine concatenata	Cutleaf Toothwort			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Carex crus-corvi	Raven's Foot Sedge	Carex crus-corvi	Ravenfoot Sedge				S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Carex frankii	Frank's Sedge	Carex frankii	Frank's Sedge			Tier 2	S1S2	G5	Vascular Plant	P
Heritage DB	Nemaha	Carex jamesii	Grass Sedge	Carex jamesii	Nebraska Sedge				S5?	G5	Vascular Plant	P
Heritage DB	Nemaha	Carphophis vermis	Worm Snake	Carphophis vermis	Western Wormsnake	NC		Tier 2	S2	G5	Vertebrate Animal	A
Heritage DB	Nemaha	Cistothorus platensis	Sedge Wren	Cistothorus platensis	Sedge Wren			Tier 2	S3	G5	Vertebrate Animal	A
Heritage DB	Nemaha	Coeloglossum viride	Long-Bract Green Orchid	Coeloglossum viride	Long-bract Green Orchis			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Corallorhiza wisteriana	Spring Coral-root	Corallorhiza wisteriana	Spring Coralroot			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Cornus racemosa	Gray Dogwood	Cornus racemosa	Gray Dogwood				S1	G5?	Vascular Plant	P
Heritage DB	Nemaha	Croton glandulosus var. septentric	Sand Croton	Croton glandulosus var. septentric	Northern Croton				S4?	G5T5	Vascular Plant	P
Heritage DB	Nemaha	Cycleptus elongatus	Blue Sucker	Cycleptus elongatus	Blue Sucker			Tier 1	S1	G3G4	Vertebrate Animal	A
Heritage DB	Nemaha	Cypripedium parviflorum	Yellow Lady's-slipper	Cypripedium calceolus	Yellow Lady's-slipper			Tier 2	S1	G5	Vascular Plant	P
Heritage DB	Nemaha	Dasistoma macrophylla	Mullein Foxglove	Dasistoma macrophylla	Mullein Foxglove			Tier 2	S1	G4	Vascular Plant	P
Heritage DB	Nemaha	Dracocephalum parviflorum	American Dragonhead	Dracocephalum parviflorum	American Dragonhead				S1	G5	Vascular Plant	P

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Nebraska Field Office
203 West Second Street
Grand Island, Nebraska 68801

June 8, 2009

Mr. Joe Citta
Corporate Environmental Manager
Nebraska Public Power District
1414 15th Street; PO Box 499
Columbus, NE 68602-0499

Dear Mr. Citta:

Please make reference to your letter dated May 8, 2009, in regards to marking a transmission line that crosses the central Platte River downstream of the Highway 34 Bridge, east of Grand Island, Nebraska. The transmission line is associated with the Cooper Nuclear Station (CNS) and the currently ongoing relicensing process. A site visit of the transmission line was conducted by representatives of the Nebraska Public Power District (NPPD) and the U.S. Fish and Wildlife Service on April 20, 2009.

We have completed a review of the NPPD proposal to mark the power line to address potential collisions by migratory birds and have determined that it is satisfactory. Additionally, we commend NPPD for its willingness to mark an additional transmission line in the immediate vicinity of the aforementioned line that could also pose a risk to migratory birds, but has no relationship to the CNS relicensing process. The proposed actions by NPPD address any concerns we have with the CNS 345kV transmission line.

We remain supportive of the relicensing application. If you have any questions or need additional information please contact Mr. Robert Harms at (308) 382-6468, extension 17.

Sincerely,

June M DeWeese

June M. DeWeese
Nebraska Field Supervisor

cc: NGPC; Lincoln, NE (Attn: Frank Albrecht)
NGPC; Lincoln, NE (Attn: Gene Zuerlein)
NGPC; Lincoln, NE (Attn: Scott Luedtke)
NGPC; Lincoln, NE (Attn: Michelle Koch)

APPENDIX D.2 BIOLOGICAL ASSESSMENT COOPER NUCLEAR STATION LICENSE RENEWAL DATE 2009 DOCKET NO. 50-298 U.S. NUCLEAR REGULATORY COMMISSION ROCKVILLE, MARYLAND

D.2 BIOLOGICAL ASSESSMENT OF THE POTENTIAL EFFECTS ON FEDERALLY LISTED ENDANGERED OR THREATENED SPECIES FROM THE PROPOSED LICENSE RENEWAL FOR COOPER NUCLEAR STATION

D.2.1 INTRODUCTION AND PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) prepared this biological assessment (BA) to support the draft supplemental environmental impact statement (SEIS) for the renewal of the operating licenses for Cooper Nuclear Station Unit 1 (CNS-1), located on the western shore of the Missouri River near the Village of Brownville, Nemaha County, Nebraska. The current 40-year license expires in 2014. The proposed license renewal for which this BA has been prepared would extend the operating licenses to 2034.

The NRC is required to prepare the draft SEIS as part of its review of a license renewal application. The draft SEIS supplements NUREG-1437, Volumes 1 and 2, *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*, (NRC 1996, 1999)[a] for the license renewal of commercial nuclear power plants. The draft SEIS covers specific issues, such as the potential impact on endangered and threatened species, that are of concern at CNS-1 and that NRC could not address generically in the GEIS.

Pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1536(a)-(d)), the NRC staff requested, in a letter dated January 29, 2009 (NRC, 2009), that the U.S. Fish and Wildlife Service (USFWS) provide information on Federally listed endangered or threatened species, as well as on proposed or candidate species, and on any designated critical habitats that may occur in the vicinity of CNS-1. Under Section 7, the NRC is responsible for providing information on the potential impact that the continued operation of CNS-1 could have on the Federally listed species, the pallid sturgeon.

D.2.2 PROPOSED ACTION

The proposed action considered in the SEIS is the renewal of the CNS-1 operating license for an additional 20-year term beyond the period of the existing licenses. If the NRC grants the operating license renewal, the applicant can operate and maintain the nuclear unit, the cooling system, and the transmission lines and corridors as they are now until 2034.

D.2.3 SITE DESCRIPTION

CNS-1 is located in Nemaha County, Nebraska 2.25 miles (3.6 km) southeast of Brownville, Nebraska and approximately 60 miles (96 km) southeast of Lincoln, Nebraska. CNS-1 property is bounded on the east by the Missouri River and by non-Nebraska Public Power District (NPPD) owned property on the north, south, and west. Figure 3-1 shows a map of a 50-mile (80-km) radius around CNS-1. Figure 3-2 shows the area within a 6-mile (9.6-km) radius of CNS-1. NPPD owns and operates the site. The structures for CNS-1 span approximately 55 acres (22 ha) of the site's total area of approximately 1,359 acres (550 ha), including 239 acres (97 ha) on the opposite bank (east) of the Missouri River in Atchison County, Missouri. Over 99 percent of the acreage in Nemaha County is used for agriculture and farming. NPPD currently

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[a] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

leases 234 acres (947 ha) of the property in Missouri and 715 acres (289 ha) in Nebraska for agricultural activities such as farming and livestock.

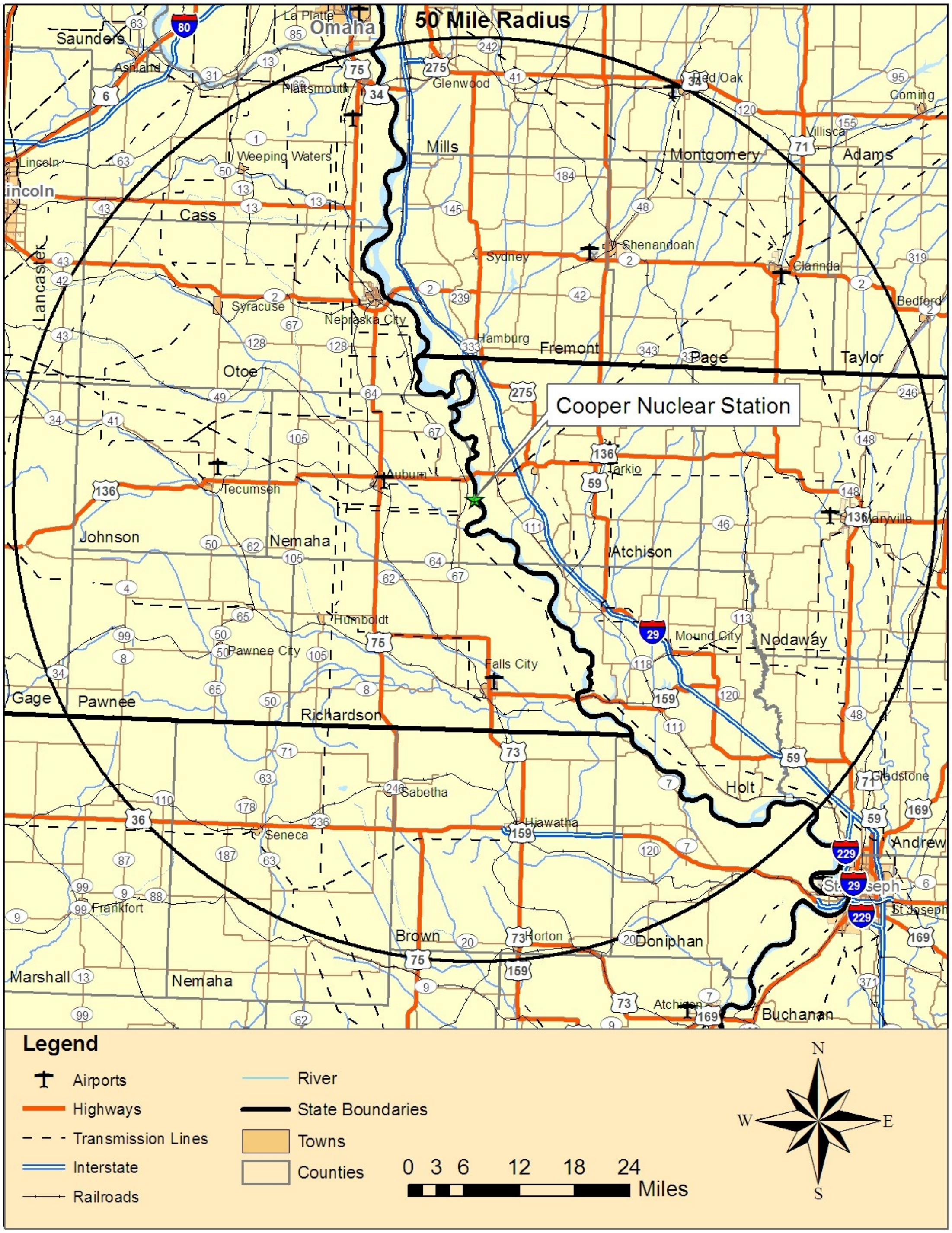

Figure 3-1. Location of Cooper Nuclear Station Unit 1, 50-mile (80-km) Region
(Source: NPPD, 2008b)

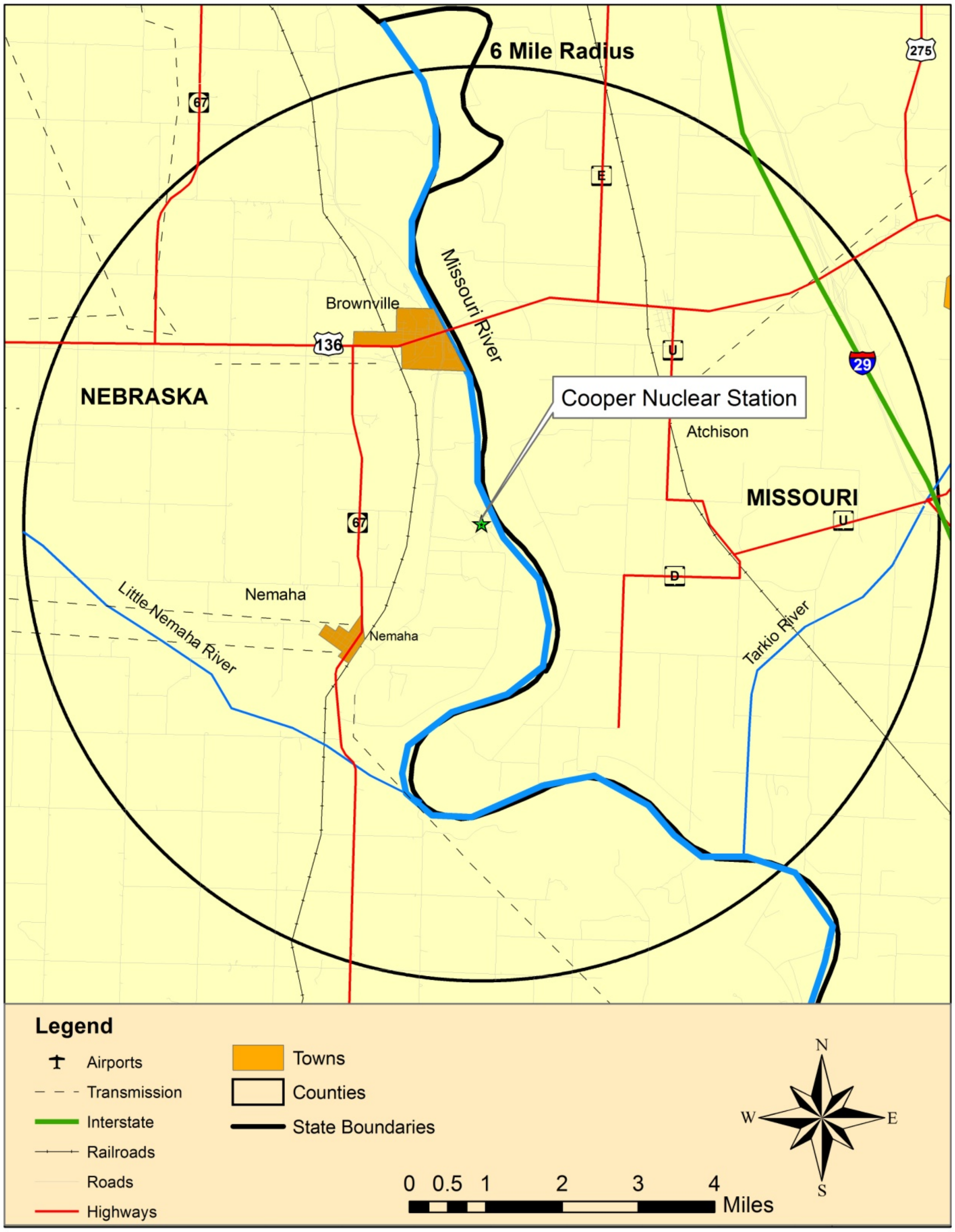

Figure 3-2. Location of Cooper Nuclear Station Unit 1, 6-miles (10-km) Region
(Source: NPPD, 2008b)

CNS-1 is a single-unit boiling water reactor plant with a nuclear steam supply system supplied by General Electric Company and a turbine generator set supplied by Westinghouse Electric Corporation. CNS-1 achieved commercial operation in 1974 with an initial licensed core thermal power of 2,381 megawatt-thermal (MWt). In 2008, with NRC approval, the applicant performed a measurement uncertainty recapture uprate that increased the core thermal power by 1.62 percent to its current level of 2,419 MWt and 830 megawatt-electric (MWe) (NPPD, 2008b). Figure 3-3 shows the general layout of the buildings at CNS-1. The principal structures at CNS-1 consist of the reactor building, turbine building (including service area appendages), control building, controlled corridor, radwaste building, augmented radwaste building, intake structure, off-gas filter building, elevated release point, diesel generator building, multi-purpose facility, railroad airlock, drywell and suppression chamber, miscellaneous circulating water system structures (e.g., circulating water conduits, seal well), optimum water chemistry gas generator building, and office building. Visually dominant features are the 290-foot (88-m) tall reactor building, the 325-foot (99-m) tall elevated release point, and the 328.8-foot (100-m) tall meteorological tower.

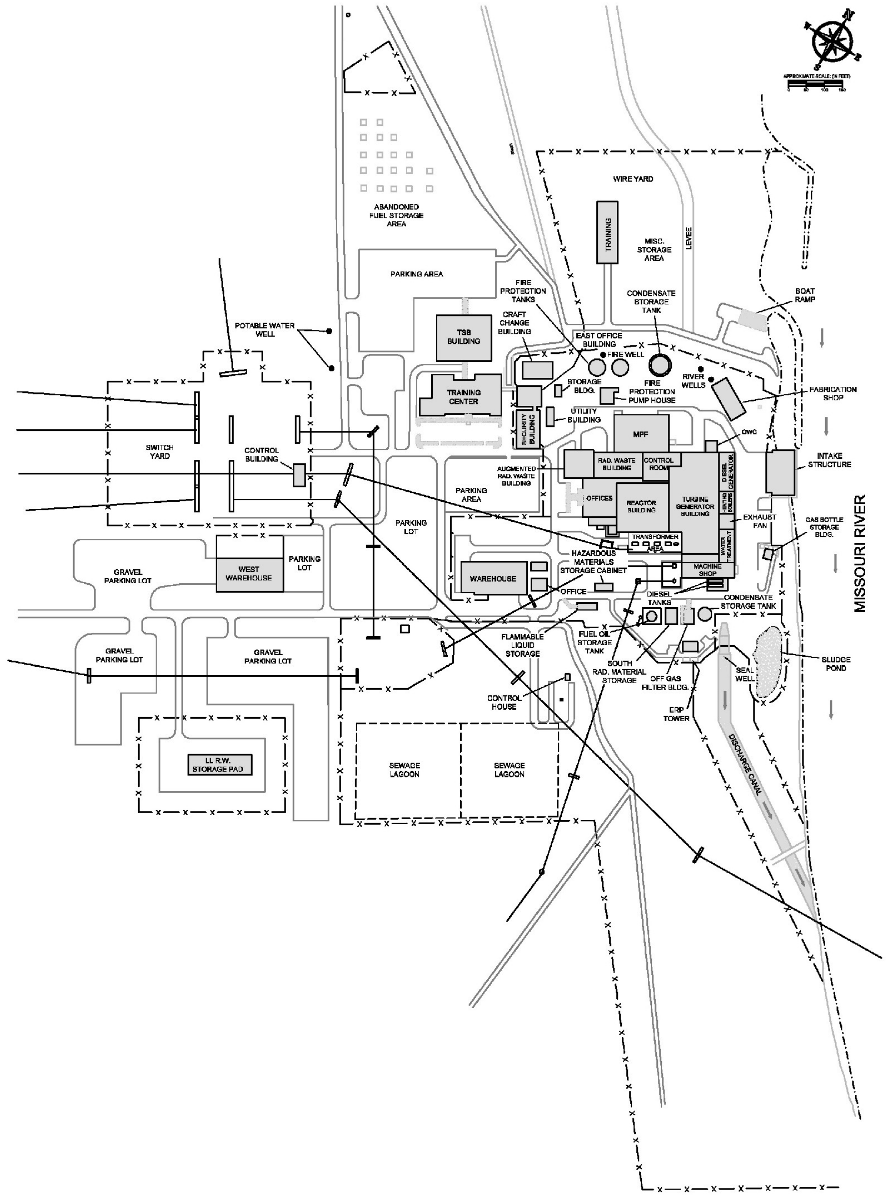

Figure 3-3. Cooper Nuclear Station Unit 1, General Site Layout *(Source: NPPD, 2008b)*

CNS-1 lies on the western shore of the Missouri River, withdraws river water for its once-through cooling system, and discharges heated water back to the river. Unless otherwise cited, NRC staff drew information about CNS-1's cooling and auxiliary water systems from NPPD (2006b) and the applicant's environmental report (ER) (NPPD, 2008b), where more in-depth information appears. In the vicinity of the plant, the Missouri River has a regulated minimum flow of 31,000 cubic feet per second (cfs) (878 m^3/sec) to the southeast. The circulating water intake structure is located on the western shore of the river behind a guide wall and submerged weir meant to reduce the amount of suspended sediment in the cooling water. The weir attaches to shoreline structures north of the intake and then runs parallel to the face of the intake at a distance of 14.25 feet (4.3 m). The wall continues past the intake and ends 40 feet (12 m) downstream of the corner of the intake structure. In a line riverward of the weir wall and extending downstream of it, 23 sheet pile vanes (10 feet wide by 6 feet high (3 m wide by 2 m high)), oriented at a 22 degree angle to the weir, redirect sand and gravel outward from the weir and the intake structure. After flowing generally south along the weir and vanes, river water must reverse course and turn northwest to move between the weir and shore and reach the intake bays. Water velocity between the weir wall and the cooling water intake structure is about 4 ft/sec (1.2 m/sec).

In winter, about 25 to 30 percent of the main condenser discharge water re-circulates through an ice control tunnel at the front of the intake structure and discharges in front of the trash rack to prevent icing. Water flows beneath a curtain wall at about 1.1 ft/sec (0.34 m/sec). Water enters the five intake bays, four of which provide circulating water and are 22 feet (6.7 m) wide and one of which provides service water and is 22.5 feet (6.8 m) wide. The incoming water then flows through trash racks, 3/8 inch (1 cm) vertical bars separated 3 inches (7.6 cm) on center, at up to 0.7 ft/sec (20 cm/sec).

The circulating water intake bays each separate into two screen bays and the service water intake bay narrows before water encounters the traveling screens, which are oriented at right angles to the flow. Water filters through 1/8 by 1/2-inch (3.175 by 1.27 cm) smooth-top mesh of nine modified dual-flow traveling screens (eight for circulating water and one for service water) twice: on the upward pass in the front and the downward pass behind as the screens, installed in 2006, rotate continuously at 8.2 ft/min (2.5 m/min). The intake water velocity at the screens is about 2 ft/sec (0.6 m/sec).

After the 4.2-foot (1.28-m) wide traveling screen panels rotate over the upper cog and begin moving down, a high pressure (30-60 psig, 200-400 kPa) screen wash of 3,000 gallons per minute (gpm) (0.19 m^3/sec) supplied by the service water pumps removes fish and debris, which return together to the river through an 18-inch (0.46-m) diameter steel pipe that discharges downstream from the intake. Although the screens are fitted with fish baskets, the system has neither a low-pressure spray system to more gently remove fish from the screens nor a fish return trough to convey fish and other aquatic organisms back to the river separately from potentially damaging debris. Debris loads are about 10 cubic yards per month (8 m^3/month).

CNS-1 plans to install “dual-flow conversion screen fish handling systems” during its current operational term. This system would have low pressure (5-10 psi, 35-70 kPa) fish washing sprays on both the ascending and descending screens and a fish return trough that is separate from the debris trough. A recovery basket would collect fish and other aquatic organisms washed from the screens, and the fish trough would return them to the river. Figures 3-4 through 3-6 show the CNS-1 intake structures.

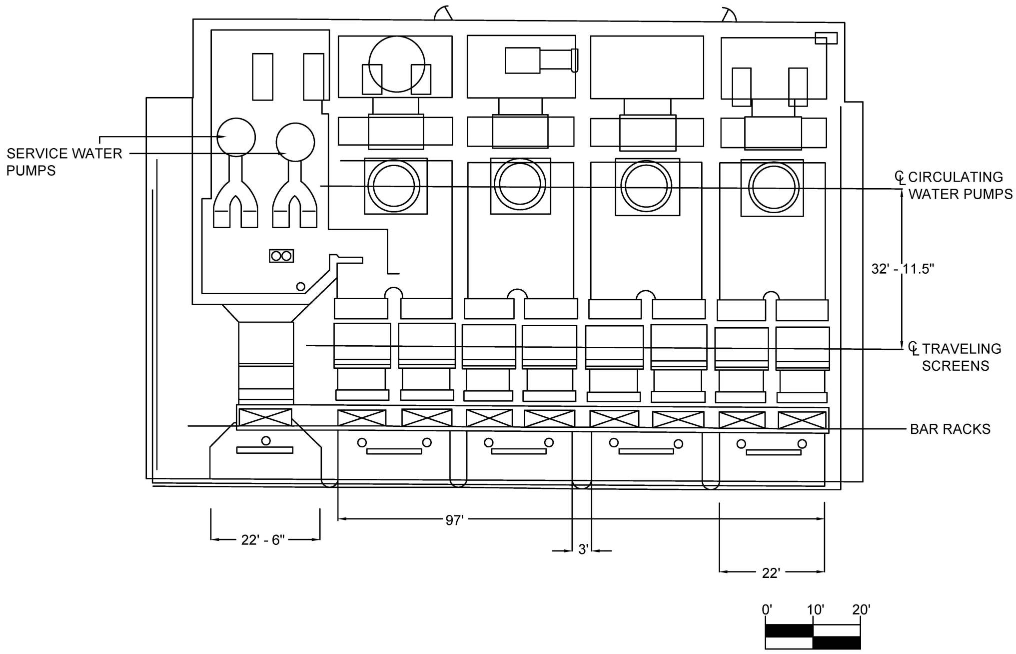

Figure 3-4. Cooper Nuclear Station Unit 1 Intake Structure Plan *(Source: NPPD, 2008b)*

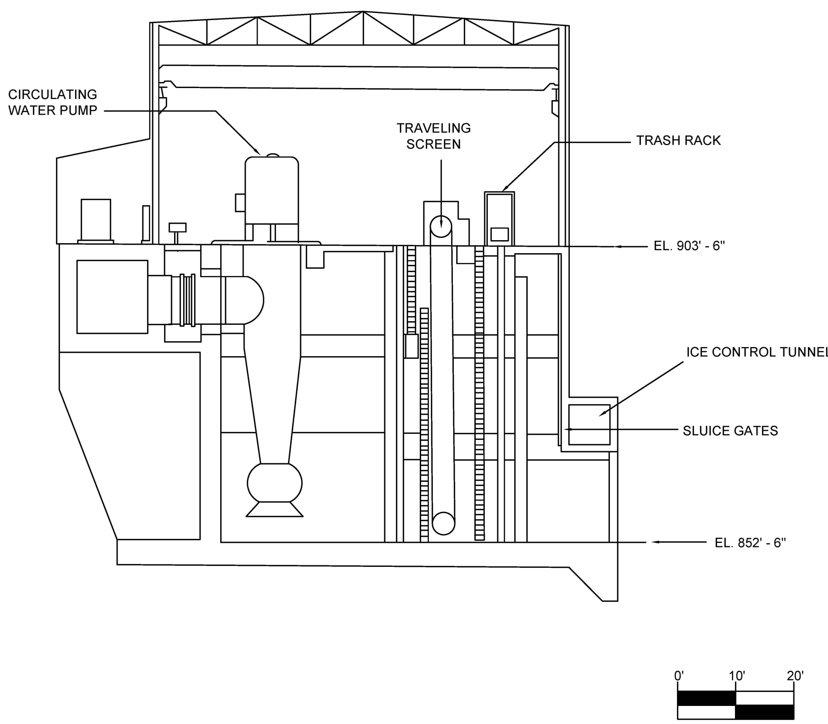

Figure 3-5. Cooper Nuclear Station Unit 1 Intake Structure Section *(Source: NPPD, 2008b)*

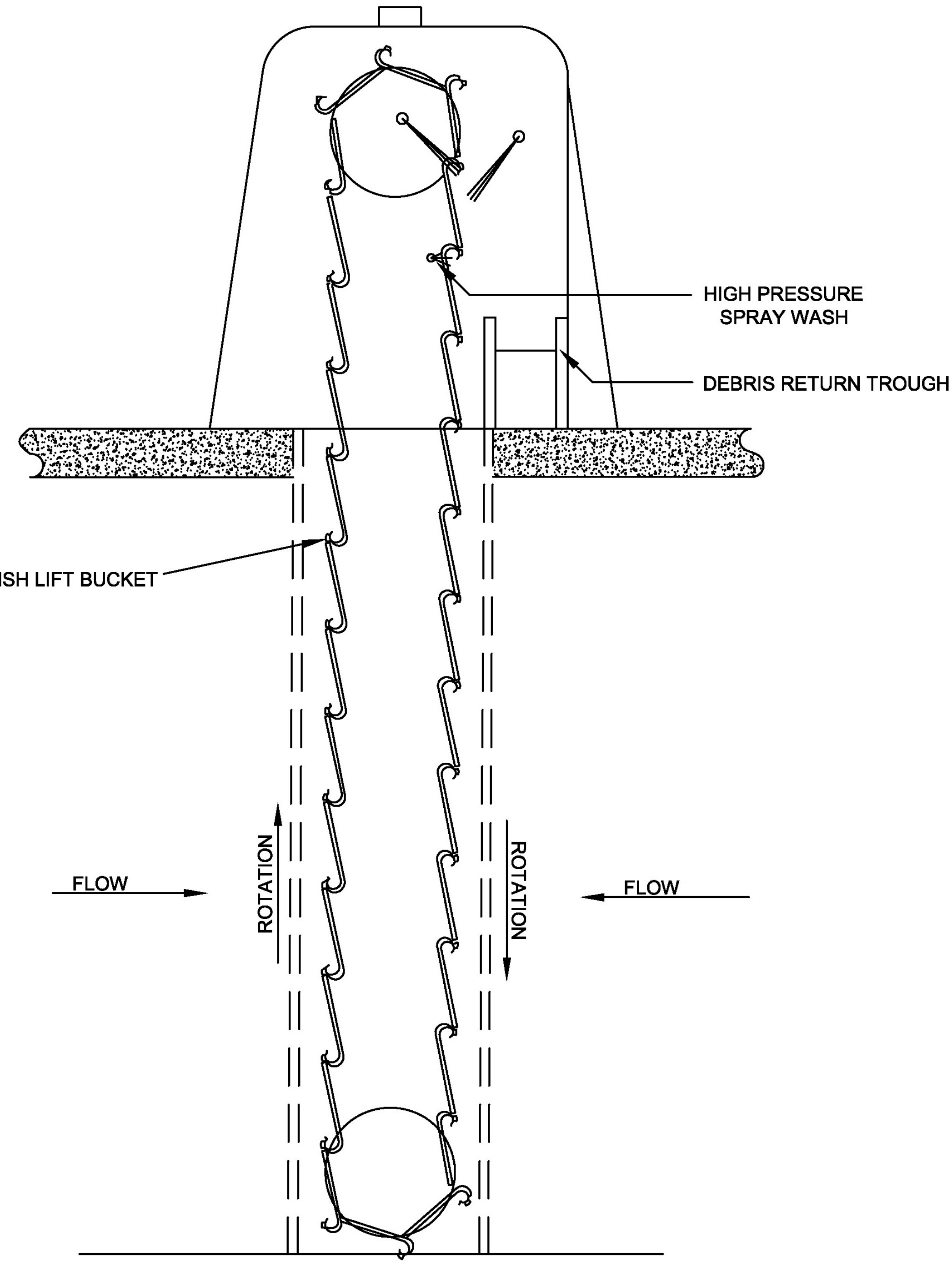

Figure 3-6. Cooper Nuclear Station Unit 1 Typical Dual Flow Screen
(Source: NPPD, 2008b)

After water passes through the traveling screens, the two screen bays of each intake bay rejoin behind the screens. The four circulating water pumps, one per bay, can draw water from the bays and can provide up to 159,000 gpm (10 m^3/sec) each. The four service water pumps in the fifth bay can provide a combined flow of 32,000 gpm (2 m^3/sec). Water from the circulating water pumps travels to and circulates through the condenser, where it cools steam from the turbines. Because of the scouring from the suspended sediment, CNS-1 typically does not need to chlorinate the circulating water to control biological film fouling, although it has the capacity to chlorinate or brominate if needed. NPPD is studying the effectiveness of those options.

Water temperature increases about 17.8 °F (10 °C) as it passes through the condenser tubes. From the condenser, circulating cooling water flows through concrete tunnels to a seal well structure and then to the discharge canal, where it travels about 1,000 ft (300 m) to discharge to the river at a slight angle. Water velocity at the discharge is about 1 ft/sec (0.3 m/sec) at average river flow and about 5.6 ft/sec (1.7 m/sec) during low flows. The travel time from the intake structure to the discharge is about 20 minutes at high river flow and 10 to 12 minutes at low flows.

Cooling water flow varies with electrical load and ambient river water temperature. At full load during summer, the expected circulating water system flow is highest: about 636,000 gpm (40 m^3/sec). Circulating water flow is lower under other conditions. In comparison, the lowest river flow at CNS-1 is about 3,000 cfs. Under these worst conditions, the circulating water system flow would be about 47 percent of the Missouri River flow. Stone rip-rap at the discharge structure prevents the discharge from eroding the river bottom.

D.2.4 STATUS REVIEW OF PALLID STURGEON

D.2.4.1 *Life History*

Sturgeons are members of an order of fish (*Acipenseriformes*) that probably evolved in the Devonian age. Living members of this order in North America include the paddlefish and eight sturgeon species. The paddlefish *Polyodon spathula* and three sturgeon species, the lake sturgeon A*cipenser fulvescens*, pallid sturgeon *Scaphirhynchus albus*, and the shovelnose sturgeon *S. platorynchus*, live in the Missouri and Mississippi Rivers. In the past, commercial fishermen harvested all three of the sturgeon species in the Missouri and Mississippi rivers. Today pallid sturgeon are a Federally-listed endangered species, and lake sturgeon are listed as endangered by Nebraska. The life history information below is from Dryer and Sandvol (1993) and USFWS (2007) if not otherwise cited.

Pallid sturgeon have a flattened snout, a long tail, and rows of bony armor plates. The upper side is convex and the lower side is straight. They have an inferior (bottom-facing) mouth and eat invertebrates, such as the immature stages of insects, and fish. The body shape is well adapted for swimming close to the bottom of relatively fast flowing, large rivers. The diet, inferior mouth, and barbels in front of the mouth are well adapted to feeding on or near the bottom in highly turbid environments.

The USFWS listed pallid sturgeon as endangered in 1990. The historic abundance of pallid sturgeon is somewhat vague since biologists did not recognize it as a separate species from shovelnose sturgeon until 1905, but its historical range probably extended from the middle and lower Mississippi River in the south up through the Missouri River and lower reaches of the Platte, Kansas, and Yellowstone rivers in the north and west. The pallid sturgeon is one of the largest fish species in those rivers. Available information suggests that the pallid sturgeon was not a common species since the time of European settlement. Today pallid sturgeon are among the rarest fish of the Missouri and Mississippi River basins, and the present range includes the States of Montana, North and South Dakota, Nebraska, Iowa, Kansas, Missouri, Illinois, Kentucky, Arkansas, Mississippi, and Louisiana. The populations are largely older fish that will die off in the near future.

Fisheries biologists know little about pallid sturgeon reproduction or even preferred spawning habitats and conditions. Hurleya et al. (2004) tracked sonically-tagged pallid sturgeon in the Mississippi River and found that they exhibited positive selection for the main-channel border, downstream island tips, between-wing-dam, and wing-dam-tip habitats; they showed negative selection for main-channel, downstream of wing dams, and upstream of wing dam habitats. The sturgeon exhibited little habitat selection for temperature or dam discharge. The authors concluded that habitat enhancement and restoration of habitat diversity might be necessary for recovery of pallid sturgeon.

Reports of pallid sturgeon reproduction are rare. The U.S. Geological Survey (USGS) (2007), Nebraska Game and Parks Commission (NGPC), and the U.S. Army Corps of Engineers (USACE) confirmed spawning of two female pallid sturgeon in the upstream reaches of the lower Missouri River in May 2007. The capture of young pallid sturgeon that would verify natural reproduction are also rare: none were captured between 1978 and a Mississippi River trawl survey in 1998 through 2000 using equipment designed to capture larval fish in deep, turbulent water (Hrabik et al., 2007). Hrabik et al. (2007) concluded that those latest captures verified reproduction, possibly from the lower Missouri River to the upper and lower Mississippi River, although they also found no evidence of recruitment of pallid sturgeon because they captured no juveniles after 374 trawl hauls that captured over 21,735 fish in that 1998 through 2000 survey. Wildhaber et al. (2007) suggest that one or more of the following factors may be responsible for the lack of finding larval pallid sturgeon and of recruitment: lack of successful spawning, low recruitment, high mortality, ineffective sampling methods, inadequate sampling of drift and settling locations, or rapid dispersal and washout of sturgeon larvae in the Missouri and Mississippi rivers. Pallid sturgeon larvae are indistinguishable from those of the congeneric shovelnose sturgeon, which may also help to explain the paucity of reported collections in the past. Also, the construction of dams and other structures with resulting habitat change and the elimination of shallow areas in the river with little or no flow have probably deprived sturgeon of critical nursery areas needed for the survival of immature sturgeon (Missouri Department of Conservation, 2009).

Larval pallid and shovelnose sturgeon become strongly photopositive and migrate upwards toward the light starting the first day after hatching. As a result, they remain far above the bottom, even at the water surface, and migrate far downriver (Kynard et al., 2002). Cultured yearling pallid sturgeon in laboratory studies also migrate downstream during summer and fall, which suggests a two-stage (larval, then yearling) downriver migration in the first year of life. Adult sturgeon are also highly migratory and often migrate hundreds of miles in a year.

The young of both shovelnose and pallid sturgeon eat invertebrates, but as pallid sturgeon grow, they become more piscivorous. Gerrity and Guy (2006) found that the diet of juvenile pallid sturgeon of age 6 and 7 was mostly fish, compared to the diet of shovelnose sturgeon, which is mainly aquatic insects. Sturgeon chub (*Macrhybopsis gelida*) and sicklefin chub (*M. meeki*) together comprised 79 percent of the number of identifiable fish in juvenile pallid sturgeon stomachs. Populations of these two cyprinid minnows have declined throughout much of the Missouri River due to the construction of dams and man's other alterations of river habitat, and the State of Nebraska lists sicklefin chub as threatened and sturgeon chub as endangered. While the population of the piscivorous pallid sturgeon has declined in the Missouri and Mississippi rivers, the population of its similar, insectivorous congener, shovelnose sturgeon, has not declined. Gerrity and Guy (2006) concluded that the prevalence of sicklefin chub and sturgeon chub as a food resource of juvenile pallid sturgeon may help explain the decline of pallid sturgeon populations and that recovery and management of native cyprinids is a potentially important step in the recovery of pallid sturgeon.

Male pallid sturgeon are believed to mature at 7 to 9 years after which they spawn at intervals of 2 to 3 years. Females may reach sexual maturity at 7 to 15 years and spawn at intervals up to 10 years. Individuals may reach ages of 60 years or more and reach lengths of 6 feet (2 m). Like many other fish species, the largest individuals are found farthest north in the species' range and maximum size decreases with distance south. For example, the maximum weight of pallid sturgeon in the upper Missouri River in Montana and North Dakota is 86 pounds (39 kg), in the Missouri River in South Dakota and Nebraska 46 pounds (21 kg), and in the Mississippi River 26 pounds (12 kg). They become much larger than shovelnose sturgeon, which rarely weigh more than 8 pounds (3.6 kg).

D.2.4.2 *Status of Pallid Sturgeon in the Missouri River*

While they were successful in the historical Missouri and Mississippi rivers, with the high flow and turbidity and diverse habitats of floodplains, backwaters, chutes, sloughs, islands, sand and gravel bars, and both braided and main channels, they are not so well adapted to the Missouri and Mississippi rivers today with the construction of dams that isolated subpopulations, channelization, controlled flow, and elimination of habitat diversity. The USFWS (2007) concludes that man's activities have adversely affected all of the 3,350 miles (5,390 km) of river habitat within their range, and habitat alteration and loss may be the biggest threat to their existence. Other threats may include hybridization with shovelnose sturgeon, commercial fishing, and exposure to environmental contaminants such as polychlorinated biphenyls (PCBs), cadmium, mercury, selenium, chlordane, dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyltrichloroethylene (DDE), and dieldrin, all of which have been found in pallid sturgeon tissue in the past.

During the early 1990s, the Missouri Department of Conservation (MDC) developed "action plans" for lake and pallid sturgeon a goal of reestablishing self-sustaining populations so they can be delisted as endangered species and ultimately provide limited sport fisheries. These plans stress the restoration of both species through habitat improvement, artificial propagation, protection, research, management, and education (MDC, 2009). As part of this effort, the MDC's Blind Pony Fish Hatchery has raised and stocked over 13,000 fingerling pallid sturgeon and 200,000 fingerling lake sturgeon into the Missouri and Mississippi rivers (MDC, 2009). In addition to these efforts, the USGS (Wildhaber et al., 2007) has developed a conceptual life history to organize the understanding about the complex life history of *Scaphirhynchus* sturgeons and improve understanding of the effects of management actions on the ecological requirements of pallid and shovelnose sturgeons. The USFWS's Pallid Sturgeon Recovery Plan (Dryer and Sandvol, 1993) designated six recovery priority management areas (RPMAs) for implementation of recovery tasks, and CNS-1 is located within RPMA 4.

D.2.4.3 *Impact Assessment of Cooper Nuclear Station on Pallid Sturgeon*

NPPD (2008a) summarizes interactions between NPPD and both State and Federal agencies regarding conservation of pallid sturgeon. That summary is outlined below:

In March 2006, before filing a license renewal application with NRC, NPPD voluntarily participated in meetings with the USFWS, the NGPC, the Nebraska Department of Environmental Quality (NDEQ), the Nebraska Department of Natural Resources (DNR), the EPA, and the USACE regarding conservation actions to improve the habitat of pallid sturgeon. NPPD (2008a) summarizes those meetings. Early in the discussions, the USFWS and NGPC showed interest in developing existing habitat on a parcel of property south of CNS-1 at Langdon Bend and later also in CNS-1 property on the Nebraska side of the Missouri River adjacent to Langdon Bend. They hoped to enhance pallid sturgeon habitat by building a chute to connect active river channels with the old river area.

NPPD had problems with this proposal. Implementing the proposal would reduce CNS-1's mixing zone, which now extends 5,000 feet south of CNS-1 along the Nebraska side of the Missouri River, to less than half, less than 2,500 feet. Reducing the mixing zone would reduce CNS-1's capacity to generate electricity, particularly during summer. The proposal also posed other negative safety and environmental concerns for CNS-1. As an alternative, NPPD then offered to contribute funds toward other new or existing projects on the Missouri River. The USFWS rejected this funding alternative in favor of increasing the amount of land for habitat development.

To meet the goal of improving habitat for pallid sturgeon, NPPD offered a conservation easement of about 230 acres (93 ha) of land that it owns on the Missouri side of the Missouri River, opposite CNS-1, for the purposes of habitat development. The USFWS indicated interest in the proposal, and asked NPPD to also acquire an adjacent property of about 150 acres (51 ha) so that the entire bend in the river could be developed into better habitat. When the property owner refused to sell the land, NPPD offered a revised, final proposal to participate in and promote habitat development along the Missouri River. It proposed to revisit the USFWS's and NGPC's interest in a suitable conservation easement and Memorandum of Understanding to enable habitat development on NPPD's approximately 230-acre (93-ha) parcel on the Missouri side of the river. Further, because NPPD recognized that this parcel alone would not meet the USFWS's and NGPC's conservation habitat development goals, NPPD indicated that its willingness to make an additional payment of $250,000 to be applied toward another conservation habitat development project on the Missouri River at the direction of the USFWS and NGPC. At the time of writing this biological assessment (BA), the involved parties are discussing details of the conservation agreement.

Plans for and construction of a chute on the parcel may also involve the owners of the transmission lines and supports that cross the property. NPPD does not own these lines, although CNS-1 provides power to them.

The probability that CNS-1 will entrain, impinge, or otherwise affect pallid sturgeon eggs or larvae is low. Hazleton (1979) collected adult and juvenile fish from seven locations in the vicinity of CNS-1 from 1970 through 1978 and reported no pallid sturgeon captured. They also conducted impingement sampling from 1974 through 1978 and reported no pallid sturgeon impinged. Based on 374 trawl hauls that captured over 21,735 fish in a 1998 through 2000 survey, Hrabik et al. (2007) concluded pallid sturgeon may reproduce in the lower Missouri River to the upper and lower Mississippi River, although no fish may survive to recruitment. NPPD's involvement in the conservation agreement, however, could have a positive impact on the pallid sturgeon population.

D.2.2 CONCLUSION

Based on this review, the staff concludes that the continued operation of CNS-1 for an additional 20 years may affect, but is not likely to adversely affect, the pallid sturgeon.

D.2.3 REFERENCES

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APPENDIX E.
CHRONOLOGY OF ENVIRONMENTAL REVIEW

E. CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and external parties as part of its environmental review for Cooper Nuclear Station, Unit 1 (CNS-1). All documents, with the exception of those containing proprietary information, are available electronically from the NRC's Public Electronic Reading Room found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html.

From this site, the public can gain access to the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents in ADAMS. The ADAMS accession number for each document is included below.

E.1. Environmental Review Correspondence

September 24, 2008	Letter from Nebraska Public Power District (NPPD) forwarding the application for renewal of the operating license for CNS-1, requesting an extension of the operating license for an additional 20 years. (ADAMS Accession No. ML0803030227)
September 24, 2008	NPPD's environmental report (ER) submitted as Appendix E for the application for renewal of the operating license for CNS- 1, requesting an extension of the operating license for an additional 20 years. (ADAMS Accession No. ML083030246)
November 10, 2008	Letter to NPPD, "Receipt and Availability of the License Renewal Application for the Cooper Nuclear Station Unit 1." (ADAMS Accession No. ML082661007)
November 17, 2008	*Federal Register* Notice of Receipt and Availability of Application for Renewal of Cooper Nuclear Station Facility Operating License No. DPR-46 for an Additional 20-Year Period (73 FR 67896). (ADAMS Accession No. ML0826608920)
December 19, 2008	Letter to NPPD, "Determination of Acceptability and Sufficiency for Docketing and Opportunity for a Hearing Regarding the Application from Nebraska Public Power District, for Renewal of the Operating License for the Cooper Nuclear Station (TAC Nos. MD9763 and Md9737)." (ADAMS Accession No. ML083330066)
December 19, 2008	*Federal Register* Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License No. DPR-46 for an Additional 20-Year Period Nebraska Public Power District Cooper Nuclear Station (73 FR 5877). (ADAMS Accession No. ML083540747)
January 15, 2009	*Federal Register* Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Licensee Renewal for Cooper Nuclear Station, Unit 1 (73 FR 13923). (ADAMS Accession No. ML090150526)

January 16, 2009	Letter to Michael Smith, Nebraska Historic Preservation Society, regarding CNS-1, license renewal application" (ADAMS Accession No. ML090080197)
January 21, 2009	Letter to NPPD transmitting notice of intent to prepare an environmental impact statement and conduct scoping process for license renewal for CNS-1." (ADAMS Accession No. ML083640401)
January 26, 2009	Letter to Sherry Black, Auburn Memorial Library, regarding maintenance of reference materials at the Auburn Memorial Library related to the review of the Cooper Nuclear Station license renewal application. (ADAMS Accession No. ML090230582)
January 26, 2009	Letter to Don Klima, Director, Advisory Council on Historic Preservation, regarding CNS-1, license renewal application. (ADAMS Accession No. ML090080683)
January 27, 2009	Letter to Mr. Joseph Cothern, USEPA Region 7, regarding CNS-1, license renewal application. (ADAMS Accession No. ML090230446)
January 28, 2009	Letter to Julia Schmitt, Department of Health and Human Services, regarding CNS-1, license renewal application. (ADAMS Accession No. ML090260380)
January 29, 2009	Notice of forthcoming meeting to discuss the safety review process and environmental scoping process for CNS-1, license renewal application review. (ADAMS Accession No. ML090160280)
January 29, 2009	Letter to Mark Miles, State Historic Preservation Officer, Department of Natural Resources, MO, regarding CNS-1, license renewal application. (ADAMS Accession No. ML090210750)
January 29, 2009	Letter to John Cochnar, U.S. Fish and Wildlife Service, requesting a list of protected species for the CNS-1, license renewal review. (ADAMS Accession No. ML0901507)
February 2, 2009	Letter from the Nebraska State Historic Preservation Office requesting a map of the boundaries of the environmental review of the license renewal application for CNS-1. (ADAMS Accession No. ML090650061)
February 4, 2009	Letter to Adrian Pushetonequa, Sac and Fox Tribe of the Mississippi in Iowa, inviting participation in scoping process related to NRC's environmental review of the license renewal application for CNS-1. (ADAMS Accession No.ML090080045)
February 4, 2009	Letter to Ann Bleed, Nebraska Department of Natural Resources, requesting a list of protected species for the CNS-1, license renewal review. (ADAMS Accession No. ML090260380)
February 25, 2009	Agenda and slides for Cooper Nuclear Station scoping and process public meeting, February 25, 2009. (ADAMS Accession No. ML090750686)

February 25, 2009	Transcript of Cooper Nuclear Station license renewal public meeting – afternoon session, February 25, 2009. (ADAMS Accession No. ML090840063)
February 25, 2009	Transcript of Cooper Nuclear Station license renewal public meeting – evening session, February 25, 2009. (ADAMS Accession No. ML090840062)
February 25, 2009	Comments from the Richardson County, Nebraska, Emergency Management Agency regarding the license renewal of CNS-1. (ADAMS Accession No. ML090720066)
February 27, 2009	Letter from the City of Rock Port regarding the license renewal of CNS-1. (ADAMS Accession No. ML090720068)
March 9, 2009	Letter from Nebraska Department of Natural Resources regarding the request for a list of protected species for license renewal of CNS-1. (ADAMS Accession No. ML090650061)
March 10, 2009	Letter from the Pawnee City Economic Development Corporation regarding the license renewal of CNS-1. (ADAMS Accession No. ML090720067)
April 3, 2009	Letter to NPPD regarding the review schedule for the application for the renewal of the operating license for CNS-1. (ADAMS Accession No. ML090220584)
April 3, 2008	Letter to Stewart B. Minahan, NPPD, regarding environmental site audit needs for CNS-1 license renewal application from NPPD. (ADAMS Accession No. ML090830248)
April 9, 2009	Letter to NPPD, “Regulatory Audit Plan for Aging Management Program Regarding Cooper Nuclear Station Unit 1 License Renewal Application.” (ADAMS Accession No. ML090930256)
April 9, 2009	Letter to NPPD, “Request for Additional Information Regarding Balance of Plant Issues for Cooper Nuclear Station Unit 1” (ADAMS Accession No. ML091060150)
April 14, 2009	Summary of public meeting for Cooper Nuclear Station Scoping and Process Public Meeting, February 25, 2009 (ADAMS Accession No. ML090910308)
April 16, 2009	Email comments from Environmental Protection Agency (EPA) Region 7, regarding the license renewal of CNS-1. (ADAMS Accession No. ML091070269)
April 30, 2009	Summary of site audit related to the review of the license renewal application for CNS-1 (TAC NOS. MD9763 and MD9737) (ADAMS Accession No. ML090970414)

May 1, 2009	Letter to NPPD, “Request for Additional Information for the Review of the Cooper Nuclear Station License Renewal Application” (TAC No. MD9763 and MD9737) (ADAMS Accession No. ML091190597)
May 1, 2009	Letter from NPPD to Fish and Wildlife Service regarding the license renewal of the Cooper Nuclear Station. (ADAMS Accession No. ML091830056)
May 5, 2009	Email from Fish and Wildlife Service to R. Bulavinez, NRC. (ADAMS Accession No. ML091400116)
May 8, 2009	Email and attachment from Nebraska Game and Parks Commission. (ADAMS Accession No. ML091400110)
May 18, 2009	Letter from NPPD, “Response to Request for Additional Information for License Renewal Application, Cooper Nuclear Station, Docket No. 50-298, DPR-46. (ADAMS Accession No. ML091600712)
May 29, 2009	Summary report of environmental scoping for the license renewal application for CNS-1 (TAC NOS. MD9763 and MD9737) (ADAMS Accession No. ML091200017)
June 8, 2009	Letter to NPPD, “Request for Additional Information for the Review of the Cooper Nuclear Station License Renewal application (TAC. No. MD9763 and MD9737) (ADAMS Accession No. ML091530316)
June 8, 2009	Letter from Fish and Wildlife Service to NPPD regarding the license renewal of Cooper Nuclear Station (ADAMS Accession No. ML091830055)
July 1, 2009	Letter from NPPD, “Response to Request for Additional Information for License Renewal Application – Severe Accident Mitigation Alternatives, Cooper Nuclear Station, Docket No. 50-298, DPR-46. (ADAMS Accession No. ML091880319)
August 26, 2009	Letter from Fish and Wildlife Service to NPPD concerning the license renewal of the Cooper Nuclear Station.
December 17. 2009	Letter from NPPD,” SAMA Meteorological Anomaly Related to the Cooper Nuclear Station License Renewal Application,” (ADAMS Accession No. ML093490997)

APPENDIX F.
U.S. NUCLEAR REGULATORY COMMISSION STAFF EVALUATION OF SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR COOPER NUCLEAR STATION, UNIT 1 IN SUPPORT OF LICENSE RENEWAL APPLICATION REVIEW

F. U.S. NUCLEAR REGULATORY COMMISSION STAFF EVALUATION OF SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR COOPER NUCLEAR STATION IN SUPPORT OF LICENSE RENEWAL APPLICATION REVIEW

NOTE: In December 7, 2009, CNS-1 identified an error in their original SAMA analysis resulting from the wind data used in their code. NPPD discovered a problem with the process they used to numerically average the site-specific meteorological data. NPPD performed a sensitivity analysis of the population dose risk and offsite economic cost risk using corrected meteorological data, and found that the population dose and offsite economic cost values for each of the release categories would be slightly less than reported in the ER, and that the conclusions of the SAMA remain valid (NPPD, 2009c). NRC staff reviewed the revised data as part of the analysis below.

F.1. Introduction

Nebraska Public Power District (NPPD) submitted an assessment of severe accident mitigation alternatives (SAMAs) for the Cooper Nuclear Station, Unit 1 (CNS-1) as part of the environmental report (ER) (NPPD, 2008). This assessment was based on the most recent CNS-1 probabilistic safety assessment (PSA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer code (NRC, 1998a), and insights from the CNS-1 individual plant examination (IPE) (NPPD, 1993) and individual plant examination of external events (IPEEE) (NPPD, 1996). In identifying and evaluating potential SAMAs, NPPD considered SAMA candidates who addressed the major contributors to core damage frequency (CDF) and large early release frequency (LERF) at CNS-1, as well as, SAMA candidates for other operating plants which have submitted license renewal applications. NPPD identified 244 potential SAMA candidates. This list was reduced to 80 unique SAMA candidates by eliminating SAMAs that are not applicable at CNS-1 due to design differences, have already been implemented at CNS-1, or are similar in nature and could be combined with another SAMA candidate. NPPD assessed the costs and benefits associated with each of the potential SAMAs, and concluded in the ER that several of the candidate SAMAs evaluated are potentially cost-beneficial.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) to NPPD by letter dated June 8, 2009 (NRC, 2009). Key questions concerned: the impact of unresolved Boiling Water Reactor Owner's Group (BWROG) PSA peer review findings on the SAMA analysis results; the process used to develop and group source terms into containment event tree (CET) end states; the rationale for identifying and screening SAMAs, and the costs and benefits of several specific candidate SAMAs and low cost alternatives. NPPD submitted additional information by letter dated July 1, 2009 (NPPD, 2009a) and email dated August 10, 2009 (NPPD, 2009b). In response to the RAIs, NPPD provided information regarding the findings of the BWROG peer review; a discussion and example of the process for assigning severe accident source terms to CET sequences; additional rationale on the process used to identify and screen SAMAs, and additional information regarding several specific SAMAs. NPPD's responses addressed the NRC staff's concerns.

An assessment of SAMAs for CNS-1 is presented below.

F.2. Estimate of Risk for Cooper Nuclear Station

NPPD's estimates of offsite risk at CNS-1 are summarized in Section F.2.1. The summary is followed by the NRC staff's review of NPPD's risk estimates in Section F.2.2.

F.2.1. Nebraska Public Power District's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the CNS-1 Level 1 and 2 PSA model, which is an updated version of the IPE (NPPD, 1993), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PSA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent CNS-1 Level 1 and Level 2 PSA models available at the time of the ER, referred to as the CNS-1 2007TM model (2007TM, Rev. 1). The scope of this CNS-1 PSA does not include external events.

The CNS-1 CDF is approximately 9.3×10^{-6} per year for internal events as determined from quantification of the Level 1 PSA model. When determined from the sum of the CET sequences, or the Level 2 PSA model, the release frequency is approximately 1.2×10^{-5} per year. The latter value was used as the baseline CDF in the SAMA evaluations (NPPD, 2009a). The CDF is based on the risk assessment for internally-initiated events, which includes internal flooding. NPPD did not include the contribution from external events within the CNS-1 risk estimates, however, it did account for the potential risk reduction benefits associated with external events by multiplying the estimated benefits for internal events by a factor of three. For some fire-related SAMAs, NPPD separately estimated the risk reduction benefits using the fire risk model. This is discussed further in Sections F.2.2 and F.6.2.

The breakdown of CDF by initiating event is provided in Table F-1. As shown in this table, events initiated by transients, loss of DC power, loss of coolant accidents (LOCA), and loss of feedwater are the dominant contributors to the CDF. Station blackout (SBO) and anticipated transient without scram (ATWS) sequences may occur following multiple initiators and so their total contributions to CDF were reported separately. Each contributes less than 3 percent to the total internal events CDF.

The Level 2 CNS-1 PSA model that forms the basis for the SAMA evaluation represents an updated version of the original IPE Level 2 model. The current Level 2 model utilizes a single CET containing both phenomenological and systemic events. The Level 1 core damage sequences are binned into one of 15 Plant Damage State (PDS) bins which provide the interface between the Level 1 analysis and Level 2 CET analysis. The CET probabilistically evaluates the progression of the damaged core with respect to radiation release into the environment. CET nodes are evaluated using supporting fault trees and logic rules. The CET end states then are examined for considerations of timing and magnitude of release and assigned to release categories.

Table F-1. Cooper Nuclear Station Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)	% Contribution to CDF
Transients	3.0×10^{-6}	32
Loss of DC Power	2.1×10^{-6}	22
LOCA	1.4×10^{-6}	15
Loss of Feedwater	1.0×10^{-6}	11
Loss of Offsite Power	6.5×10^{-7}	7
Loss of Service Water (SW)	6.0×10^{-7}	7
Loss of AC Buses	2.6×10^{-7}	3
Internal Flood	2.6×10^{-7}	3
Interfacing System LOCA	5.1×10^{-8}	<1
Total CDF (Internal Events)	$\mathbf{9.3 \times 10^{-6}}$	**100**

The result of the Level 2 PSA is a set of 12 release categories, also referred to as source term categories, with their respective frequency and release characteristics. The release categories and their characteristics are provided in Table E.1-10 of the ER (NPPD, 2008). The categories were defined based on the timing, duration, and magnitude of the release and whether or not the containment remains intact or fails. The frequency of each release category was obtained by summing the frequency of the individual accident progression CET endpoints assigned to each release category. Source terms were developed for each of the 12 release categories using the results of Modular Accident Analysis Program (MAAP Version 4.0.5) computer code calculations.

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and general public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 50-mile (80-km) radius) for the year 2034, emergency response evacuation modeling, and economic data. The magnitude of the onsite impacts (in terms of clean-up and decontamination costs and occupational dose) is based on information provided in NUREG/BR-0184 (NRC, 1997a).

In the ER, NPPD estimated the dose to the population within 50 miles (80 km) of the CNS-1 site to be approximately 0.021 person-Sievert (Sv) (2.1 person-roentgen equivalent man (rem)) per year. The breakdown of the total population dose by containment release mode is summarized in Table F-2. Containment failures within the early time frame (less than 3.7 hours following event initiation) dominate the population dose risk at CNS-1, with failures in the intermediate time frame (3.7 to 24 hours following event initiation) contributing most of the remaining population dose risk.

Table F-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] Per Year)	% Contribution
Early Containment Failure	1.67	78
Intermediate Containment Failure	0.47	22
Late Containment Failure	<0.1	<1
Intact Containment	Negligible	negligible
Total	**2.14**	**100**

[1]One person-rem = 0.01 person-Sv

F.2.2. Review of Nebraska Public Power District's Risk Estimates

NPPD's determination of offsite risk at CNS-1 is based on the following three major elements of analysis:

- The Level 1 and 2 risk models that form the basis for the 1993 IPE submittal (NPPD, 1993) and the external event analyses of the 1996 IPEEE submittal (NPPD, 1996)
- The major modifications to the IPE model that have been incorporated in the CNS-1 PSA
- The MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PSA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of the NPPD risk estimates for the SAMA analysis, as summarized below.

The NRC staff's review of the CNS-1 IPE is described in an NRC report dated February 14, 1996 (NRC, 1996). Based on a review of the IPE submittal and responses to RAIs, the NRC staff concluded that the IPE submittal met the intent of GL 88-20 (NRC, 1988); that is, the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities. Although no vulnerabilities were identified in the IPE, several improvements to the plant or procedures were identified. These improvements have been either implemented at the site or addressed in the SAMA evaluation process (NPPD, 2008). These improvements are discussed in Section F.3.2.

There have been five revisions to the IPE model since the 1993 IPE submittal. A listing of the major changes in each revision of the PSA was provided by NPPD in the ER and is summarized in Table F-3. A comparison of the internal events CDF between the 1993 IPE and the 2007TM Rev. 1 PSA model used for the SAMA evaluation indicates a decrease of approximately 88 percent (from 8.0×10^{-5} per year to 9.3×10^{-6} per year). A description of those changes that resulted in the greatest impact on the internal event CDF is provided in Section E.1.4 of the ER (NPPD, 2008). The decrease is mainly attributed to plant and modeling improvements made between the IPE and the 1996b model update.

Table F-3. Cooper Nuclear Station Probabilistic Safety Assessment Historical Summary

PSA Version	Summary of Changes from Prior Model	CDF (per year)
1993	IPE Submittal (excluding internal flooding)	8.0 × 10-5
1996b	- Revised the human reliability analysis to incorporate revisions to emergency operating procedures - Added credit for newly installed torus hard pipe vent - Corrected conservative thermal hydraulic analysis of safety relief valve (SRV) flow - Improved loss of offsite power model	1.3 × 10-5
2001a	- Incorporated minor improvements stemming from the 9/97 peer review - Updated component failure and unavailability database - Developed LERF model	1.3 × 10-5
2005TM	Updated initiating event frequencies to reflect information in NUREG/CR-6890	1.1 × 10-5
2006TM	Updated model to support the Mitigating System Performance Index (MSPI) and maintenance rule update	1.4 × 10-5
2007TM (Revision 1)	- Added internal flooding to the Level 1 model - Incorporated operator action dependencies - Expanded the treatment of common cause failures - Developed a more detailed CET and new Level 2 fault trees - Added new Level 1 system models including severe accident mitigation strategies such as firewater injection - Updated PSA model data - Developed initiator fault trees to calculate some initiating event frequencies, such as loss of turbine equipment cooling (TEC)	9.3 × 10-6

The CDF value from the 1993 CNS-1 IPE (8.9×10^{-5} per year) is near the upper end of the range of the CDF values reported in the IPEs for other boiling water reactor (BWR) 3/4 plants. Figure 11.2 of NUREG-1560 shows that the IPE-based total internal events CDF for BWR 3/4 plants, ranges from about 9×10^{-8} per year to 1×10^{-4} per year, with an average CDF for the group of 2×10^{-5} per year (NRC, 1997b). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The internal events CDF result for CNS-1 used for the SAMA analysis (9.3×10^{-6} per year) is comparable to other plants of similar vintage and characteristics.

The NRC staff considered the peer reviews performed for the CNS-1 PSA and the potential impact of the review findings on the SAMA evaluation. In the ER (NPPD, 2008), NPPD described the BWROG peer review of the 2007TM Revision 1 model conducted in May 2008. The peer review was performed using the NEI 05-04 process (NEI, 2007), the ASME PRA Standard (ASME, 2007), and NRC Regulatory Guide 1.200, Rev. 1 (NRC, 2007). The NRC staff asked NPPD to provide a summary of each of the peer review findings and an assessment of the impact of resolving each finding on the SAMA identification and analysis results (NRC, 2009). In response to this request, NPPD provided a table summarizing the peer review findings in relation to the applicable supporting requirements (SR) and an assessment of the impact of the resolution of the findings on the PSA results (NPPD, 2009a). The peer review identified 22 findings against the SR, including 10 classified as not met. The 10 not-met findings included documentation of analysis bases, PSA configuration control, identification of internal flooding mechanisms, and evaluation of human error dependencies. NPPD's review of the 22 peer review findings resulted in no changes to the PSA model and no impacts on the SAMA identification and analysis results. The NRC staff considers NPPD's rationale reasonable and that the final resolution of the peer review findings is not likely to impact the results of the SAMA analysis.

Because the CNS-1 internal events PSA model has been peer-reviewed and the peer review findings were all addressed, and NPPD has satisfactorily addressed NRC staff questions regarding the PSA, the NRC staff concludes that the internal events Level 1 PSA model is of sufficient quality to support the SAMA evaluation.

As indicated above, the current CNS-1 PSA does not include external events. In the absence of such an analysis, NPPD used the CNS-1 IPEEE to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below and in Section F.3.2.

The CNS-1 IPEEE was submitted in October 1996 (NPPD, 1996), in response to Supplement 4 of Generic Letter 88-20 (NRC, 1991). These submittals included a seismic margins analysis, an internal fire PSA, and evaluations of high winds, external flooding, and other hazards. While no fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events were identified, several opportunities for risk reduction were identified as discussed below. In a letter dated April 27, 2001, the NRC staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC, 2001).

The CNS-1 IPEEE used a focused scope Electric Power Research Institute (EPRI) seismic margins analysis which was completed in conjunction with the Seismic Qualification User's Group (SQUG) program (SQUG, 1992). This method is qualitative and does not provide numerical estimates of the CDF contributions from seismic initiators (EPRI, 1991). For this assessment, the review level earthquake (RLE) value for CNS-1 was specified by NRC to be 0.3g. Plant walkdowns were performed in which components and structures were screened for the RLE based on the EPRI guidelines, and specific high confidence low probability of failure (HCLPF) capacities were calculated for components and structures that did not screen out. All structures and all but six components were screened out, of which five were Unresolved Safety Issue (USI) A-46 program outliers. Several improvements were identified to address the six unscreened components and to reduce seismic risk. While some of these improvements have been implemented, all were addressed as SAMA candidates, as discussed in Section F.3.2. The NRC review and closure of USI A-46 for CNS-1 is documented in a letter dated September 30, 1999 (NRC, 1999).

To provide additional insight into the appropriate seismic CDF to use for the SAMA evaluation, the NRC staff developed an independent estimate of the seismic CDF for CNS-1 using the simplified-hybrid approximation method described in a paper by Robert P. Kennedy, entitled "Overview of Methods for Seismic PRA and Margin Analysis Including Recent Innovations" (Kennedy, 1999) and using updated 2008 seismic hazard curve data from the U.S. Geologic Survey (USGS, 2008). The NRC staff's independent calculations indicate the seismic CDF for CNS-1 to be approximately 6×10^{-6} per year depending on the seismic hazard curve and plant fragility assumptions. Since NPPD did not provide a seismic CDF contribution in the ER, the NRC staff used this result to assess the appropriateness of the external event multiplier used in the SAMA evaluation.

The CNS-1 IPEEE fire analysis employed a combination of PSA with the EPRI's fire-induced vulnerability evaluation (FIVE) methodology (EPRI, 1993). Fire compartments were initially qualitatively screened out if all compartment boundaries screened out according to Fire

Compartment Interaction Analysis (FCIA) criteria and if the compartment did not contain Appendix R equipment. Quantitative screening was then performed using fire frequencies based on the FIVE methodology and the assumption that fire failed all of the equipment in the compartment. The sequence was then quantified using the internal events PSA model. If the CDF was greater than 1×10^{-6} per year the compartment was subjected to more detailed analysis. In this analysis, the FIVE fire screening methodology was used in the fire modeling with one exception. The exception involved the partitioning of oil spill fires into large and small spills based on a recommendation in the “EPRI Fire PRA Implementation Guide” (EPRI, 1994). The total fire CDF, found by summing the values for all compartments, is 1.9×10^{-5} per year. The fire compartments having a fire CDF greater than 1×10^{-7} per year and their contributions to the fire CDF are listed in Table F-4.

In the ER, NPPD identifies a number of conservatisms in the fire analysis, including:

- The NRC fire events database indicates a trend toward lower frequency and less severe fires since the IPEEE fire analysis was performed.
- Because of little industry experience with crew actions following a fire, crew actions were conservatively characterized in the fire model.
- A fire that damaged a cable was assumed to always induce a conductor failure.
- Manual fire suppression was only credited in the control room and non-essential switchgear rooms.
- Hardware repair activities were not credited.

The NRC staff inquired about additional measures that NPPD had already taken to reduce fire risk since the IPEEE (NRC, 2009). NPPD provided a description of the measures taken in the four dominant fire compartments (3A-switchgear room 1F, 3B-switchgear room 1G, 10B-control room and security access control corridor, and 20A-SW pump room). These measures consisted primarily of improvements to monitoring and controlling the quantity of combustible materials and pre-staging of outage materials.

Table F-4. Cooper Nuclear Station Fire Compartments and Their Contributions to Fire Core Damage Frequency

Fire Compartment	Fire Compartment Description	CDF (per year)
10B	Control Room and Security Alarm Station (SAS) Corridor	3.7 × 10-6
3B	Switchgear Room 1G	2.7 × 10-6
20A	SW Pump Room	1.7 × 10-6
3A	Switchgear Room 1F	1.1 × 10-6
8-1	Condenser Pit Area	9.7 × 10-7
9A	Cable Spreading Room	8.2 × 10-7
2A/2C	Reactor Building El. 903’-6” – Control Rod Drive (CRD) Units – North/South	8.2 × 10-7
8G	DC Switchgear Room 1B	7.9 × 10-7
8B	Reactor Protection System (RPS) Room 1B	7.3 × 10-7
8F	Battery Room 1B	6.7 × 10-7
14A	Emergency Diesel Generator (EDG) Room 1A	6.1 × 10-7
14B	EDG Room 1B	6.1 × 10-7
7A	Residual Heat Removal Service Water (RHRSW) Booster and Service Air Compressor	5.6 × 10-7
4A/4C/4D	Reactor Building El. 958’-3” – Fuel Pool Heat Exchanger/Lube Oil	5.4 × 10-7
8A	Auxiliary Relay Room	3.7 × 10-7
9B	Cable Expansion Room	3.4 × 10-7
8H	DC Switchgear Room 1A	3.4 × 10-7
13B	Non-Critical Switchgear Room	3.3 × 10-7
3C/3D/3E	Reactor Building El. 932’-6” - REC	2.7 × 10-7
8E	Battery Room 1A	1.8 × 10-7
1F	Suppression Pool Area	1.7 × 10-7
12D	Turbine Building Floor – North 903’-6” El.	1.4 × 10-7
1B/1G	Core Spray (CS) and CRD Room	1.0 × 10-7
	Other Compartments	6.4 × 10-7
Total Fire CDF		**1.9 × 10-5**

Based on the conservatisms in the analysis and the actions taken by NPPD to reduce fire risk since the IPEEE, the NRC staff concludes that the fire CDF of 1.9×10^{-5} per year is reasonable for the SAMA analysis.

The CNS-1 IPEEE analysis of high winds, tornadoes, external floods and other external events followed the screening and evaluation approaches specified in Supplement 4 to GL 88-20 (NRC, 1991) and did not identify any sequences or vulnerabilities that exceeded the 1.0×10^{-6} per year criterion except for the design-basis tornado and a lightning strike to the control building (NPPD, 1996). Plant improvements were identified to address each of these issues and included as SAMA candidates, as discussed in Section F.3.2. The NRC staff concluded in the review of the CNS-1 IPEEE that the tornado missiles contribution to CDF is less than the screening criteria and that lightning did not pose a significant hazard to the plant (NRC, 2001).

Based on the aforementioned results, including the NRC staff assessment of the CNS-1 seismic CDF, the external events CDF is approximately two times the internal events CDF (based on a seismic CDF of 6×10^{-6} per year, a fire CDF of 1.9×10^{-5} per year, and an internal events CDF of 1.2×10^{-5} per year). Accordingly, the NRC staff concurred with NPPD's conclusion that the total CDF (from internal and external events) would be approximately three times the internal events CDF. In the SAMA analysis submitted in the ER, NPPD tripled the benefit that was derived from the internal events model to account for the combined contribution from internal and external events. The NRC staff agrees with the licensee's overall conclusion concerning the multiplier used to represent the impact of external events and concludes that the licensee's use of a multiplier of three to account for external events is reasonable for the purposes of the SAMA evaluation. This is discussed further in Section F.6.2.

The NRC staff reviewed the general process used by NPPD to translate the results of the Level 1 PSA into containment releases, as well as the results of the Level 2 analysis, as described in the ER and in response to NRC staff requests for additional information (NPPD 2008, 2009a). This model is an updated version of the model used in the IPE and reflects the CNS-1 configuration and design as of December 2007. Major revisions and updates to the Level 2 model include equipment performance data for failure rates and system unavailability, plant configuration changes, improved modeling techniques, inclusion of additional PDS bins to improve the Level 1and Level 2 PSA interface, and updated accident progression and source term analyses using a later version of the MAAP computer code. The Level 1 core damage sequences are binned into one of 15 PDS bins which provide the interface between the Level 1 and Level 2 analysis. The PDS, which are described in Table E.1-8 of the ER (NPPD, 2008), are defined by a set of functional characteristics for system operation which are important to accident progression, containment failure and source term definition. The Level 2 models utilize a single CET for each PDS with functional nodes representing both systemic and phenomenological events. The CET is used to determine the appropriate release category for each Level 2 sequence. CET nodes are evaluated using supporting fault trees and logic rules.

NPPD characterized the releases for the spectrum of possible radionuclide release scenarios using a set of 12 release categories based on the timing and magnitude of the release and whether or not the containment remained intact. The frequency of each release category was obtained by summing the frequency of the individual accident progression CET endpoints binned into the release category. The release characteristics for each release category were developed by grouping the hundreds of source terms generated for internal initiators into the 12 categories based on similar properties. Source term release fractions were developed for each of the 12 release categories using the results of 46 Modular Accident Analysis Program (MAAP 4.0.5) computer code calculations (NPPD, 2009a). In response to an NRC staff RAI, NPPD identified that for each CET sequence, a value for each of the release-to-environment mass fractions was obtained from the representative MAAP calculation (NPPD, 2009a). These mass fractions were then weighted according to the contribution of that sequence to the sum of the sequences in the end state bin. The final mass fraction representing the end state bin was the sum of these individual weighted mass fractions for each species. The release categories, their frequencies, and release characteristics are presented in Tables E.1-6 and E.1-7, E.1-9, and E.1-10 of the ER, respectively (NPPD, 2008).

The NRC staff noted that the iodine and cesium mass fractions for the low-low intermediate release category in Table E.1-10 of the ER are substantially less than the corresponding mass fractions for the low-low early and low-low late release categories and requested NPPD to provide an explanation for this apparent anomaly (NRC, 2009). In response, NPPD explained that the dominant sequences for the low-low intermediate release category involve offsite release via containment venting through an intact suppression pool, resulting in effective fission product scrubbing (NPPD, 2009a). In contrast, the dominant sequences for the low-low early and low-low late release categories involve release paths from the primary containment that bypass the suppression pool, resulting in much less fission product scrubbing than for the low-low intermediate release category. Consequently, the cesium and iodine mass fractions for the low-low intermediate release category will be less than that for the low-low early and low-low late release categories.

The NRC staff requested NPPD provide an explanation of the reasons for the difference in the total release frequency value of 1.2×10^{-5} derived from the CET and the Level 1 CDF value of 9.3×10^{-6} and to provide the rationale for using the total release frequency for the SAMA analysis (NRC, 2009). In response, NPPD indicated that (NPPD, 2009a):

- The total release frequency derived from the CET is larger than the Level 1 CDF because of the methodology used in the CET for deriving the split fraction values. The CET contains numerous paths that do not meet the rare event approximation criterion (e.g., split fractions > 5×10^{-2}) in the quantification approach used. For these paths, the sum of the split fractions for the corresponding failure and success branches is greater than 1.0 resulting in a conservatively high total CDF.

- Since the SAMA evaluation requires both Level 1 and 2 PSA results, NPPD chose the higher value from the CET as the basis for quantifying SAMA benefits.

NPPD concludes that use of the release frequency, rather than the Level 1 CDF, will have a negligible impact on the results of the SAMA evaluation because the delta risk calculation, performed to assess SAMA benefits, effectively cancels out the impact of the simplified model quantification methodology, and because the external event multiplier and uncertainty multiplier used in the SAMA analysis (discussed in Section F.6.2) have a much greater impact on the SAMA evaluation results than the small error arising from the model quantification approach. The NRC staff agrees with this conclusion.

The NRC staff's review of the Level 2 IPE concluded that it addressed the most important severe accident phenomena normally associated with the Mark I containment type, and identified no significant problems or errors (NRC, 1996). The changes to the Level 2 model since the IPE to update the methodology and to address peer review recommendations are described in Section E.1.4 of the ER. The Level 2 PSA model was included in the May 2008 BWROG peer review mentioned previously. Of the 22 peer review findings, one finding in the SR not-met category was related to identification of limitations in the LERF analysis that would impact applications. In response to an NRC staff RAI, NPPD reviewed this finding and determined that there were no limitations that would impact projected applications that are not already documented, and concluded that the finding would not impact the results of the SAMA analysis.

Based on the NRC staff's review of the Level 2 methodology, the fact that the Level 2 model was reviewed in more detail as part of the BWROG peer review and that the peer review findings do not impact the SAMA analysis, and the responses to the RAIs concerning the analysis and review process, the NRC staff concludes that the Level 2 PSA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

As indicated in the ER, the reactor core radionuclide inventory used in the consequence analysis was derived from ORIGEN2 calculations using a bounding core enrichment and burnup for CNS-1. A core power of 2,429 megawatt-thermal (MWt) was assumed to bound the licensed maximum power of 2,419 MWt for the CNS-1 Measurement Uncertainty Recapture power uprate approved by the NRC in 2008. The NRC staff requested additional information about the expected fuel burnup and management for the renewal period (NRC, 2009). NPPD responded that the bounding core inventory assumed an initial enrichment of 3.908 weight percent Uranium-235 and 1300 effective full-power days (EFPD) of continuous operation to achieve an end of cycle core average exposure of 35.8 Gwd/MT (NPPD, 2009a), and that this core inventory reflects the expected fuel management/burnup for the renewal period.

The NRC staff reviewed the process used by NPPD to extend the containment performance (Level 2) portion of the PSA to an assessment of offsite consequences (Level 3). This included consideration of the source terms used to characterize fission product releases for the applicable containment release categories and the major input assumptions used in the offsite consequence analyses. Version 1.13.1 of the MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within a 50-mile (80-km)) radius for the year 2034, emergency evacuation modeling, and economic data. This information is provided in Attachment E to the ER (NPPD, 2008).

NPPD used site-specific meteorological data for the five years, 2002 through 2006, as input into the MACCS2 code. NPPD averaged the data over this interval for this study. The data were collected from the onsite meteorological monitoring system and regional National Weather System (NWS) stations. Regional mixing heights were estimated using ground level and upper-air data collected at National Weather Service Station No. 94980 in Valley, Nebraska (NE) (approximately 76 miles(120 km) north-northwest of CNS-1) and Station No. 72553 in Falls City/Brenner, NE (approximately 19 miles (30 km) south of CNS-1). Missing data were estimated using data substitution methods. These methods include substitution of missing data with valid data from the previous hour, or valid data collected from other elevations on the meteorological tower. The NRC staff notes that previous SAMA analyses results have shown little variation resulting from year-to-year differences in meteorological data and concludes that the approach taken for collecting and applying the meteorological data in the SAMA analysis is reasonable.

The population distribution used by the licensee as input to the MACCS2 analysis was estimated for the year 2034 based on county-level projections obtained from the University of Nebraska Bureau of Business Research (UN, 2007), Woods & Poole Economics, Inc. for Iowa (Woods & Poole, 2006), Darrel Eklund, et. al. for Kansas (Eklund, 1999), and the Missouri Census Data Center (Missouri, 2007). Year 2004 tourist information was used to estimate the transient population for year 2005 (Global Insight, 2006; IDED, 2006; Kaylen, 2006; NDED, 2006). These data were used to project county-level populations using a regression method to extrapolate population projections to 2034. For the counties with population in decline, the population value for year 2014 was used, which corresponds to the license expiration date for CNS-1. The NRC staff considers the methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending out 10 miles (16 km) from the plant. NPPD assumed that 100 percent of the population would move at an average speed of approximately 19.5 miles per hour (mph) (8.7 meters per second (m/s)) with a delayed start time of 2.0 hours (NPPD, 2008). The evacuation speed and time were based on the average values identified in the Missouri and Nebraska time estimate studies. NPPD performed sensitivity analyses in which the evacuation delay time was increased to 4.0 hours, and the evacuation speed was decreased to 1.0 m/s. These sensitivity cases resulted in less than 1 percent and 2 percent increases in the total population dose, respectively. The 100 percent population evacuation assumption is slightly less conservative than the assumption used in NUREG-1150 study (NRC, 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone (EPZ). The NRC staff asked NPPD to address the potential impact on the population dose if 5 percent of the population fails to evacuate the EPZ (NRC, 2009). In response, NPPD performed a sensitivity analysis that showed only a slight increase in population dose (less than 1 percent for the late release) would result (NPPD, 2009a). The NRC staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data was obtained from the 2002 Census of Agriculture (USDA, 2002). These included the value of farm and non-farm wealth. Other generic data that applies to the region as a whole, such as the cost of evacuating and relocating people, land decontamination, and property decontamination, were obtained from the code manual for MACCS2 (NRC, 1997c) . The data from the MACCS2 code manual were inflation-adjusted using the consumer price index corresponding to the year 2006. Information on regional crops was obtained from the 2002 Census of Agriculture. Crops for each county were mapped into the seven MACCS2 crop categories.

The NRC staff concludes that the methodology used by NPPD to estimate the offsite consequences for CNS-1 provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDF and offsite doses reported by NPPD.

F.3. Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by NPPD are discussed in this section.

F.3.1. Process for Identifying Potential Plant Improvements

NPPD's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- Review of the most significant basic events from the current, plant-specific PSA,
- Review of potential plant improvements identified in the CNS-1 IPE and IPEEE,
- Review of SAMA candidates identified for license renewal applications for 11 other U.S. General Electric (GE) plants, and
- Review of other NRC and industry documentation discussing potential plant improvements.

Based on this process, an initial set of 244 candidate SAMAs, referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, NPPD performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- The SAMA modified features are not applicable to CNS-1,
- The SAMA has already been implemented at CNS-1, or
- The SAMA is similar in nature and could be combined with another SAMA candidate.

Based on this screening, 164 SAMAs were eliminated leaving 80 for further evaluation. The remaining SAMAs, referred to as Phase II SAMAs, are listed in Table E.2-2 of the ER (NPPD, 2008). In Phase II, a detailed evaluation was performed for each of the 80 remaining SAMA candidates, as discussed in Sections F.4 and F.6 below. To account for the potential impact of external events, the estimated benefits, based on internal events, were multiplied by a factor of three, as previously discussed.

F.3.2. Review of Nebraska Public Power District's Process

NPPD's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating event, and risk reduction worth (RRW) perspectives at CNS-1, and included selected SAMAs from prior SAMA analyses for other plants.

NPPD provided a tabular listing of the PSA basic events sorted according to their RRW (NPPD, 2008). SAMAs impacting these basic events would have the greatest potential for reducing risk. NPPD used an RRW cutoff of 1.005, which corresponds to about a 0.5 percent change in CDF given 100-percent reliability of the SAMA. This equates to a benefit of approximately $5,300 (after the benefits have been multiplied to account for external events). NPPD also provided and reviewed the LERF-based RRW events down to an RRW of 1.005.

NPPD correlated the top Level 1 and Level 2 events with the SAMAs evaluated in the ER, and showed that all of the significant basic events are addressed by one or more SAMAs (NPPD, 2008).

The NRC staff asked NPPD to provide the rationale for identifying candidate SAMAs for LERF-based success events (NRC, 2009). In response to the RAI, NPPD replied that, unlike SAMAs identified for the purpose of decreasing the risk of failure events, SAMAs identified for success events are intended to decrease the risk contribution from the cutsets or basic events related to the success event (NPPD, 2009a). NPPD further noted that SAMAs identified for success events are also identified for related failure events, and provided specific examples of this relationship. The staff finds NPPD's treatment of success events acceptable.

The NRC staff also asked NPPD to clarify how RRW was calculated for complementary events and to provide an assessment of the impact on the SAMA identification and evaluation process if complementary events were not directly coupled in the computation of RRW (NRC, 2009). NPPD responded that complementary events were directly coupled in the calculation of RRW, provided an example of this direct coupling, and concluded that since this coupling was performed correctly there is no impact on the SAMA identification and evaluation process (NPPD, 2009a). The NRC staff agrees that NPPD appropriately accounted for direct coupling of complementary events in the calculation of RRW.

The NRC staff requested clarification on the screening criteria used for the Phase I SAMAs because the ER was inconsistent in describing this process (NRC, 2009). NPPD responded that the criteria for screening Phase I SAMAs based on SAMA modifying features not applicable to CNS-1 is broader than this description suggests and includes; (1) SAMAs that have already been analyzed for CNS-1 and determined to be of low benefit, and (2) SAMAs that have been previously resolved with NRC based on further evaluation that determined that the modification was not necessary (NPPD, 2009).

For a number of the Phase II SAMAs listed in the ER, the information provided did not sufficiently describe the proposed modification. Therefore, the NRC staff asked the applicant to provide more detailed descriptions of the modifications for several of the Phase II SAMA candidates (NRC, 2009). In response to the RAI, NPPD provided the requested information on the modifications for SAMAs 20, 44, 45, 63, 70, 72, 73, 76, 77, and 80 (NPPD, 2009a).

NPPD considered the potential plant improvements described in the IPE and IPEEE in the identification of plant-specific candidate SAMAs for internal and external events. Although the IPE did not identify any vulnerabilities, seven potential enhancements to the plant, procedures, and training at CNS-1 were identified as part of the IPE process. The seven enhancements include (NPPD, 1993):

- Upgrading the plant-specific emergency operating procedures based on Revision 4 of the BWROG Emergency Procedure Guidelines,
- Performing a load study to relax the assumed four-hour battery lifetime and provide a procedure to improve battery loading schemes,
- Providing a procedure to bypass the AC solenoid valve on the nitrogen supply line to the SRVs,

- Providing a diesel-driven fire water pump or other similar source of low pressure water independent of AC power,
- Improving the reliability of the high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) systems,
- Providing a backup for the SW pumps by modifying the existing system and making procedural changes, and
- Providing improved drywell spray capability.

NPPD noted that the first four of these enhancements have already been implemented at CNS-1 and the remaining three enhancements are addressed by SAMAs. The fifth enhancement, to improve the reliability of the HPCI and RCIC systems, as addressed by Phase II SAMA 35, “provide a redundant train or means of ventilation,” and SAMA 67, “improve the reliability of the HPCI and RCIC systems by upgrading their control systems.” The sixth enhancement, to provide a backup for the SW pumps, as addressed by Phase II SAMA 68, “proceduralize the ability to cross-connect the circulating water pumps and the SW going to the TEC heat exchangers.” The last enhancement, to provide an improved drywell spray capability, was judged to be already implemented at CNS-1 where the fire water system is used as a backup source for the drywell spray system. Nevertheless, NPPD further addressed this enhancement with Phase II SAMA 47, “install a passive drywell spray system to provide a redundant drywell spray method.”

Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER, together with those identified in response to NRC staff RAIs, addresses the major contributors to internal event CDF.

Several seismic-related improvements were identified in the CNS-1 IPEEE. The specific seismic interaction issues are as follows (NPPD, 1996):

- Potential relay chatter at low seismic levels for ten relays,
- Potential impact of the 480V critical switchgear 1G with an adjacent concrete beam,
- Potential seismic interaction of the solatron/accuvolt line conditioners with a stairway supported by a masonry wall,
- Potential inadequate seismic capacity for the SE and NE quad recirculation fans,
- Potential impact of the jet pump instrument rack A with an adjacent rack,
- Inadequate anchorage capacity for loose equipment in the control room and lack of support for the overhead lighting diffusers,
- Inadequate anchorage for the aux relay room panels,

- Inadequately braced unistrut trapeze frame in the northeast corner of elevation 903 feet of the reactor building, and
- Loose bolt securing one corner of an interior panel of the SW pump B & D strainer control panel.

All of these were identified as Phase I SAMAs but have already been implemented or previously resolved under the USI A-46 Program (NRC, 2001). As a result, no Phase II SAMAs were identified to address these issues. The CNS-1 IPEEE seismic/fire interaction evaluation did conclude that the CNS-1 water-based fire protection systems were vulnerable to a seismic event. This vulnerability was addressed by Phase II SAMA 69, "upgrade the seismic capacity of the diesel fire pump fuel tank and water supply tank." The NRC staff concludes that the opportunity for seismic-related SAMAs has been adequately explored and that it is unlikely that there are additional potentially cost-beneficial, seismic-related SAMA candidates.

The CNS-1 IPEEE fire assessment concluded that the four fire compartments (Control Room and SAS Corridor, Switchgear Rooms 1F and 1G, and SW Pump Room) that did not screen out based on having a fire CDF of less than 1.0×10^{-6} per year represent vulnerabilities (NPPD, 1996). Two plant improvements were identified to address these risk contributors:

- Addition of a feature to allow remote control of the switchyard breakers from the control room, or to have a pre-planned recovery/repair action for control of the switchyard breakers following a fire, and
- Provide a diverse water supply for the SW system.

Both of these were identified as Phase I SAMAs. As indicated in the ER, an evaluation of improvements for control of the switchyard breakers showed a decrease in CDF of less than 0.5 percent, therefore, this change was not implemented or evaluated as a Phase II SAMA. The second improvement was evaluated as Phase II SAMA 68, "proceduralize the ability to cross-connect the circulating water pumps and the SW pumps going to the TEC heat exchangers." NPPD also identified two additional Phase II SAMAs to reduce the fire CDF in dominant fire zones without suppression and in the control room: (1) SAMA 63, "add automatic fire suppression systems to the dominant fire zones," and (2) SAMA 65, "upgrade the ASDS panel to include additional system controls for the opposite division." The NRC staff concludes that the opportunity for fire-related SAMAs has been adequately explored and that it is unlikely that there are additional potentially cost-beneficial, fire-related SAMA candidates.

As stated earlier, other external hazards (e.g., high winds, external floods, transportation and nearby facility accidents) are below the threshold screening frequency and are not expected to impact the conclusions of the SAMA analysis. Nevertheless, two plant improvements were identified to address the risk contribution from tornados and lightning:

- Protect the diesel generator exhaust system from tornado-generated missiles, and
- Reduce the potential vulnerability of the control building to a lightning-induced loss of offsite power that also affects the station batteries.

Both were identified as Phase I SAMAs. The first, Phase I SAMA 232, “protect the diesel exhaust from tornado missiles,” has already been implemented at CNS-1. The NRC inquired about this SAMA being described as resolved in 1998, while the IPEEE SER stated that the issue had yet to be addressed. NPPD responded that the matter was resolved by a letter from NPPD to NRC in 2001 clarifying that the modification was in fact completed in 1998. The second improvement was further evaluated and it was determined that the control building was not vulnerable to a lightning-induced loss of offsite power which might affect the station batteries.

The NRC staff questioned NPPD about lower cost alternatives to some of the SAMAs evaluated (NRC, 2009), including:

- Providing additional space cooling to the RHRSW booster pump rooms, CS pump rooms, residual heat removal (RHR) pump rooms, SW pump rooms, and HPCI pump room via the use of portable equipment,
- Improving alternate shutdown training and equipment,
- Enhancing DC power availability (provide cables from diesel generators or another source to directly power battery chargers),
- Developing guidance/procedures for local, manual control of reactor core isolation cooling following loss of DC power, and
- Enhancing manual venting of containment using either a local hand wheel or gas bottle supplies as a possible alternative for containment pressure control.

In response to the RAIs, NPPD addressed the suggested lower cost alternatives (NPPD, 2009a). This is discussed further in Section F.6.2.

The NRC staff notes that the set of SAMAs submitted is not all-inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the NRC staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated when the subsidiary costs associated with maintenance, procedures, and training are considered.

The NRC staff concludes that NPPD used a systematic and comprehensive process for identifying potential plant improvements for CNS-1, and that the set of SAMAs evaluated in the ER, together with those evaluated in response to NRC staff inquiries, is reasonably comprehensive and, therefore, acceptable. This search included reviewing insights from the plant-specific risk studies and reviewing plant improvements considered in previous SAMA analyses. While explicit treatment of external events in the SAMA identification process was limited, it is recognized that the prior implementation of plant modifications for fire risks and the absence of external event vulnerabilities reasonably justifies primarily examining the internal events risk results for this purpose.

F.4. Risk Reduction Potential of Plant Improvements

NPPD evaluated the risk-reduction potential of the 80 remaining SAMAs that were applicable to CNS-1. The majority of the SAMA evaluations were performed in a bounding fashion—the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement. On balance, such calculations overestimate the benefit and are conservative.

NPPD used model requantification to determine the potential benefits. The CDF, population dose, and offsite economic cost reductions were estimated using the CNS-1 2007TM model, Rev. 1. The changes made to the model to quantify the impact of SAMAs are detailed in Section E.2.3 of Attachment E to the ER (NPPD, 2008). Table F-5 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk. The estimated benefits reported in Table F-5 reflect the combined benefit in both internal and external events. The determination of the benefits for the various SAMAs is further discussed in Section F.6.

The NRC staff questioned the assumptions used in evaluating the benefits or risk reduction estimates of certain SAMAs provided in the ER (NRC, 2009). For example, for SAMA 6, “change the time available to recover offsite power to 24 hours,” the NRC staff requested clarification on the modeling assumption provided in ER Table 2-2 for this SAMA, which is inconsistent with the modeling assumption for analysis Case 6, “set failure probability to transfer the RPS panels to their alternate power source to zero” (NRC, 2009). In response to the RAI, NPPD clarified that the modeling assumption for SAMA 6, as provided in Table 2-2 of the ER, was incorrect and should have been the same as described for Case 6. The correct modeling assumption was used in the cost benefit analysis (NPPD, 2009a).

For SAMA 14, “portable generator for DC power to supply individual panels,” the NRC staff asked NPPD to clarify the rationale for using the modeling assumption for Case 14, which was to set the CDF contribution due to unavailability of the HPCI system to zero in the Level 1 PSA model (NRC, 2009). In response to the RAI, NPPD explained that the benefit of providing an alternate DC power source to HPCI to support emergency core cooling was judged to be larger than the benefit of providing an alternate DC power source to other panels based on: (1) the importance of HPCI in intermediate LOCA sequences, and (2) the fact that the turbine-driven HPCI pump can continue to run in SBO sequences as long as DC control power is available (NPPD, 2009a). The NRC staff further asked NPPD to explain the large CDF reduction for this SAMA (32 percent) when the CDF contribution from HPCI unavailability due to test and maintenance is only 3 percent. In response to the RAI, NPPD responded that the evaluation of this SAMA conservatively assumes HPCI never fails, which eliminates the CDF contribution from all events contributing to HPCI unavailability, not just the test and maintenance event. Other contributing events include loss of DC power, failure of the turbine-driven HPCI pump to start or continue to run, failure of HPCI hydraulic valve HO10, and failure to bypass the HPCI high temperature trip. The NRC staff considers the assumptions, as clarified, to be reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff questioned how the modeling assumption of eliminating failure of the diesel-driven fire pump in the Level 1 PSA model for SAMA 69, “upgrade the seismic capacity of the diesel fire pump fuel tank and water supply tank,” addresses the intent of this SAMA, which is to mitigate seismic risk (NRC, 2009). In response to the RAI, NPPD explained that while the diesel fire pump may be needed to fight a fire following a seismic or fire event, its contribution to preventing core damage is from its dual function of providing an alternate source of water for core cooling. NPPD further argued that the estimated risk reduction benefit for this SAMA is conservative since the analysis credited the benefit from internal events risk reduction, in addition to the benefit from external events risk reduction, through use of the external events multiplier (NPPD, 2009a). The NRC staff agrees that the resulting benefit estimate is conservative since there would be no reduction in internal events risk from implementation of the SAMA.

The NRC staff requested clarification on how SAMA 70, “install a curb to prevent debris from spreading across the floor and contacting the shell,” reduces CDF as indicated in the ER (NRC, 2009). In response to the RAI, NPPD explained that SAMA 70 does not impact Level 1 CDF and that the CDF reduction value reported in the ER for this SAMA is actually based on the release frequency reduction for this SAMA (NPPD, 2009a). In a follow-up response to the NRC staff RAI, NPPD further clarified that the analysis of this SAMA resulted in about a 12 percent reduction in the frequency for the large early release category, and that this was treated as a 12 percent reduction in CDF in assessing the benefits for this SAMA (NPPD, 2009b). NPPD indicated that a more accurate assessment of SAMA 70 would require modifying the CET and that the approach taken results in a conservative estimate of the benefits for this SAMA. Although this approach is not consistent with regulatory analysis methodology, the NRC staff agrees that the resulting benefit estimate would be conservative since a reduction in CDF would result in averted onsite costs that would not be included otherwise for the SAMA. NPPD also noted that this analysis methodology was unique to SAMA 70 and does not impact the evaluation of other SAMAs.

For SAMA 75, “Generation Risk Assessment (GRA) implementation into plant activities,” the NRC staff asked for additional clarification of the SAMA and justification for the assumed factor of two reduction in the initiating event frequencies impacted by this SAMA (NRC, 2009). In response to the RAI, NPPD explained that GRA is a new program to identify plant components most likely to result in a plant trip, insights from which are used to identify and reevaluate maintenance and operational practices to reduce the likelihood of future plant trips. NPPD further explained that the GRA program was only recently piloted by CNS-1 for EPRI and that the factor of two is based on recent plant operating history and opinion based on NPPD’s experience in the GRA process. The NRC staff considers the assumptions, as clarified, to be reasonable and acceptable for purposes of the SAMA evaluation.

For two of the SAMAs that specifically address fire events (i.e., SAMA 63, “add automatic fire suppression systems to the dominant fire zones,” and SAMA 65, “update the alternate shutdown system (ASDS) panel to include additional system controls for opposite division,” the reduction in fire CDF and population dose was not directly calculated (in Table F-5 these are noted as “Not Estimated”). For these SAMAs, a bounding estimate of the impact was made by assuming the SAMA would eliminate the contribution to fire CDF from fires in the dominant fire zones in SAMA 63 and the control room in SAMA 65. The dominant fire zones in SAMA 63 are those having a fire CDF greater than 1.0×10^{-6} per year. Based on information from the IPEEE, the dominant fire zones are switchgear rooms 1F and 1G, the main control room, and the SW pump room. Based on logic in Section E.2.3 of the ER, only switchgear rooms 1F and 1G would benefit from the addition of automatic fire suppression systems. The benefit or averted cost risk from eliminating the risk in these fire zones is then calculated by multiplying the ratio of the fire zone CDF to the internal events CDF by the total present dollar-value equivalent associated with completely eliminating severe accidents from internal events at CNS-1. These SAMAs were assumed to have no additional benefits in internal events.

The NRC staff has reviewed NPPD's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on NPPD's risk reduction estimates.

F.5. Cost Impacts of Candidate Plant Improvements

NPPD estimated the costs of implementing the 80 candidate SAMAs through the application of engineering judgment and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include maintenance and surveillance costs of the installed equipment (NPPD 2008, 2009a). The cost estimates provided in the ER did not account for inflation, which is considered another conservatism.

The NRC staff reviewed the bases for the applicant's cost estimates (presented in Section E.2 of Attachment E to the ER). For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The NRC staff noted that several of the cost estimates provided by the applicant were drawn from previous SAMA analyses for a dual-unit site. For those cost estimates that were taken from a dual-unit SAMA analysis, NPPD reduced the estimated costs by one-half. In response to an RAI requesting a more detailed description of the changes associated with SAMAs 20, 44, 45, 63, 70, 72, 73, 76, 77, and 80, NPPD provided additional information detailing the analysis and plant modifications included in the cost estimate of each improvement (NPPD, 2009a). The staff reviewed the costs and found them to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The NRC staff requested additional clarification on the estimated cost of $1,200,000 for implementation of SAMA 41, “provide ability to align diesel power to more air compressors,” which is high for what is described as a procedural modification (NRC, 2009). In response to the RAI, NPPD further described this modification as involving electrical, mechanical, and structural hardware modifications, in addition to the procedural changes (NPPD, 2009a). Based on this additional information, the NRC staff considers this estimated cost to be reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff concludes that the cost estimates provided by NPPD are sufficient and appropriate for use in the SAMA evaluation.

Table F-5. Severe Accident Mitigation Alternatives Cost/Benefit Screening Analysis for Cooper Nuclear Station[a]

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Increase Availability of DC Power	Increase time available to recover offsite power (before HPCI and RCIC are lost) to 24 hours during SBO scenarios.	3	3	32K	97K	
1 – Provide additional DC battery capacity.						500K
2 – Replace lead-acid batteries with fuel cells.						1.0M
13 – Portable generator for DC power to supply the battery chargers.						200K
21 – Modify plant procedures to allow use of a portable power supply for battery chargers.						Included in SAMA 13(b)
Improve DC Battery Charging Reliability	Eliminate all common cause failures due to loss of DC battery chargers.	<1	0	2.3K	7.0K	
3 – Add battery charger to existing DC system.						90K
15 – Proceduralize battery charger high-voltage shutdown circuit inhibitor.						50K
Improve DC Power Availability and Reliability						
4 – Provide DC bus cross-ties for the 250V buses.	Eliminate failure of the 250V DC buses.	0	0	0	0	300K
19 – Modify plant procedures to use existing 125V DC bus cross-ties.	Eliminate failure of the operator to use the 125V DC bus cross-tie.	<1	0	2.0K	6.0K	25K
Improve Availability of the 120V Vital AC Bus						
5 – Provide additional DC power to the 120/240V vital AC system.	Eliminate failure of providing DC power to the no break power panel (NBPP).	~0	0	470	1.4K	>100K
6 – Add an automatic feature to transfer the 120V vital AC bus from normal to standby power.	Eliminate failure to transfer the reactor protection system (RPS) panels to their alternate power source.	0	0	0	0	500K

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Increase Availability of Onsite AC Power	Eliminate failure of the EDGs.	13	14	140K	430K	
7 – Provide an additional diesel generator.						20M
10 – Install a gas turbine generator.						2.0M
Increase Reliability of EDGs						
11 – Add a new backup source for diesel cooling.	Eliminate failure of providing SW cooling to the EDGs.	5	3	45K	130K	2.0M
16 – Provide a portable EDG fuel oil transfer pump.	Eliminate failure of the EDG fuel oil transfer pumps.	<1	<1	6.2K	19K	100K
Improve Availability of AC Power	Eliminate failure of the 4.16-kV buses.	3	5	35K	110K	
8 – Improve 4.16-kV bus cross-tie ability.						660K
17 – Provide alternate feeds to essential loads directly from an alternate emergency bus.						220K
Reduce Probability of Loss of Offsite Power During Severe Weather	Eliminate the weather-centered loss of offsite power initiating event.	4	4	43K	130K	
9 – Install an additional, buried offsite power source.						2.5M
12 – Bury offsite power lines.						1.1B
Reduce Plant-Centered Loss of Offsite Power	Eliminate the plant-centered loss of offsite power initiating event.	~0	0	610	1.8K	
18 – Protect transformers from failure.						780K
Improve Reliability of the Direct Torus Vent Valves	Eliminate failure to power the hard pipe torus vent valves.	4	13	77K	230K	
20 – Provide redundant power to direct torus hard pipe vent valves.						710K

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Increase Availability of High Pressure Injection	Eliminate the CDF contribution from unavailability of the HPCI system.	32	22	300K	910K	
14 – Portable generator for DC power to supply the individual panels (using available skid-mounted portable AC generator).						710K
22 – Install an independent active or passive high pressure injection system.						1.0M
23 – Provide an additional high pressure injection pump with independent diesel.						1.0M
Extend RCIC Operation	Eliminate failures due to the RCIC backpressure trip.	4	<1	29K	86K	
24 – Raise HPCI/RCIC backpressure trip set points.						>200K
25 – Revise procedure to allow bypass of RCIC turbine exhaust pressure trip.						25K
Improve Reliability of the Automatic Depressurization System (ADS)	Eliminate failure of the ADS accumulators.	0	0	0	0	
26 – Modify ADS components by adding larger accumulators.						>100K
Improve Reliability of the SRVs	Eliminate failure to open the SRVs when required by reactor pressure vessel overpressure conditions.	19	<1	140K	410K	
27 – Add signals to open SRVs automatically in a main steam isolation valve (MSIV) closure transient.						1.5M
Increase Availability of Low Pressure Injection	Eliminate failure of the low pressure injection system.	55	63	600K	1.8M	
28 – Add a diverse low pressure injection system.						8.8M

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Emergency Core Cooling System (ECCS) Low Pressure Interlock	Eliminate failure of the low pressure interlock circuitry.	24	6	190K	570K	
29 – Install a bypass switch to allow operators to bypass the low reactor pressure interlock circuitry.						1.0M
Improve Reliability of HPCI and RCIC	Eliminate failure of the HPCI and RCIC turbine driven pumps.	6	0	42K	130K	
67 – Upgrade the HPCI and RCIC control systems.						430K
Improve Reliability/Redundancy of Steam Tunnel HVAC	Eliminate failure of the steam tunnel HVAC condenser and eliminate the group 1 isolation (closure of the MSIVs) initiating event.	3	1	27K	80K	
76 – Improve steam tunnel HVAC reliability/redundancy.						>100K
Improve Reliability of ECCS Equipment	Eliminate failure of the auto-start features for the ECCS equipment.	1	0	9.3K	28K	
77 – Improve reliability of auto-start features for the ECCS equipment.						>100K
Improve Reliability of Alternate Injection						
78 – Improve training on providing alternate injection via FPS.	Reduce failure of operator actions to provide alternate injection via the fire water system by a factor of two to 5.0E-02 for events FPS-XHE-FO-DFPAL and FPS-XHE-FO-RPVIN and to 9.5E-03 for event FPS-XHE-FO-DISEL.(c)	5	4	53K	160K	25K
32 – Include the RHRSW and fire water cross-tie valves in the maintenance program.	Eliminate the CDF contribution due to the SW cross-tie valves that are not contained in the maintenance program.	~0	0	360	1.1K	50K
33 – Create ability for emergency connection of existing or new water sources to feedwater and condensate systems.	Eliminate the CDF contribution due to loss of feedwater and condensate systems as alternate injection paths.	38	46	430K	1.3M	25K

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Increase Availability of the RHR Heat Exchangers 30 – Revise procedures to allow manual alignment of the fire water system to RHR heat exchangers.	Eliminate failure of SW to provide cooling to the RHR heat exchangers.	21	16	200K	600K	25K
Improve Reliability of Emergency SW System	Eliminate all common cause failures due to loss of SW system pumps.	<1	0	3.2K	9.5K	
31 – Add an additional SW pump.						5.9M
Increase Availability of the TEC Heat Exchangers 68 – Proceduralize the ability to cross-connect the circulating water pumps and the SW going to the TEC heat exchangers.	Eliminate failure of the SW to provide cooling to the TEC heat exchangers.	15	20	180K	530K	50K
Improve Reliability of Main Feedwater System 34 – Add a motor-driven feedwater pump.	Eliminate failure of feedwater turbine-driven pumps.	~0	0	90	270	1.7M
Increase Availability of the Condensate Storage Tank (CST) 72 – Provide a means of automatically preventing drain-down of CST to hotwell during a SBO.	Eliminate the CDF contribution from operator failure to prevent CST inventory drain-down to the hotwell.	2	2	21K	63K	230K
Increase Availability of Room Cooling 35 – Provide a redundant train or means of ventilation.	Eliminate failure of room cooling to the RHRSW booster pump rooms.	4	3	38K	120K	2.2M

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Increase Availability of EDG System	Eliminate failure of the EDG HVAC.	3	3	33K	99K	
36 – Add a diesel building high temperature alarm or redundant louver and thermostat.						1.3M
38 – Install diverse set of EDG HVAC fan actuation logic.						100K
39 – Install additional fan and louver pair for EDG heating, ventilation, and air conditioning.						6.0M
40 – Revise operator procedures to provide additional space cooling to the EDG room via the use of portable equipment.						25K
Improve Diagnosis of a Loss of Switchgear HVAC	Eliminate failure of room cooling to the critical switchgear rooms.	0	0	0	0	
37 – Add a switchgear room high temperature alarm.						400K
Increase Reliability of Instrument Air	Eliminate failure of the instrument air compressors.	17	14	170K	500K	
41 – Provide ability to align diesel power to more air compressors.[(d)]						1.2M
42 – Replace service and instrument air compressors with more reliable compressors which have self-contained air cooling by shaft driven fans.						1.4M
45 – Provide an alternate means of supplying the instrument air header.						100K
Extend SRV Operation Time	Eliminate failure of loss of nitrogen and air to the SRVs.	0	0	0	0	
43 – Install nitrogen bottles as backup gas supply for SRVs.						>100K

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Improve Availability of SRVs and MSIVs	Eliminate failure of nitrogen, air, and accumulators for the SRVs and MSIVs.	17	21	190K	570K	
44 – Improve SRV and MSIV pneumatic components.						1.5M
Improve Reliability of the Decay Heat Removal System – Torus Cooling	Eliminate loss of torus cooling mode of RHR and RHRSW system events.	35	37	370K	1.1M	
46 – Install an independent method of suppression pool cooling.						5.8M
71 – Upgrade existing equipment to transfer water from the torus to the radwaste system.						11M
73 – Provide ability to maintain suppression pool temperature lower.						1.3M
Improve Reliability of the Decay Heat Removal System – Drywell Spray	Eliminate loss of drywell sprays mode of RHR and RHRSW system events.	17	55	320K	960K	
47 – Install a passive drywell spray system to provide a redundant drywell spray method.						5.8M
Improve Reliability of Fission Product Scrubbing	Reduce accident progression source terms by a factor of two (excluding noble gases).	0	25	89K	270K	
48 – Install a filtered containment vent.						1.5M
49 – Enhance fire protection system and/or standby gas treatment system hardware and procedures.						2.5M
Improve Reliability of Containment Venting	Eliminate failure of the operator to control the venting evolution.	~0	0	35K	110K	
50 – Modify containment venting procedure to control containment venting within a narrow band.						250K

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Improve Reliability of Vacuum Breakers	Eliminate failure of the vacuum breakers.	1	4	23K	69K	
51 – Install improved vacuum breakers (redundant valves in each line).						500K
Improve Reliability of Containment Overpressure Relief	Eliminate failure of the hard pipe vent.	7	22	130K	380K	
52 – Provide passive overpressure relief by changing the containment vent valves to “fail open” and improving the strength of the rupture disk.						1.0M
53 – Install an alternate path to the torus hard pipe vent via the wet well using a rupture disk.						5.7M
Improve Reliability of Debris Barriers	Eliminate the CDF contribution due to failure of the drywall (DW) barriers to prevent debris from contacting the shell.	12	40	230K	680K	
70 – Install a curb to prevent debris from spreading across the floor and contacting the shell.						840K
Reduce Probability of an Interfacing Systems Loss of Coolant Accident (ISLOCA)	Eliminate all ISLOCA initiating events.	<1	1	8.6K	26K	
54 – Increase frequency of valve leak testing.						100K
56 – Revise emergency operating procedures (EOPs) to improve ISLOCA identification.						50K
57 – Improve operator training on ISLOCA coping.						110K
Improve Reliability of MSIVs	Eliminate failure of the MSIVs to close or remain closed.	<1	0	2.7K	8.2K	
55 – Improve MSIV design to decrease the likelihood of containment bypass scenarios.						1.0M

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Improve Reliability of the Standby Liquid Control (SLC) System	Eliminate the CDF contribution due to failure to initiate SLC and failures due to the boron concentration being too low.	<1	2	12K	37K	
58 – Increase boron concentration in the SLC system.						>50K
Improve Availability of Boron Injection	Eliminate failure of the SLC system.	1	4	22K	67K	
59 – Add an independent boron injection system.						>100K
60 – Provide ability to use the CRD for alternate boron injection.						150K
Improve SRV Reseat Reliability	Eliminate failure of the SRVs to reseat.	1	<1	11K	32K	
61 – Increase reliability of SRV to reseat after SLC injection.						2.2M
Reduce Probability of Internal Flooding						
62 – Improve internal flooding procedures.	Eliminate failure of the operator to implement flood mitigation measures.	2	2	17K	52K	460K
74 – Provide flow diversion to help mitigate the fire water pipe break in the control building ground floor corridor.	Eliminate failure to isolate the large and medium fire water pipe breaks in the control building ground floor corridor.	<1	0	2.0K	6.1K	>100K
Increase Reliability of the Fire Water System	Eliminate failure of the diesel-driven fire pump.	3	2	27K	82K	
64 – Proceduralize the use of a fire pumper truck to pressurize the fire water system.						50K
69 – Upgrade the seismic capacity of the diesel fire pump fuel tank and water supply tank.						>100K
Improve Fire Suppression Capability	Eliminate the fire CDF contribution from critical Switchgear Rooms 1F and 1G.	Not Estimated		120K	350K	
63 – Add automatic fire suppression systems to the dominant fire zones.						375K

SAMA	Modeling Assumptions	% Risk Reduction		Total Benefit ($)		Cost ($)
		CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
Reduce Risk from Fires that Require Control Room Evacuation 65 – Upgrade the alternate shutdown system (ASDS) panel to include additional system controls for Division 1 equipment.	Eliminate the fire CDF contribution from the main control room.	Not Estimated		110K	340K	790K
Reduce Probability of Large Break LOCA	Eliminate all large break LOCA initiating events.	1	3	19K	58K	
66 – Provide digital large break LOCA protection.						100K
Reduce Frequency of Plant Trips and Shutdowns 75 – Include Generation Risk Assessment (trip and shutdown modeling) in plant activities.	Reduce the probability of all initiating events except pipe breaks, floods, and loss of offsite power (LOOP) by a factor of two.	39	35	390K	1.2M	500K
Improve Availability of RHRSW System 79 – Modify procedures to allow use of the RHRSW system without a service water booster pump (SWBP).	Eliminate failure to use the RHRSW system without a SWBP.	11	10	110K	330K	25K
Improve Plant Identification of Reference Leg Leakdowns 80 – Install additional instrumentation to assist in identifying a reference leg leakdown.	Eliminate failure of cognitive recognition of a leakdown of the reference legs.	1	0	5.3K	16K	>100K

(a) SAMAs in bold are potentially cost-beneficial

(b) In response to an NRC staff RAI, NPPD clarified that SAMA 21 was originally included as a unique SAMA because it was believed that a suitable, existing portable power supply was available to supply the battery chargers (NPPD, 2009a). However, after further investigation, it was determined that the available skid-mounted portable power supply is not sufficient to supply the battery chargers and that a portable power supply would need to be purchased (which is the same as SAMA 13).

(c) Modeling assumption information provided in response to NRC staff RAI 6d (NPPD, 2009a).

(d) SAMA title changed in response to NRC staff RAI 6e (NPPD, 2009a).

F.6. Cost-Benefit Comparison

NPPD's cost-benefit analysis and the NRC staff's review are described in the following sections.

F.6.1. Nebraska Public Power District's Evaluation

The methodology used by NPPD was based primarily on NRC's guidance for performing cost-benefit analysis (i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook)* (NRC, 1997a). The guidance involves determining the net value for each SAMA according to the following formula:

Net Value =(APE + AOC + AOE + AOSC) - COE where,

APE = present value of averted public exposure ($)

AOC = present value of averted offsite property damage costs ($)

AOE = present value of averted occupational exposure costs ($)

AOSC = present value of averted onsite costs ($)

COE = cost of enhancement ($)

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. NPPD's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed, one at 3 percent and one at 7 percent (NRC, 2004). NPPD provided a base set of results using the 7 percent discount rate and a sensitivity study using the 3 percent discount rate (NPPD, 2008).

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem per year)

x monetary equivalent of unit dose ($2,000 per person-rem)

x present value conversion factor (10.76 based on a 20-year period with a 7-percent discount rate)

As stated in NUREG/BR-0184 (NRC, 1997a), the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NPPD calculated an APE of approximately $46,000 for the 20-year license renewal period (NPPD, 2008).

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction

x offsite economic costs associated with a severe accident (on a per-event basis)

x present value conversion factor

This term represents the sum of the frequency-weighted offsite economic costs for each release category, as obtained for the Level 3 risk analysis. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NPPD calculated an annual offsite economic cost of about $7,000 based on the Level 3 risk analysis. This results in a discounted value of approximately $75,000 for the 20-year license renewal period (NPPD, 2008).

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction

x occupational exposure per core damage event

x monetary equivalent of unit dose

x present value conversion factor

NPPD derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC, 1997a). Best estimate values provided for immediate occupational dose (3,300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2,000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NPPD calculated an AOE of approximately $4,400 for the 20-year license renewal period (NPPD, 2008).

Averted Onsite Costs

Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. NPPD derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184, the regulatory analysis handbook (NRC, 1997a).

NPPD divided this cost element into two parts – the onsite cleanup and decontamination cost, also commonly referred to as averted cleanup and decontamination costs (ACC), and the replacement power cost.

ACC were calculated using the following formula:

ACC = Annual CDF reduction
x present value of cleanup costs per core damage event
x present value conversion factor

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in NUREG/BR-0184 to be \$1.5 x 10^9 (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NPPD calculated an ACC of approximately \$134,000 for the 20-year license renewal period.

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction
x present value of replacement power for a single event
x factor to account for remaining service years for which replacement power is required
x reactor power scaling factor

NPPD based its calculations on the 910 megawatt-electric (MWe) reference plant in NUREG/BR-0184 (NRC, 1997b), and did not scale down to the 830 MWe rating for CNS-1. Therefore, NPPD did not apply a power scaling factor to determine the replacement power costs, which are conservative. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NPPD calculated an RPC of approximately \$91,000 and an AOSC of approximately \$225,000 for the 20-year license renewal period (NPPD, 2008).

Using the above equations, NPPD estimated the total present dollar-value equivalent associated with completely eliminating severe accidents from internal events at CNS-1 to be about \$351,000. Use of a multiplier of 3 to account for external events increases the value to \$1.05M and represents the dollar-value associated with completely eliminating all internal and external event severe accident risk at CNS-1, also referred to as the Modified Maximum Averted Cost Risk (MMACR).

<u>NPPD's Results</u>

If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. In the baseline analysis contained in the ER (using a 7 percent discount rate) NPPD identified eight potentially cost-beneficial SAMAs. The potentially cost-beneficial SAMAs are:

- SAMA 25 – Develop procedures to allow bypass of the reactor core isolation cooling (RCIC) turbine exhaust pressure trip, extending the time available for RCIC operation.
- SAMA 30 – Revise procedures to allow manual alignment of the fire water system to the RHR heat exchangers, providing improved ability to cool the RHR heat exchangers in a loss of SW.

- SAMA 33 – Provide for the ability to establish an emergency connection of existing or new water sources to feedwater and condensate systems, increasing availability of feedwater.

- SAMA 40 – Revise procedures to provide additional space cooling to the EDG room via the use of portable equipment, increasing availability of the EDG.

- SAMA 45 – Provide an alternate means of supplying the instrument air header, increasing availability of instrument air.

- SAMA 68 – Revise procedures to allow the ability to cross-connect the circulating water pumps and the SW going to the TEC heat exchangers, allowing continued use of the power conversion system after SW is lost.

- SAMA 78 – Improve training on alternate injection via the fire water system, increasing the availability of alternate injection.

- SAMA 79 – Revise procedures to allow use of the RHRSW system without a SW booster pump, increasing availability of the RHRSW system.

NPPD performed additional analyses to evaluate the impact of an alternative discount rate (3 percent) and remaining plant life (26 years instead of 20 years) on the results of the SAMA assessment. No additional SAMA candidates were determined to be potentially cost-beneficial (NPPD, 2008).

If the benefits are increased by an additional factor of 3 to account for uncertainties, three additional SAMA candidates were determined to be potentially cost-beneficial:

- SAMA 14 – Provide a portable generator to supply DC power to individual panels during a SBO, increasing the time available for AC power recovery.

- SAMA 64 – Revise procedures to allow use of a fire pumper truck to pressurize the fire water system, increasing availability of the fire water system.

- SAMA 75 – Implement GRA (trip and shutdown risk modeling) into plant activities, decreasing the probability of trips/shutdown.

The potentially cost-beneficial SAMAs, and NPPD's plans for further evaluation of these SAMAs are discussed in more detail in Section F.6.2.

F.6.2. Review of Nebraska Public Power District's Cost-Benefit Evaluation

The cost-benefit analysis performed by NPPD was based primarily on NUREG/BR-0184 (NRC, 1997a) and discount rate guidelines in NUREG/BR-0058 (NRC, 2004) and was executed consistent with this guidance.

SAMAs identified primarily on the basis of the internal events analysis could provide benefits in certain external events, in addition to internal events. To account for the additional benefits in external events, NPPD multiplied the internal event benefits by a factor of 3 for each SAMA, except for two SAMAs that specifically address fire risk (SAMAs 63 and 65). Doubling the internal event estimate for SAMAs 63 and 65 would not be appropriate because these SAMAs are specific to fire risks and would not have a corresponding benefit on the risk from internal events. The NRC staff notes that the CNS-1 external events CDF is approximately 200 percent of the internal events CDF from the CNS-1 2007TM PSA model (based on the fire CDF of 1.9 x 10-5 per year, a seismic CDF of 6 x 10-6 per year as estimated by the NRC staff, a negligible HFO contribution, and an internal events CDF of 1.2 x 10-5 per year). Accordingly, the total CDF from internal and external events would be approximately 2.1 times the internal events CDF from the CNS-1 2007 TM PSA model. Because the CDF from internal fires and other external events, as reported by NPPD, is about twice the CDF for internal events, the NRC staff agrees that the factor of 3 multiplier for external events is reasonable.

NPPD provided the results of additional sensitivity analyses in the ER, including use of a 3 percent discount rate and use of a longer plant life. These analyses did not identify any additional potentially cost-beneficial SAMAs.

NPPD considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. In the ER, NPPD states that an uncertainty analysis of the internal events CDF resulted in a 95th percentile value that is a factor of 1.86 times the mean CDF. The ER further states that an uncertainty factor of 3 was conservatively selected for the uncertainty analysis. The NRC staff asked NPPD to provide the results of the internal events CDF uncertainty analysis and to provide further justification for the use of a factor of 3 for the SAMA uncertainty analysis. In response to the RAI, NPPD provided the results of the internal events CDF, which indicates that the 95th percentile is a factor of 1.86 x the mean CDF as described in the ER. NPPD further clarified that the uncertainty factor of 3 was developed from an earlier version of the uncertainty analysis and that the SAMA analysis was not subsequently updated to avoid rework (NPPD, 2009a). Since the Phase I SAMAs were not screened based on quantitative criteria, a reexamination of the Phase I SAMAs based on the upper bound benefits was not necessary. NPPD considered the impact on the Phase II screening if the estimated benefits were increased by a factor of 3 (in addition to the multiplier of 3 for external events). Three additional SAMAs became cost-beneficial in NPPD’s analysis (SAMAs 14, 64, and 75 as described above).

The NRC staff noted that SAMA 14, “portable generator for DC power to supply the individual panels,” and SAMA 13, “portable generator for DC power to supply the battery chargers,” both involve use of a portable generator and requested that NPPD reassess whether or not SAMA 13 would be cost-beneficial if it were to use the same portable generator as for SAMA 14, which was determined to be cost beneficial (NRC, 2009). In response, NPPD stated that since the SAMA submittal, SAMA 13 has been implemented at CNS-1 (NPPD, 2009a).

The NRC staff also noted that all of the SAMAs considered for basic event PCI-CNT-FF-PREEX, “pre-existing containment failure,” involve major hardware modifications. The NRC staff asked NPPD to provide an assessment of lower cost alternatives, such as periodic monitoring of containment integrity during normal operation or procedures to isolate the containment following an event (NRC, 2009). In response to the RAI, NPPD stated that these two specific alternatives have already been implemented at CNS-1 (NPPD, 2009a). NPPD further clarified that basic event PCI-CNT-FF-PREEX represents a preexisting containment failure leading to loss of net positive suction head (NPSH) to the ECCS pumps and that since the CNS-1 containment is inerted during normal operation, a leak large enough to lead to loss of NPSH would require significant nitrogen makeup and would be noticed by the operators.

The NRC staff noted that for certain SAMAs considered in the ER, there may be alternatives that could achieve much of the risk reduction at a lower cost. The NRC staff asked the applicant to evaluate several additional lower cost alternatives to the SAMAs considered in the ER, including SAMAs that had been found to be potentially cost-beneficial at other BWR plants. These alternatives were: (1) providing additional space cooling to the RHRSW booster pump rooms, CS pump rooms, RHR pump rooms, SW pump rooms, and HPCI pump room via the use of portable equipment, (2) improving alternate shutdown training and equipment, (3) enhancing DC power availability by providing cables from diesel generators or another source to directly power battery chargers, (4) developing guidance/procedures for local, manual control of reactor core isolation cooling following loss of DC power, and (5) manually venting containment using either a local hand wheel or gas bottle supplies (NRC, 2009). NPPD provided a further evaluation of these alternatives and concluded that each had already been implemented at CNS-1 (NPPD, 2009a).

In the ER and in response to an NRC staff RAI, NPPD indicated that detailed engineering project cost-benefit analyses have been initiated for the 11 potentially cost-beneficial SAMAs (NPPD 2008, 2009a).

In light of the many potentially cost-beneficial SAMAs identified in the ER, the NRC staff asked NPPD to identify those SAMAs having higher priority for being considered for implementation based on risk reduction potential and implementation cost, and which SAMAs would no longer be cost-beneficial if these higher priority SAMAs were implemented (NRC, 2009). In response to the RAI (NPPD, 2009a), NPPD performed a qualitative assessment to prioritize the cost-beneficial SAMAs. NPPD determined that SAMAs 30, 33, 68, and 79 would have the highest priority based on their potential for significant reduction in risk and relatively low implementation cost. NPPD further identified SAMAs 14, 45, 75, and 78 as a second priority based on their potential for risk reduction and mitigation of plant risk contributors not addressed by SAMAs 30, 33, 68, and 79. The impact of the remaining potentially cost-beneficial SAMAs is expected to be reduced significantly if the higher priority SAMAs are implemented. The NRC considers this approach for prioritizing SAMAs to be reasonable.

The NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the other SAMAs evaluated would be higher than the associated benefits.

F.7. Conclusions

NPPD compiled a list of 244 SAMAs based on a review of the most significant basic events from the plant-specific PSA, insights from the plant-specific IPE and IPEEE, Phase II SAMAs from license renewal applications for other plants, and review of other NRC and industry documentation. A qualitative screening removed SAMA candidates that (1) modified features not applicable to CNS-1, (2) had already been implemented at CNS-1, or (3) were similar and could be combined with another SAMA. Based on this screening, 164 SAMAs were eliminated leaving 80 candidate SAMAs for evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate were developed as shown in Table F-5. The cost-benefit analyses showed that eight of the SAMA candidates were potentially cost-beneficial in the baseline analysis (Phase II SAMAs 25, 30, 33, 40, 45, 68, 78, and 79). NPPD performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. Three additional SAMAs were identified as potentially cost-beneficial in the ER (Phase II SAMAs 14, 64, and 75). NPPD has indicated that detailed engineering project cost-benefit analyses have been initiated for the 11 potentially cost-beneficial SAMAs.

The NRC staff reviewed the NPPD analysis and concludes that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by NPPD are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

The NRC staff concurs with NPPD's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NPPD is warranted. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to Title 10 of the Code of Federal Regulations, Part 54.

F.8. References

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Docket Number 50-298

11. ABSTRACT *(200 words or less)*

This supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by Nebraska Public Power District (NPPD) to the Nuclear Regulatory Commission (NRC) to renew the Operating License for Cooper Nuclear Station, Unit 1 (CNS-1), for an additional 20 years under 10 CFR Part 54. The SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's recommendation regarding the proposed action.

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for CNS-1 are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. The recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by NPPD; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

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